X-SEL Controller
RC Gateway Function

Operation Manual Sixth Edition

• SIO Type :	XSEL-P/Q/PX/QX R/S/RX/SX RXD/SXD
• Fieldbus Type :	XSEL-R/S/RX/SX RXD/SXD

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 or 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.
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- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

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Safety Guide

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

Safety Precautions for Our Products

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

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

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

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

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

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

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

Alert Indication

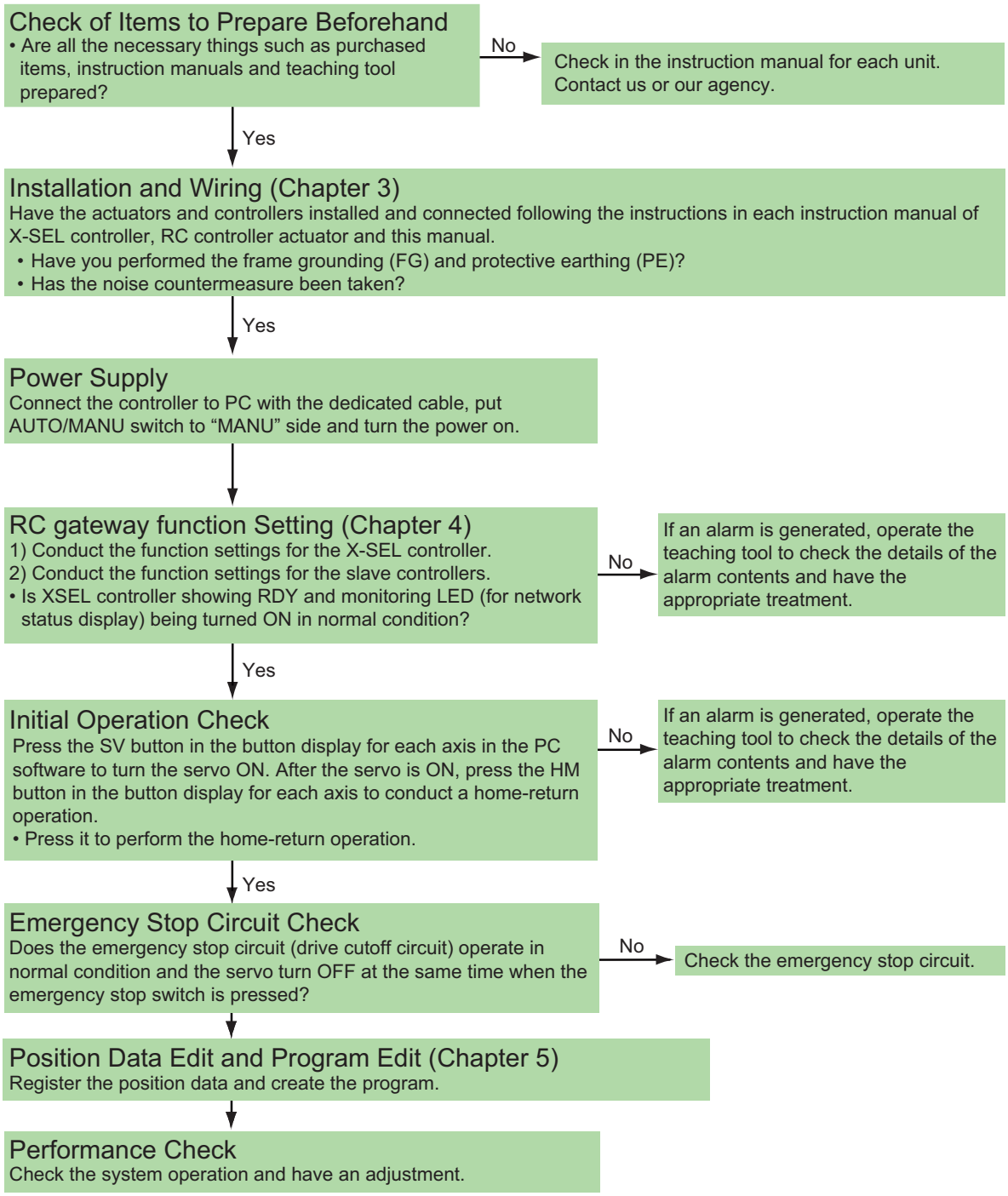
The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Operation Manual for each model.

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

Precautions in Handling

1. Sending an address or a function that is not mentioned in this manual may disable the ROBO Cylinder from operating normally or may cause to perform an unexpected movement.
   Do not attempt to send a function or address out of the indication.
2. For the RC controller which operates under the setting of RC Gateway Function, the safety speed function that controls the maximum speed compulsorily is ineffective. (This does not activate even with Mode Changeover Switch (AUTO/MANU) of X-SEL controller.)
3. For the RC controller setting, connect a teaching tool such as the PC software to the teaching port on each RC controller, and start the communication with X-SEL controller after the setting is complete.
4. Turn OFF the power to the RC controller and X-SEL controller when inserting/removing connectors or lay out the wires. Leaving the power ON while doing so may cause an electric shock or malfunction of the components.
5. To avoid an operation error due to noise, conduct the noise protection treatment to the electric devices sharing the same power supply or in the same system.
6. SIO type and Fieldbus type cannot be applied in RC Gateway Function at the same time.
7. In Fieldbus type (dedicated for R/S/RX/SX/RXD/SXD), the wiring tools of DeviceNet (cables, T-junction taps, etc.) are to be used. However, it is not available to connect to DeviceNet as the network.
   Connection is only available between X-SEL controller and DeviceNet type RC controller of IAI.
8. When using SCON-CA with RC Gateway Function, an actuator of the direct drive motor type cannot be connected.

Starting procedures



Now, the operation adjustment is complete.
Conduct an adjustment by the system.
!
!

1. Control Method Overview

RC Gateway Function (SIO Type and Fieldbus Type) enables an operation in the network with the X-SEL controller as the master and RC (ROBO Cylinder : Described as RC from now) controller as the slave, and is able to operate the RC (ROBO Cylinder) axes with SEL language programs.
The existing RC Gateway Function (SIO Type) uses RS232C port equipped on X-SEL controller in standard to construct a simple network system. Also, Fieldbus Type enables to construct a system with the communication network faster than the existing SIO type by adding the dedicated network board (option).

This manual explains how to set up RC Gateway Function (SIO type and Fieldbus type).
Refer to the separate instruction manual for how to handle X-SEL controller.

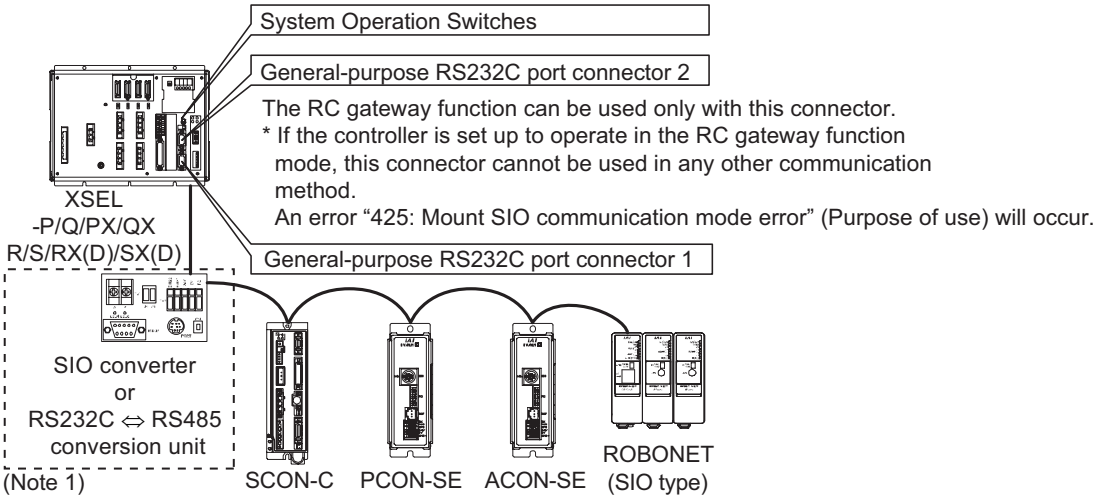
⚠ Caution
- ㋑ SIO type is the standard function for P/Q/PX/QX/R/S/RX/SX/RXD/SXD type X-SEL controllers.
- ㋑ Fieldbus type is an optional function for R/S/RX/SX/RXD/SXD type X-SEL controllers.

1.1 Communication system

RC Gateway Function can be selected from two types of communication systems and two types of operation systems.

[1] For SIO type
For XSEL-P/Q/PX/QX Controllers, the slave (RC Controller) is to be connected with RS485 communication system using SIO converter or RS232C Converter Unit.
For XSEL-R/S/RX/SX Controllers, switching over between RS232C and RS485 settings is available by the system operation setting switches provided on the controller unit. Put it on RS485 setting.
Neither of SIO converter or RS232C Converter Unit is necessary (Note 1) and the slave (RC Controller) can directly be connected.

● System Configuration Example



(Note 1) It is not necessary for XSEL-R/S/RX(D)/SX(D).
(Turn ON System Operation Switch No. 2 on the operation panel of XSEL controller.)

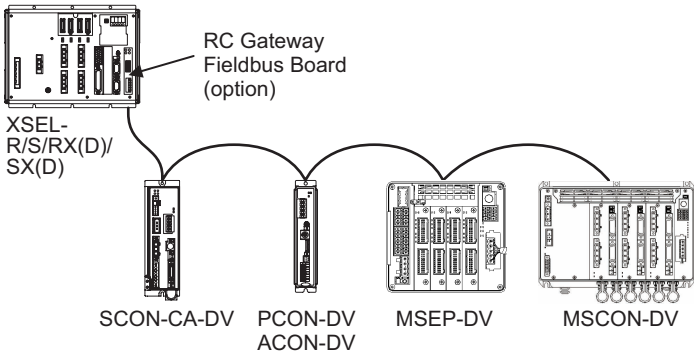
Applicable Controller

Controller name	Model No.	Applicable version
X-SEL Controller	XSEL-P/Q	V0.68 or later
	XSEL-PX/QX	V0.34 or later
	XSEL-R/S	→
	XSEL-RX/SX	→
	XSEL-RXD/SXD	→
RC Controller	PCON-SE	→
	ACON-SE	→
	SCON-C	→
	ROBONET_SIO type	→
	ERC2-SE	→

(Note) Network constructing components [Refer to Section 3.2.1.]

[2] For Fieldbus type (DeviceNet Communication system)
Connect an X-SEL controller and slaves (RC controllers) with DeviceNet system.

● System Configuration Example



Applicable Controller

Controller name	Model No.	Applicable version
X-SEL Controller	Equipped with XSEL-R/S RC Gateway Fieldbus Board (option)	V1.04 or later
	Equipped with XSEL-RX/SX RC Gateway Fieldbus Board (option)	V1.05 or later
	Equipped with XSEL-RXD/SXD RC Gateway Fieldbus Board (option)	→
RC Controller	PCON-C-DV PCON-CG-DV PCON-CA-DV PCON-CFA-DV	→
	ACON-C-DV ACON-CG-DV	→
	SCON-CA-DV	→
	MSEP-DV	→
	MSCON-DV	

Refer to Item 3.2.2, for the network components.

1.2 Operation system

[1] To use position data in X-SEL
It is the method to perform operation using the RC position data set in X-SEL controller.
(Note) If the number of effective axes increases, the number of positions will decrease.

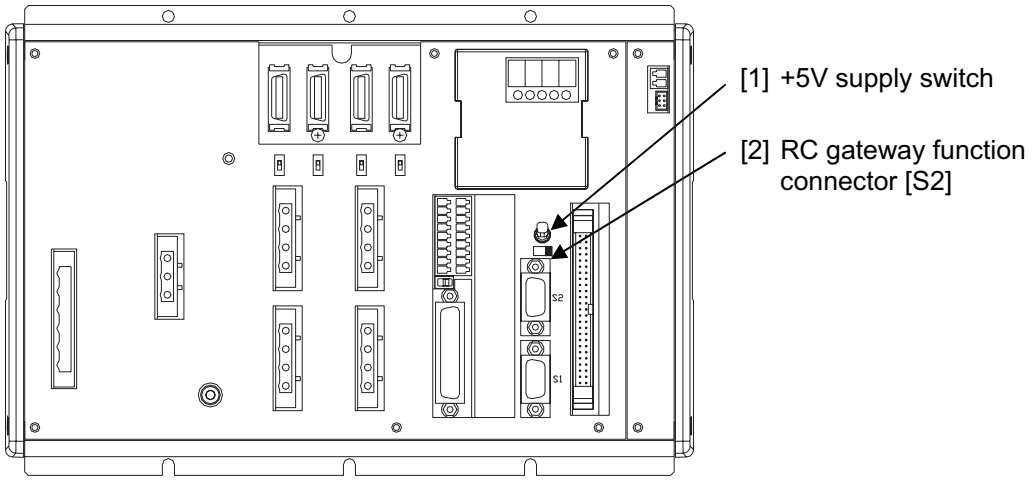
Largest axis number	Number of positions (per axis)
0 to 7	512
8	455
9	409
10	372
11	341
12	315
13	292
14	273
15	256

[2] To use position data in RC
It is the method to perform operation using the position data set in RC controller.
The number of positions available for setting depends on the specifications of each controller.

1.3 Name and Function of Each Part Relating to RC Gateway Function

1.3.1 For SIO type

(1) XSEL-P/Q/PX/QX



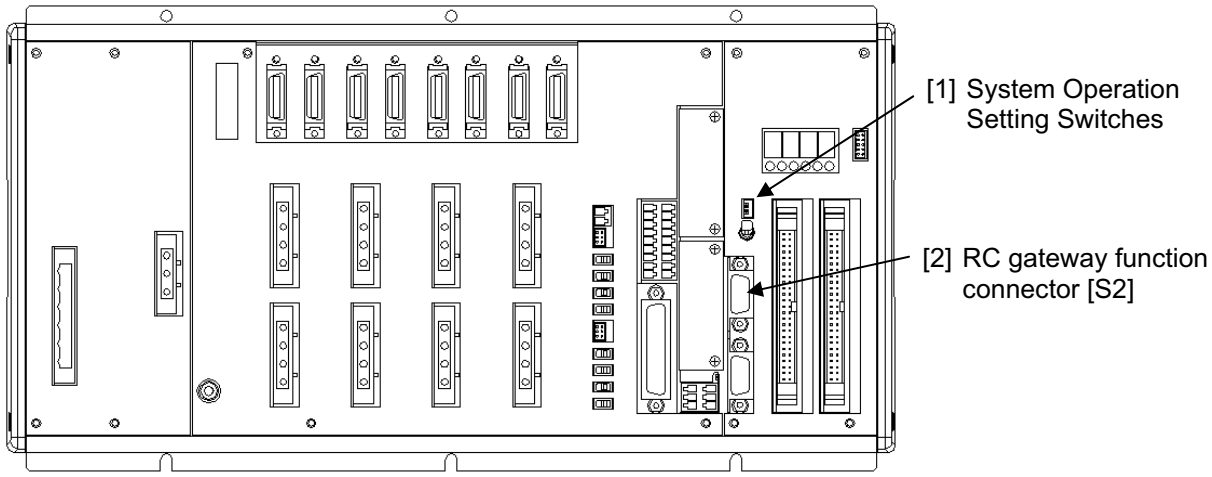
[1] +5V supply switch
If a SIO converter is used, set this switch to the left position. (+5V will not be output.)
If a RS232C converter unit (RCB-CV-GW) is used, set the switch to the right position. (+5V will be output.)

⚠ Caution: If the port is used as a standard RS232C port, be sure to set this switch to the left position (so that +5V will not be output). Failure to do so may cause shorting of the +5V power output circuit depending on how the connection cable is wired.

[2] RC gateway function connector [S2]
For SIO type, use the general-purposed RS232C Port Connector 2.
Connect to RC Controller and ROBONET using SIO Converter.
Connector : D-sub, 9-pin (Controller: Male end / Cable: Female end)
Interface standard : RS232C

Pin number	Signal name	Details
1	CD	Carrier Detection (not used)
2	RD	Receive Data
3	SD	Send Data
4	ER	Equipment Ready
5	SG	Signal Ground
6	DR	Data Set Ready
7	RS	Request to Send
8	CS	Clear to Send
9	+5V	RCB-CV-GW Converter Power

(2) XSEL-R/S/RX/SX/RXD/SXD



[1] System Operation Setting Switches
These are switches to set the operation mode of the system. (Normally, they are all OFF.)
When setting to RC Gateway Function, turn ON the switch No. 2

[2] RC gateway function connector [S2]
For SIO type, use the general-purposed RS232C Port Connector 2. Switch the setting over to RS485 communication with the system operation switches and connect directly to RC controller and ROBONET.

Connector: D-sub, 9 pin (Controller side: Male, Cable Side: Female)

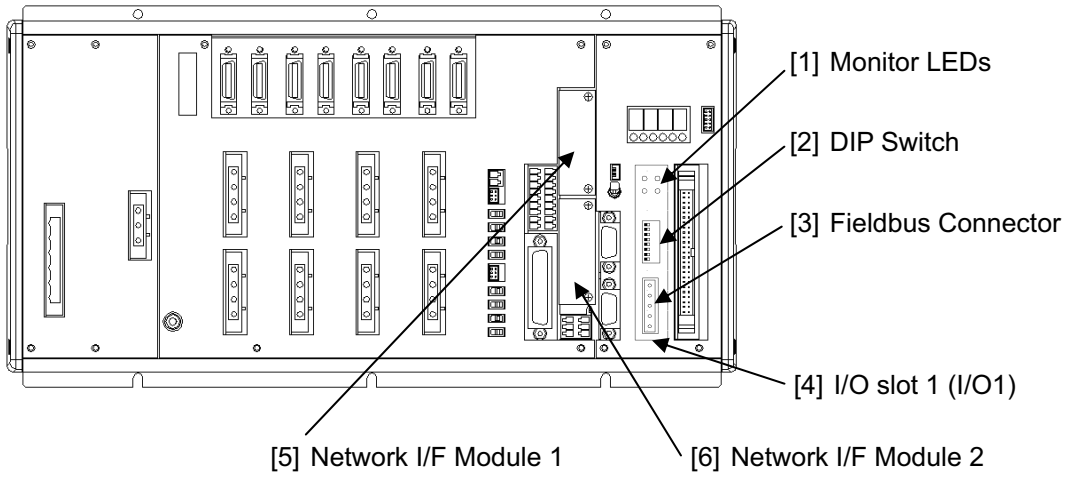
Pin number	Signal name	Details
1	(CD)	(Carrier Detection: Not used)
2	(RD)	(Receive Data (RXD): Not used) (Note 1)
3	(SD)	Do not connect anything. (Send Data (TXD): Not used)
4	(ER)	Do not connect anything. (Equipment Ready (DTR): Not used)
5	SG	Signal Ground
6	(DR)	Do not connect anything. Data Set Ready (DSR): Not used)
7	SA	Sent and received data A (Positive side) (RS485)
8	SB	Sent and received data B (Negative side) (RS485)
9	NC	Not used

Note 1 Short-circuit Pin 2 (RD) to the signal ground Pin 5 (SG).

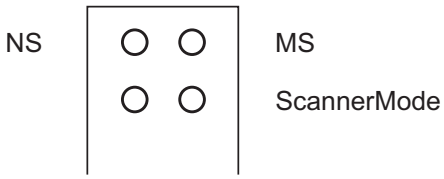
1.3.2 For Fieldbus type (option)

(1) XSEL-R/S/RX/SX/RXD/SXD

The position to mount the fieldbus board for the gateway is fixed to I/O Slot 1 (I/O1).



[1] Monitor LEDs



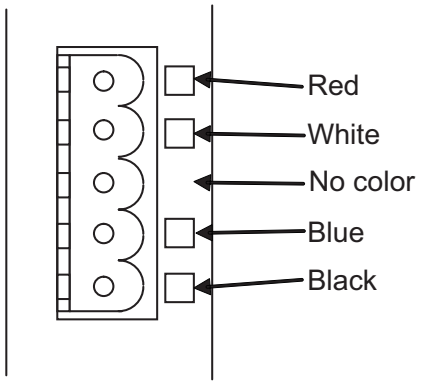
The conditions of the slaves (each controller) and the network can be checked with the three LED lamps, MS, NS and ScannerMode, mounted on the front face of RC Gateway Fieldbus Board.

LED	Color	Indication Status	Indication Description
NS (Network Status)	Green	Illuminating	Online, connection of more than one line is established
		Flashing	Online, no connection established
	Red	Illuminating	Critical link error
		Flashing	Connection timeout occurred in at least one node
	-	OFF	No power supply to DeviceNet Not online
MS (Module Status)	Green	Illuminating	Normal operation
		Flashing	In automatic baud rate process
	Red	Illuminating	Serious trouble
		Flashing	Slight trouble
	-	OFF	No power supply to DeviceNet
Scanner Mode	Green	Illuminating	In DeviceNet Master operation
	-	OFF	No power supply to DeviceNet

[2] DIP switch
Not for use. (There should be no problem no matter what the setting of this switch is.)

[3] Fieldbus connector
Connect the slaves (IAI controllers applicable for RC Gateway Fieldbus Type) to X-SEL.
(Note) RC Gateway can only connect to IAI RC by DeviceNet.

Connector : MSTBA2.5/5-G-5.08AU M
Interface Standard : DeviceNet



Type	Color	Contents	Symbol
Signal cable	Blue	Signal “Low” side	CAN L
	White	Signal “High” side	CAN H
Power supply cable	Red	Communication power “+” side	V+
	Black	Communication power “-” side	V-
Shield cable	No color	Shield	S

[4] I/O Slot 1
This is the slot that a PIO board or the Fieldbus board for RC Gateway is to be attached.
(Note) The position to mount the fieldbus board is fixed to I/O Slot 1 (I/O1).

[5] Network I/F Module 1
This is the slot that the option board for the field network is to be attached. Connection to a host controller (PLC, etc.) with the field network is available.
Field Network: EtherNet/IP, EtherCAT

[6] Network I/F Module 2
This is the slot that the option board for the field network is to be attached. Connection to a host controller (PLC, etc.) with the field network is available.
Field Network: DeviceNet, CC-Link, PROFIBUS

2. Specification

2.1 SIO type

2.1.1 Communication type

Item	Specification	
Transmission path structure	IAI's dedicated multi-drop differential communication	
Communication method	Half-duplex	
Synchronization method	Start-stop	
Transmission path format	XSEL-P/Q/PX/QX	X-SEL ⇔ SIO converter: EIA (RS)-232 SIO converter ⇔ Each RC controller: EIA (RS)-485, 2-wire type
	XSEL-R/S/RX/SX /RXD/SXD	EIA (RS)-485, 2-wire type (Switchover with system operation switches)
Baud rate	230.4 kbps	
Character length	8 bits	
Stop bit	1 bit	
Parity bit	None	
Error control method	CRC check	
Communication cable length	Total cable length: 100 m or less	
Number of connected axes	Maximum 16 axes	
Communication cable	Twisted pair cable, 2 pairs (Recommended model: HK-SB/20276×L 2P×AWG22 by Taiyo Electric Wire & Cable)	
Communication protocol	Modbus protocol	
Transmission mode	RTU mode	

*CRC: Cyclic Redundancy Check
(A data error detection method commonly used in synchronous transmission)

2.1.2 Teaching Tool

For XSEL-P/Q/PX/QX (Note 1)

Teaching tool name	Model	Applicable versions
RC PC Software	RCM-101-MW (RS232C communication type) or RCM-101-USB (USB communication type)	Refer to the operation manual of the corresponding slave controller.
Parameter Configuration tool		
PC Interface Software for XSEL	IA-101-X-MW (RS232C communication type) or IA-101-X-USB (USB communication type)	V.7.02.00.00 or later
Teaching Pendant	RCM-E	Refer to the operation manual of the corresponding slave controller.
	RCM-P	
	CON-T/TG	
	CON-PT/PD/PG	
	CON-PTA/PDA/PGA	
	IA-T-X/XD	V1.46 or later
	SEL-T/TD	V1.01 or later

Note 1 For the teaching tolls for XSEL-R/S/RX/SX/RXD/SXD, refer to Instruction Manual “X-SEL Controllers R/S/RX/SX Types” provided separately.

2.1.3 Operation Manuals Related to This Product

No.	Name	Manual No.
1	Operation Manual for XSEL-P/Q controller	ME0148
2	Operation Manual for XSEL-PX/QX controller	ME0152
3	Operation Manual for XSEL-R/S/RX/SX/RXD/SXD	ME0313
4	Operation manual for PCON-C/CG/CF controller	ME0170
5	Operation manual for PCON-SE controller	ME0163
6	Operation Manual for ACON-C/CG controller	ME0176
7	Operation Manual for ACON-SE controller	ME0171
8	Operation Manual for SCON-C controller	ME0161
9	Operation Manual for ROBONET	ME0208
10	Operation Manual for ERC2 Controller	ME0159
11	Operation Manual for RC PC Software RCM-101-MW/RCM-101-USB	ME0155
12	Operation Manual for SEL PC Software IA-101-MW/IA-101-USB	ME0154
13	Teaching Pendant RCM-E Operation Manual	ME0174
14	Teaching Pendant RCM-P Operation Manual	ME0175
15	Teaching Pendant CON-T/TG Operation Manual	ME0178
16	Touch Panel Teaching CON-PT/PD/PG Operation Manual	ME0227
17	Touch Panel Teaching CON-PTA/PDA/PGA Operation Manual	ME0295
18	Teaching Pendant IA-T-X/XD Operation Manual	ME0160
19	Teaching Pendant SEL-T/TD/TG Operation Manual	ME0183

2.1.4 Input and Output Timing (SIO Type)

The response time (Time it takes RC controller to respond back to XSEL controller's query) can be calculated by the formula below:

Response time [msec] = Yt + Xt + 2 × (Mt + n) + Command processing time

Mt = 10 [msec] × m : SIO Link (Modbus) Cycle time

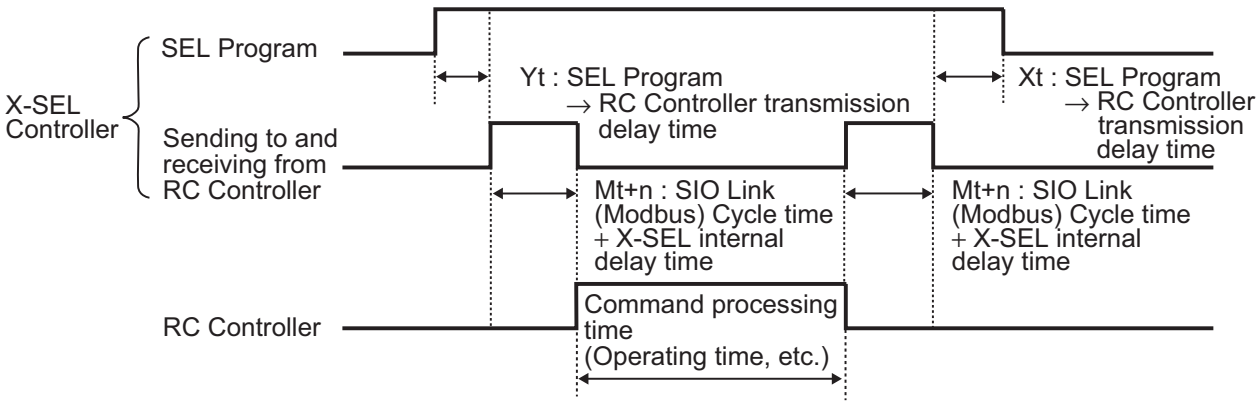
m : Number of link axes

n : (Maximum axis number + 2) /2…… (Decimals to be rounded down)

Yt : SEL Program → RC Controller transmission delay time… 1ms or more (It may increase due to number of executed SEL programs or number of effective axes.)

Xt : RC Controller → SEL Program transmission delay time… 2ms or more (It may increase due to number of executed SEL programs or number of effective axes.)

Notice :
- If the number of the control axes is big, the response time is longer since n is increased.
- Yt and Xt may fluctuate depending on the number of executed SEL programs or number of effective axes.
- The time that the command reaches the RC controller after SEL Command execution is approximately the half of the response time.
- When a communication error is generated, the SIO Link Cycle Time (Mt) may be longer since a retry or axis disconnection recovery treatment is necessary to be conducted.



2.2 Fieldbus type

2.2.1 Communication type

Item	Specification
Transmission path structure	IAI's dedicated differential communication (Multi-Drip, T-Junction)
Communication method	Half-duplex
Synchronization method	Polling
Transmission path format	Complying with DeviceNet
Baud rate	500 kbps
Communication cable length	Total cable length: 100 m or less
Number of connected axes	Maximum 16 axes
Slave I/O Data Size	Up to 288bytes for both Input and Output (Note 1)
Communication cable	Cable dedicated for DeviceNet
Master node address	63 fixed
Slave node address	0 to 15
Communication protocol	Original
Connector	MSTBA2.5/5-G-5.08AU M (Manufactured by PHOENIX CONTACT) Cable Side : SMSTB 2.5/5-ST-5.08AU
Communication Power Supply	24V DC
Consumption Current of Communication	60mA

Note 1 In the case that the data size exceeds 288bytes, even when the number of axes is 16 or less, an error occurs and the communication becomes unavailable.

2.2.2 Teaching Tool

Refer to Instruction Manual "X-SEL Controllers R/S/RX/SX Types" provided separately.

2.2.3 Operation Manuals Related to This Product

No.	Name	Manual No.
1	Operation Manual for XSEL-R/S/RX/SX/RXD/SXD	ME0313
2	Operation manual for PCON-C/CG/CF controller	ME0170
3	Operation manual for PCON-CA/CFA controller	ME0289
4	Operation Manual for ACON-C/CG controller	ME0176
5	Operation Manual for SCON-CA controller	ME0243
6	Operation Manual for DeviceNet ACON/PCON/SCON-CA controller	ME0256
7	Operation Manual for MSEP	ME0299
8	Operation Manual for MSCON	ME0306
9	Operation Manual for RC PC Software RCM-101-MW/RCM-101-USB	ME0155
10	Operation Manual for SEL PC Software IA-101-MW/IA-101-USB	ME0154
11	Teaching Pendant RCM-E Operation Manual	ME0174
12	Teaching Pendant RCM-P Operation Manual	ME0175
13	Teaching Pendant CON-T/TG Operation Manual	ME0178
14	Touch Panel Teaching CON-PT/PD/PG Operation Manual	ME0227
15	Touch Panel Teaching CON-PTA/PDA/PGA Operation Manual	ME0295
16	Teaching Pendant IA-T-X/XD Operation Manual	ME0160
17	Teaching Pendant SEL-T/TD/TG Operation Manual	ME0183

2.2.4 Input and Output Timing (Fieldbus Type)

The response time (Time it takes RC controller to respond back to XSEL controller's query) can be calculated by the formula below:

Response time [msec] = Yt + Xt + 2 × (Ft + Mt) + Command processing time

Yt : SEL Program → RC Controller transmission delay time… 2ms or more (It may increase due to number of executed SEL programs or number of effective axes.)

Xt : RC Controller → SEL Program transmission delay time… 2ms or more (It may increase due to number of executed SEL programs or number of effective axes.)

Ft : Fieldbus Link Cycle Time

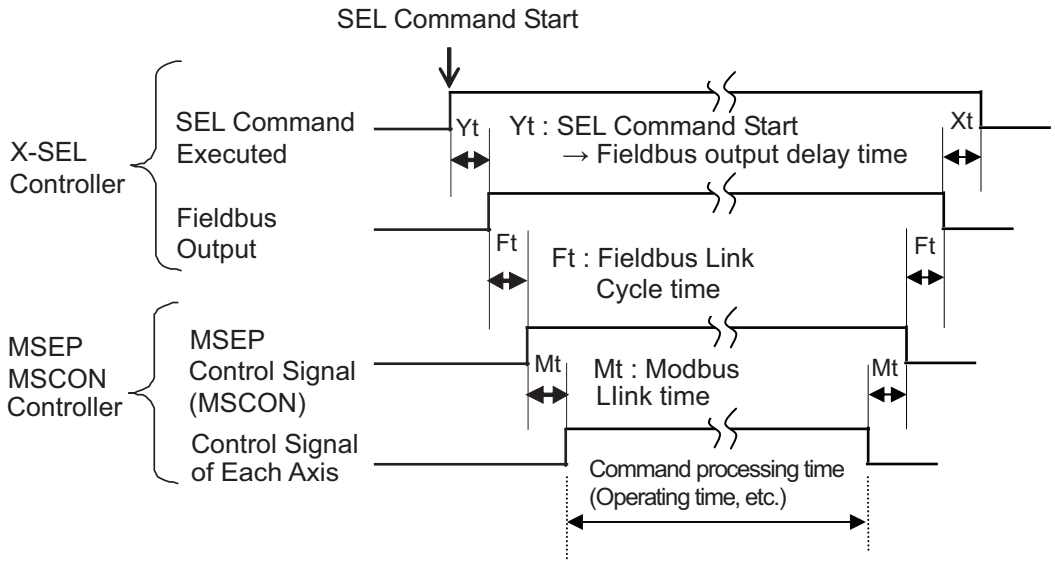
- In the case that the Multi-axis (MSEP or MSCOM) units only are connected:
  $Ft = \Sigma \{0.316 + 0.076 \times (T_{HBYTE} + T_{ABYTE} \times Ni)\} + 1.0$
  Σ : Total No. of the controller connected multi-axis (MSEP or MSCOM) units (= No. of Connected Nodes)
  T_{HBYTE} : Number of header domain bytes. Fixed to 16
  T_{ABYTE} : Number of bytes for each axis.16 for method to use position data in X-SEL, and 8 for method to use position data in RC
  Ni : No. of connected axes of the multi-axis (MSEP or MSCOM) units per controller

- When connecting only CON single axis (A/PCON, SCON-CA)
  Ft = 1.532 × N + 1.0 (Method to use position data in X-SEL)
  Ft = 0.556 × N + 1.0 (Method to use position data in RC)
  N : Number of connected nodes (= number of connected axes)

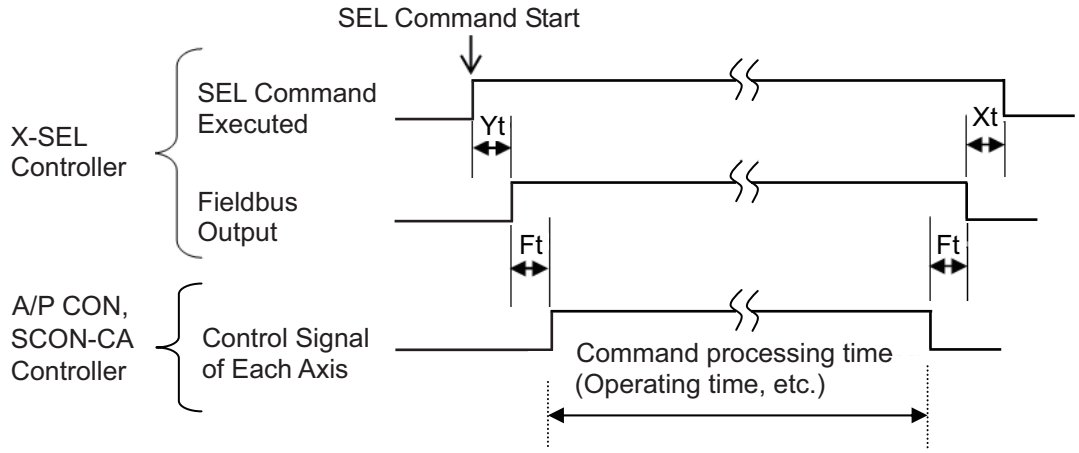
Mt : Modbus Line Time (Added only for MSEP or MSCOM): 10ms

⚠ Caution :
- Regarding the response time of Fieldbus Type, because the communication data length of DeviceNet is 8 bytes, the communication speed becomes slow if the number of communication bytes for each node exceeds 8 bytes. For instance, even though the communication size in the method to use the position data in RC is 80 bytes for input and output, for MSEP (8-axis connection: 1 node), it is 20 [ms], but for CON single axis (10-axis connection: 10 nodes), it iis 9 [ms].
- Yt increases with the facts such as the number of SEL programs executed at the same time or the number of effective axes in the RC Gateway Funciton.
- When a communication error is generated, the Fieldbus Link Time Ft and Modbus Link Time Mt may be longer since such actions as a retry will take place.

MSEP, MSCON



A/PCON, SCON-CA

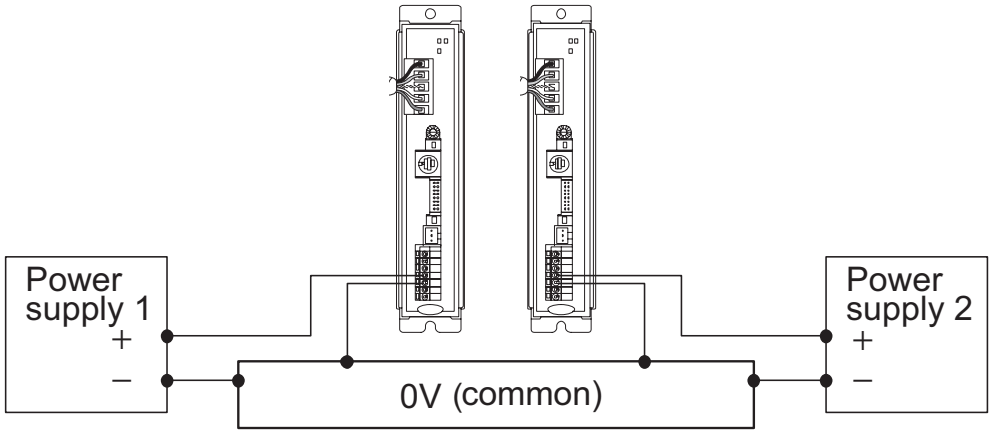


3. Wiring

3.1 Notes on Wiring

[1] Provide noise elimination measures for the electrical devices located along the same power-supply path or in the same system according to the operation manuals for the X-SEL controller, RC controller and ROBONET.

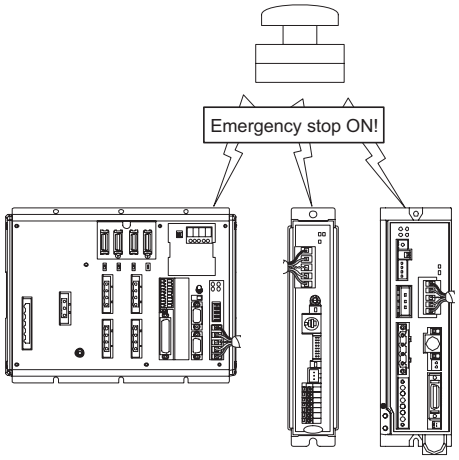
[2] If multiple power-supply units are used to supply 24V DC power to RC controllers, connect the 0V lines of the power supplies for respective controllers.



[3] Be sure to shield the communication cable. Connect the cable's shield to a single point ground.

[4] Make sure emergency stop signals are input simultaneously to the X-SEL and each RC controller /ROBONET. If the emergency stop timing of the X-SEL varies from that of the RC controller/ROBONET by a specified time (approx. 5 seconds) or longer, the X-SEL will generate an error "6B4: RC gateway emergency stop inconsistency error"(Note 1) and enter the emergency stop mode (cold-start level).

Note1
- Connecting some ERC2 controllers or avoiding this error detection on other controllers, set bits 0 to 3 of the X-SEL controller's I/O parameter No. 507 to "1."
  (The setting of I/O Parameter No. 507 is available in V0.90 or later for X-SEL P/Q and V0.42 or later for X-SEL PX/QX. Refer to 6.1 for details.)
- If the RC controller is connected via the X-SEL, this error will not occur.



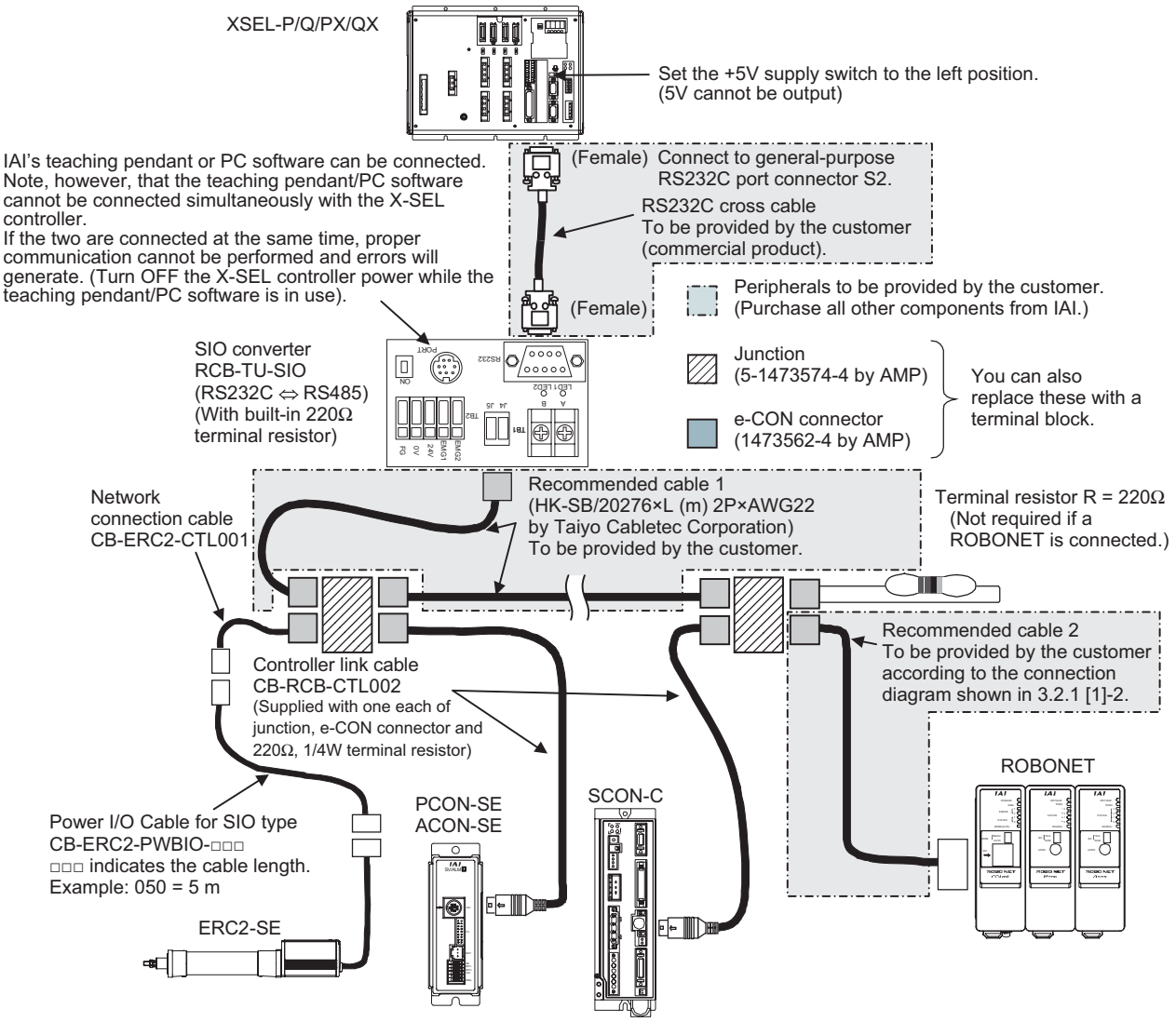
3.2 Wiring method

RC gateway function has SIO type and Fieldbus type. Wiring method and necessary equipment differ between each type.
Refer to the following examples to perform the wiring layout suitable for each type.

3.2.1 Wiring Method of SIO type

[1]-1 Wiring diagram (Example 1: When SIO converter is used for XSEL-P/Q/PX/QX)

> ⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)



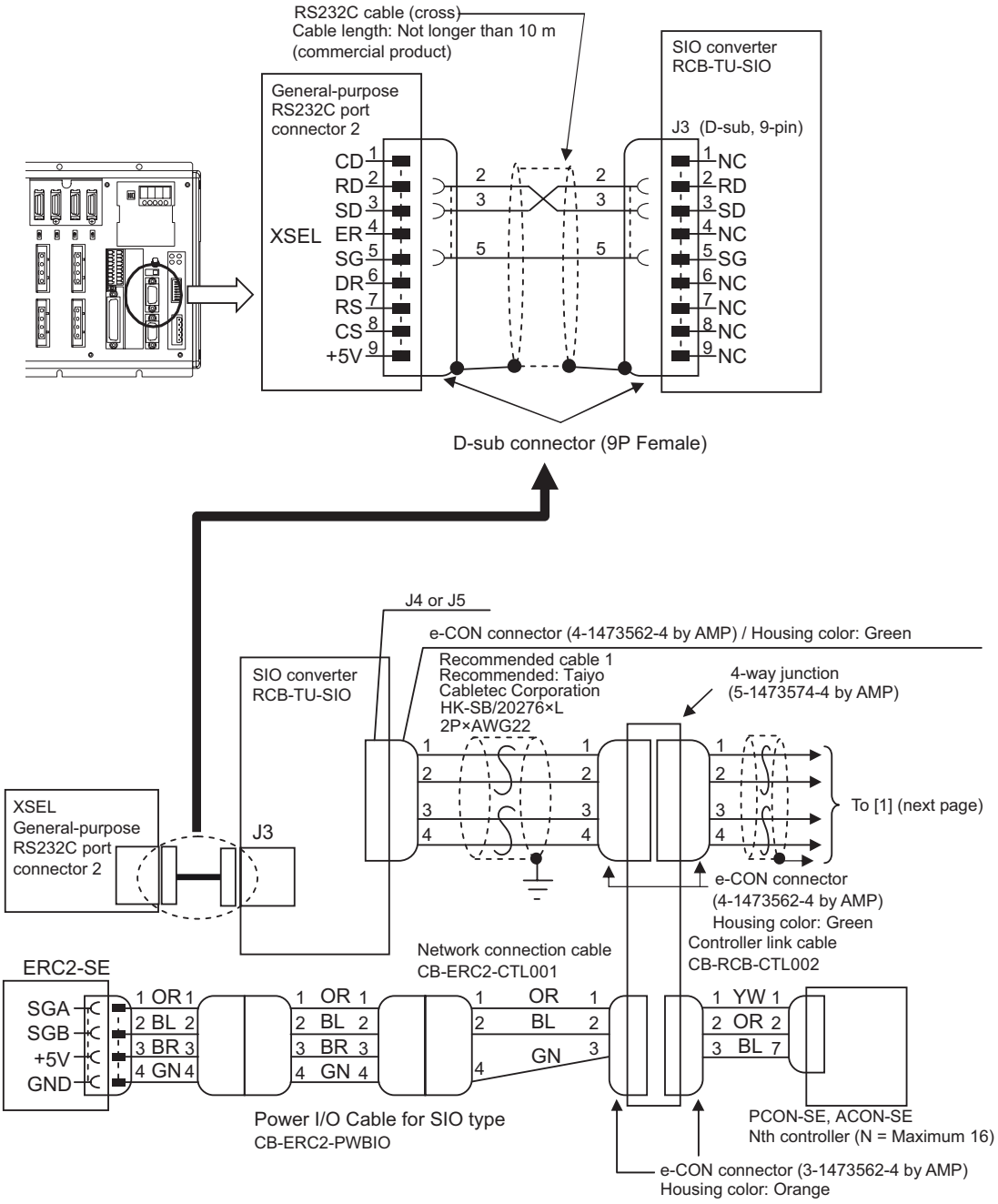
> ⚠ Caution:
> - Multiple ROBONET GatewayR_SIO units cannot be connected to a single network.
> - Since the ROBONET has a built-in terminal resistor, connect the ROBONET to the junction farthest away from the X-SEL (at the end of the trunk line). Do not connect a terminal resistor to the junction.

SIO communication components required by the configuration shown in Example 1

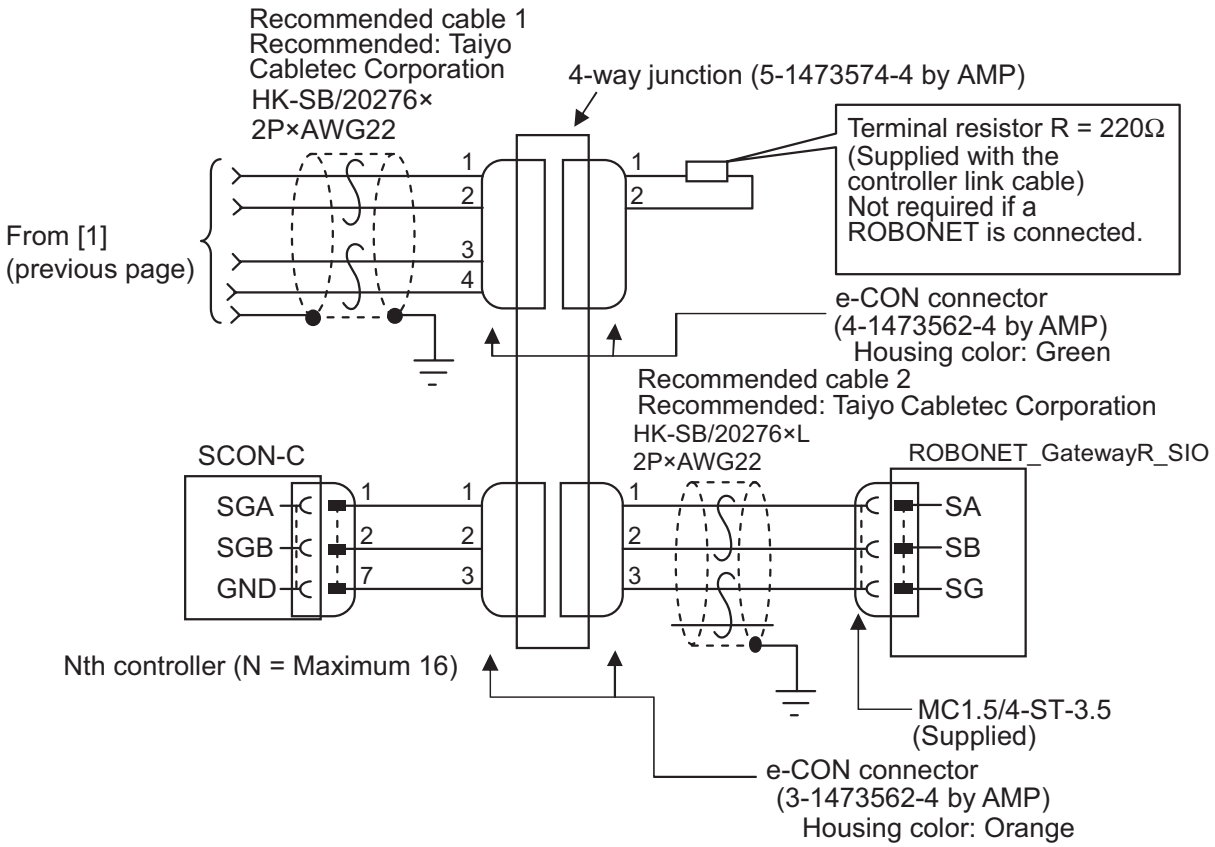
	Name	Model	Quantity
Purchased from IAI	SIO converter	RCB-TU-SIO-A or B	1
	Power I/O Cable for SIO type	CB-ERC2-PWBIO-□□□	1
	Network connection cable	CB-ERC2-CTL001	1
	Controller link cable	CB-RCB-CTL002	2
Provided by the customer	RS232C cross cable (D-sub, 9-pin)	(Commercial product)	1
	Recommended cables 1, 2	HK-SB/20276 (Taiyo Cabletec Corporation)	Lm
	e-CON connector	3-1473562-4 (AMP)	1
		4-1473562-4 (AMP)	1

The above table only lists the components required for SIO communication. The customer must provide other components that are required, such as a safety circuit, power supply and cables for their connection.
□□□ in the table indicates the cable length. Example: 050 = 5 m

[1]-2 Connection diagram (Example 1: When SIO converter is used for XSEL-P/Q/PX/QX)



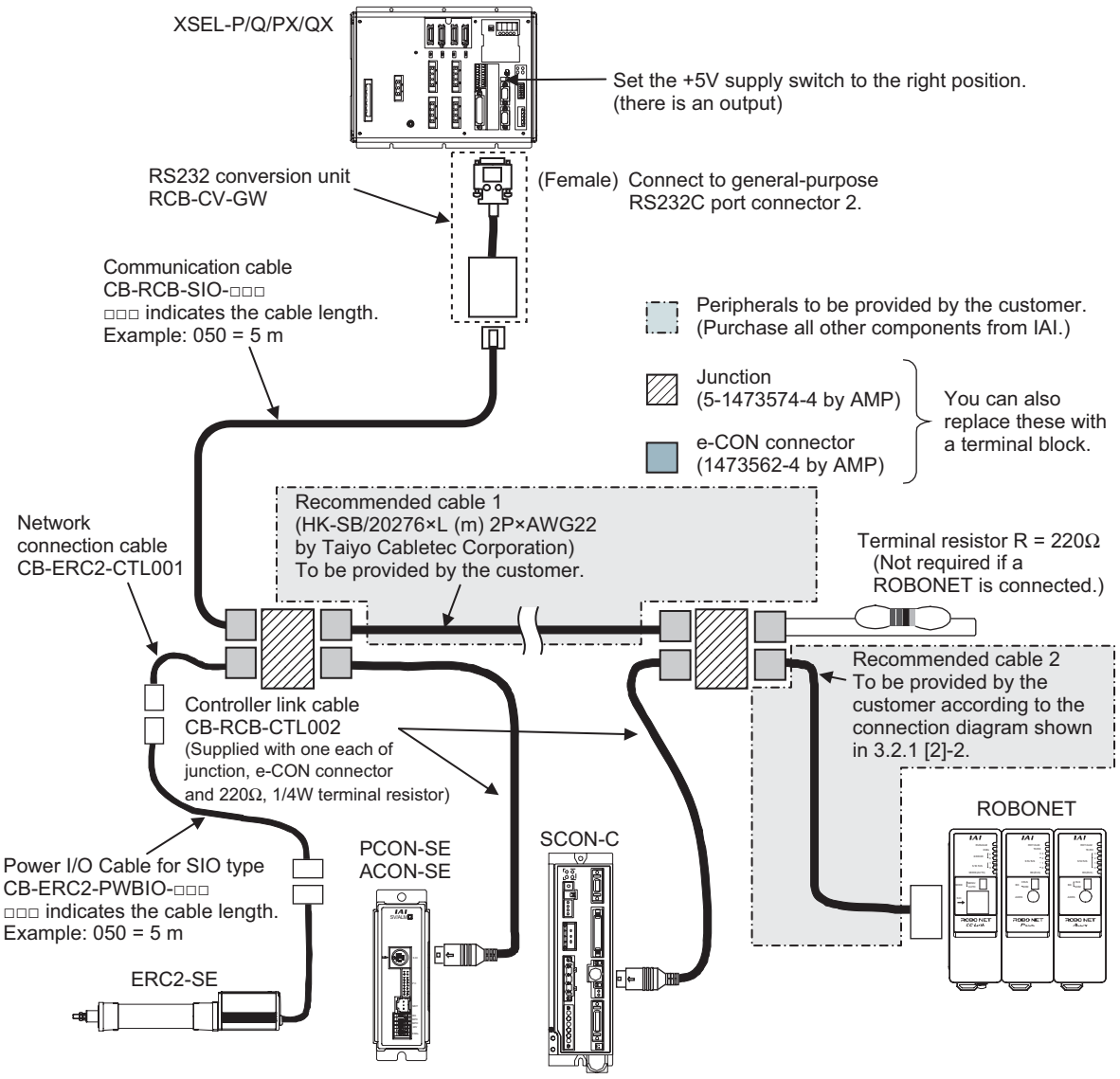
⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)



⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)

[2]-1 Wiring diagram (Example 2: When RS232 conversion unit is used for XSEL-P/Q/PX/QX)

⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)



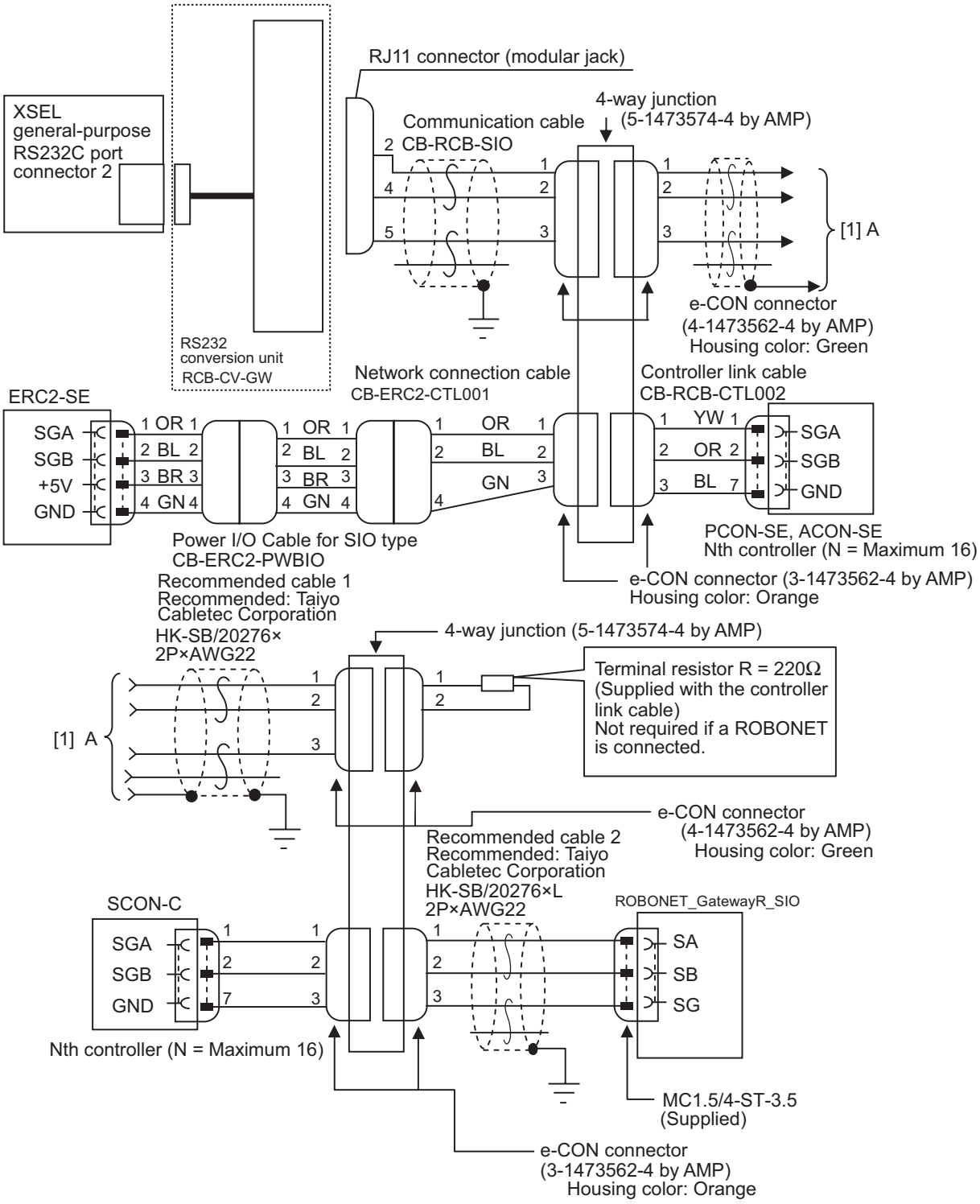
⚠ Caution:
- Multiple ROBONET GatewayR_SIO units cannot be connected to a single network.
- Since the ROBONET has a built-in terminal resistor, connect the ROBONET to the junction farthest away from the X-SEL (at the end of the trunk line). Do not connect a terminal resistor to the junction.

Components required by the configuration shown in Example 2

	Name	Model	Quantity
Purchased from IAI	RS232 conversion unit	RCB-CV-GW	1
	Communication cable	CB-RCB-SIO-□□□	1
	Power I/O Cable for SIO type	CB-ERC2-PWBIO-□□□	1
	Network connection cable	CB-ERC2-CTL001	1
	Controller link cable	CB-RCB-CTL002	2
Provided by the customer	Recommended cables 1, 2	HK-SB/20276 (Taiyo Cabletec Corporation)	Lm
	e-CON connector	3-1473562-4 (AMP)	1

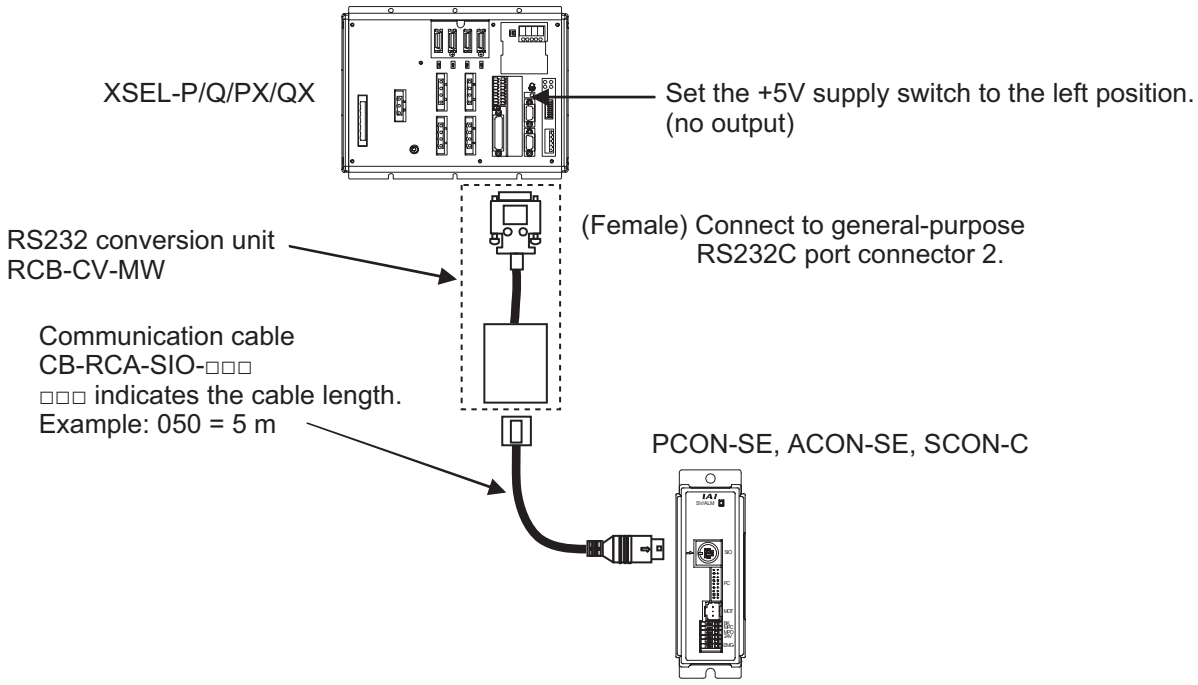
The above table only lists the components required for SIO communication. The customer must provide other components that are required, such as a safety circuit, power supply and cables for their connection.
□□□ in the table indicates the cable length. Example: 050 = 5 m

[2]-2 Circuit diagram (Example 2: When RS232 conversion unit is used for XSEL-P/Q/PX/QX)



⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)

[3]-1 Wiring drawing (Example 3: When RS232 conversion unit is used to connect only 1 axis for XSEL-P/Q/PX/QX)

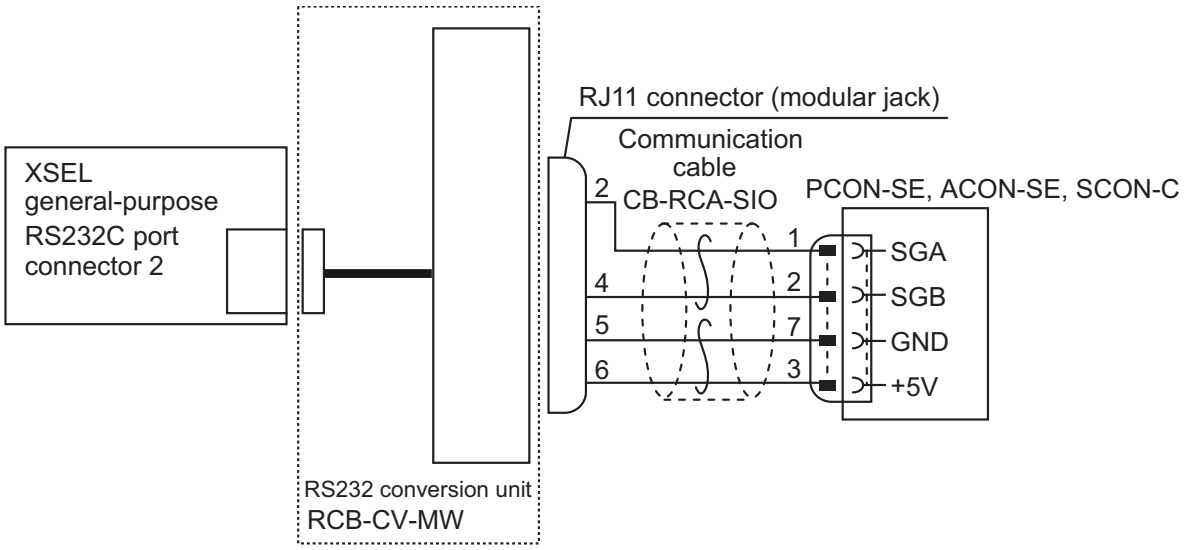


Parts required by the configuration in Example 3

	Name	Model	Quantity
Parts to be purchased from IAI	RS232 conversion unit	RCB-CV-MW	1
	Communication cable	CB-RCA-SIO-□□□	1

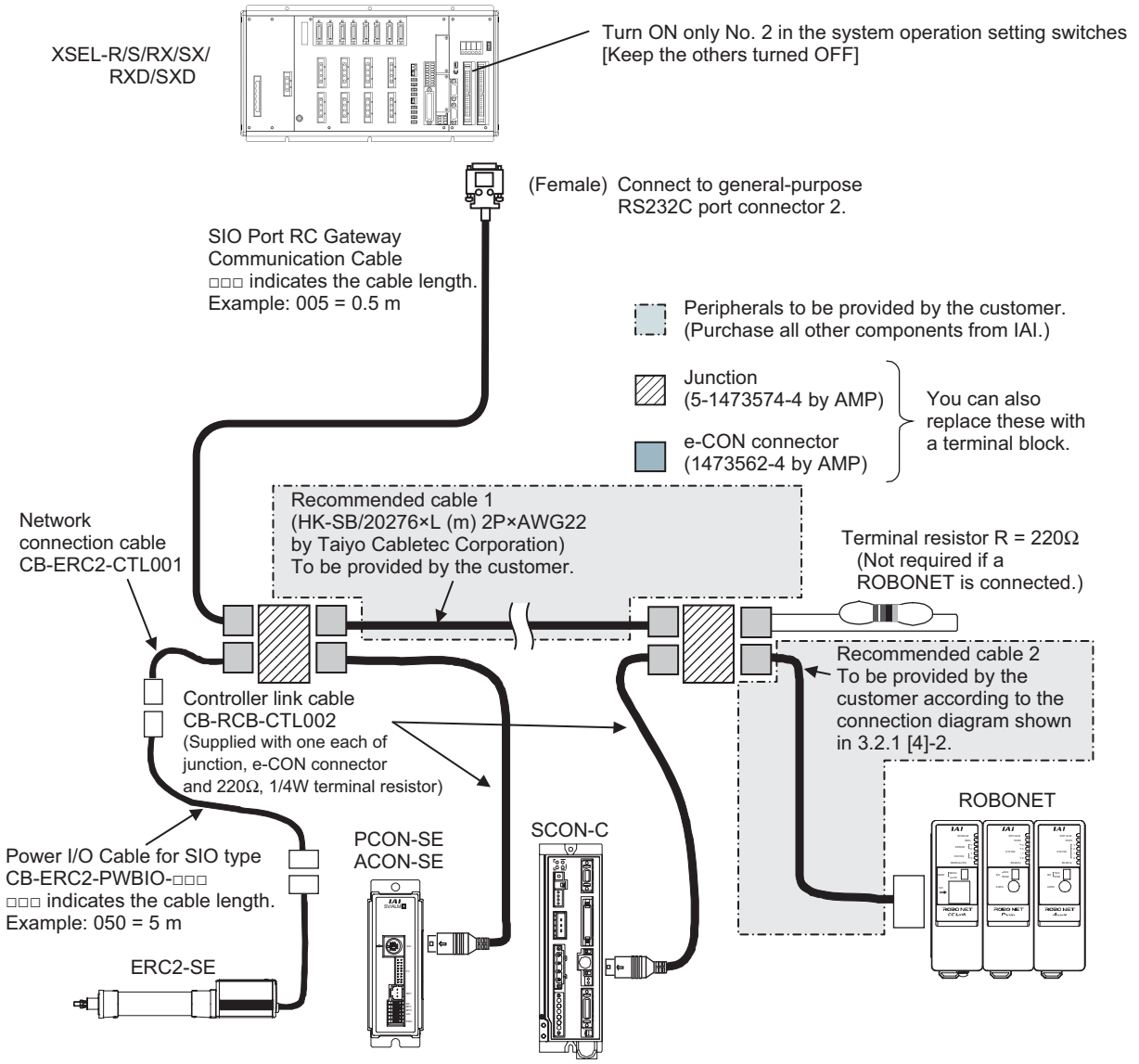
The above table lists only the parts used directly for SIO communication. Other parts, such as safety circuits, power supplies and wirings to connect the foregoing, must be provided separately.
In the table, □□□ indicates the cable length. Example: 050 = 5 m

[3]-2 Wiring drawing (Example 3: When RS232 conversion unit is used to connect only 1 axis for XSEL-P/Q/PX/QX)



[4]-1 Wiring diagram (Example 4: When connecting to XSEL-R/S/RX/SX/RXD/SXD)

> ⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)



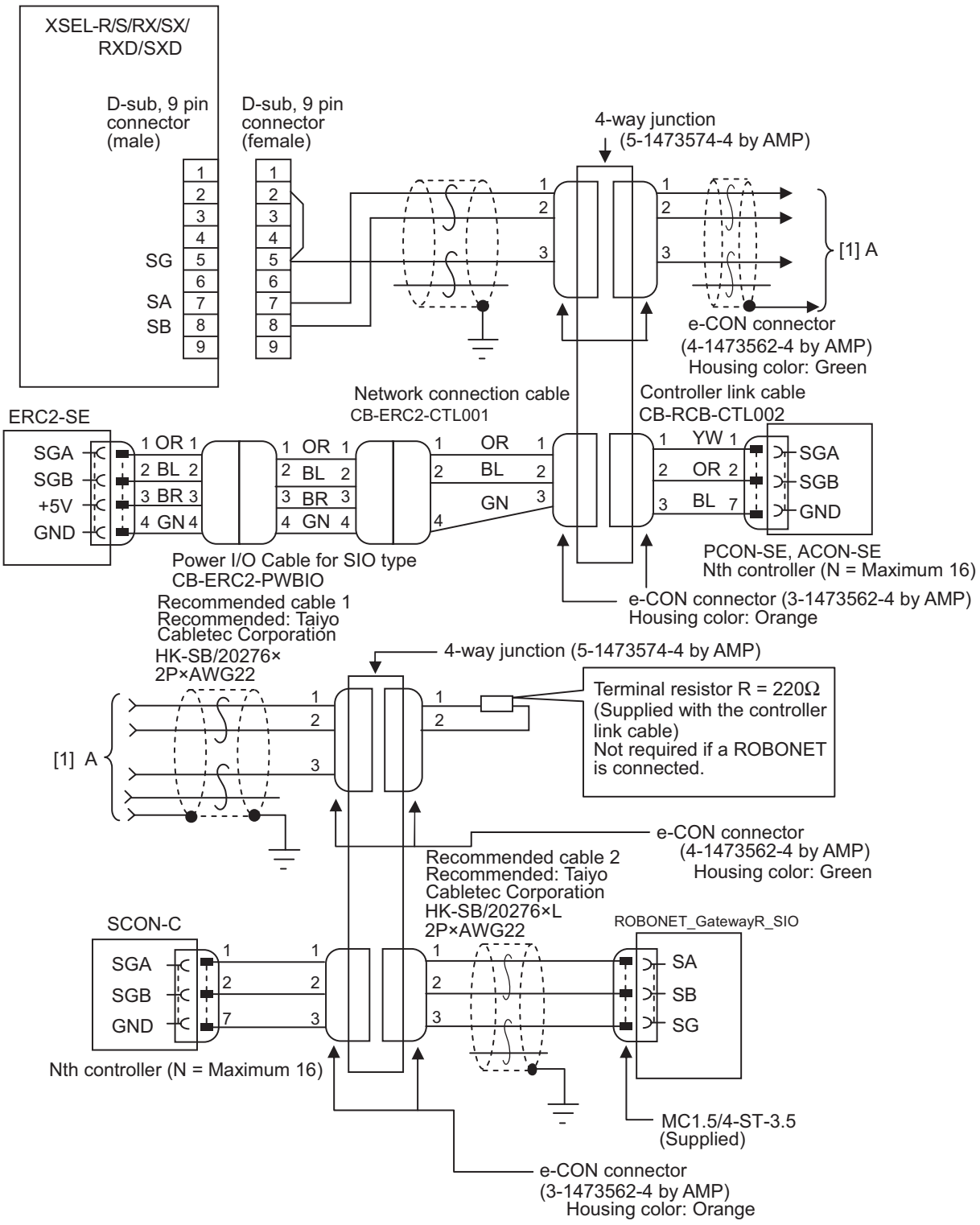
> ⚠ Caution:
> - Multiple ROBONET GatewayR_SIO units cannot be connected to a single network.
> - Since the ROBONET has a built-in terminal resistor, connect the ROBONET to the junction farthest away from the X-SEL (at the end of the trunk line). Do not connect a terminal resistor to the junction.

Components required by the configuration shown in Example 4

	Name	Model	Quantity
Purchased from IAI	Power I/O Cable for SIO type	CB-ERC2-PWBIO-□□□	1
	Network connection cable	CB-ERC2-CTL001	1
	Controller link cable	CB-RCB-CTL002	2
	SIO Port RC Gateway Communication Cable	CB-RS-SIO□□□	1
Provided by the customer	Recommended cables 1, 2, 3	HK-SB/20276 (Taiyo Cabletec Corporation)	Lm
	e-CON connector	3-1473562-4 (AMP)	1

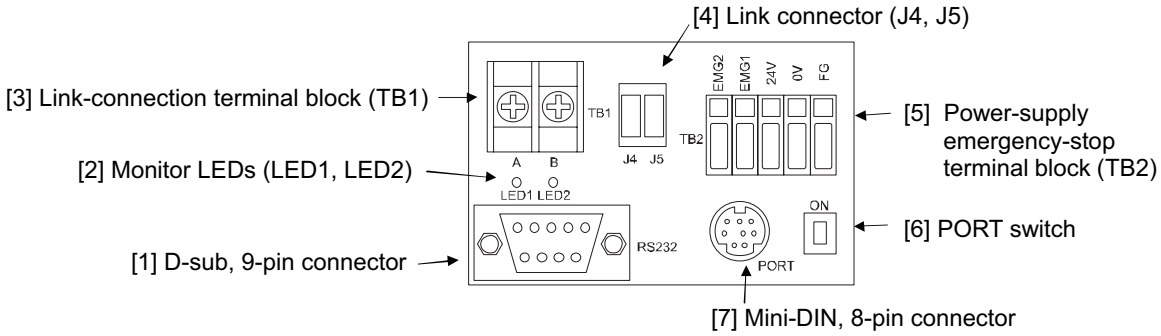
The above table only lists the components required for SIO communication. The customer must provide other components that are required, such as a safety circuit, power supply and cables for their connection.
□□□ in the table indicates the cable length. Example: 050 = 5 m

[4]-2 Circuit diagram (Example 4: When connecting to XSEL-R/S/RX/SX/RXD/SXD)



⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON)

[5] SIO converter for X-SEL and RC controller connection (RCB-TU-SIO)
This is a RS232C ⇔ RS485 converter.



1) D-sub, 9-pin connector
This connector provides connection points with the host.
Connect to general-purpose RS232C port connector 2 (S2) on the X-SEL controller using a RS232C cross cable (commercial product).

2) Monitor LEDs (LED1, LED2)
- LED1 : This LED turns ON/blinks while the RC controller is sending data.
- LED2 : This LED turns ON/blinks while the host is sending data.

3) Link-connection terminal block (TB1)
This terminal block provides connection points for linking RC controllers.
- A : Connect to pin 1 on the RC controller's communication connector (SGA).
- B : Connect to pin 2 on the RC controller's communication connector (SGB).

4) Link connectors (J4, J5)
These connectors provide connection points with the RC controller.
An optional link cable (CB-RCB-CLT002) can be connected directly.

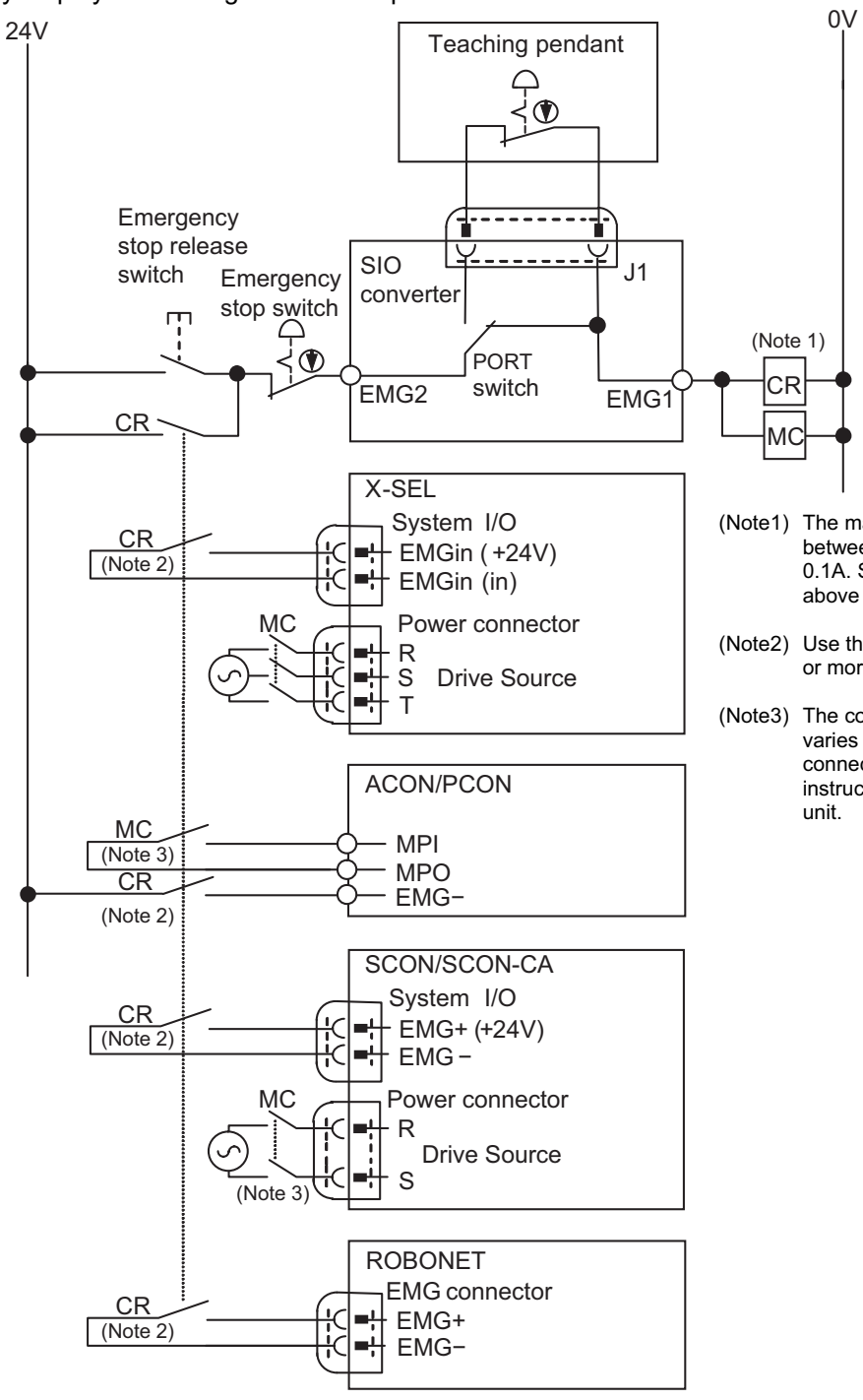
5) Power-supply & emergency-stop terminal block (TB2)
- EMG1, EMG2 : Contact outputs for the emergency stop switch on the teaching pendant
When the PORT switch is in the ON position, EMG1 and EMG2 are connected to the emergency stop switch on the teaching pendant. When the PORT switch is in the OFF position, EMG1 and EMG2 are shorted.
- 24V : Supply +24V power. (Current consumption: 0.1 A or less)
- 0V : Supply 0V power. (Use a common 0V line for 24V DC controllers.)
- FG : A FG connection terminal.

* Applicable wires Single wire ϕ0.8 to 1.2 mm
Stranded wire AWG18 to 20 (stripped by 10 mm, with wire tips soldered)

6) PORT switch
- ON : When a teaching pendant is used
- OFF : When no teaching pendant is used

7) Mini-DIN, 8-pin connector
This connector provides connection points with the teaching pendant or PC software.
This connector can be used when no X-SEL controller is connected or a X-SEL controller is connected but its power is turned OFF.

[6] Emergency stop system configuration example



(Note1) The maximum flowing current between EMG1 and EMG2 is 0.1A. Set the coil capacity to be above it.

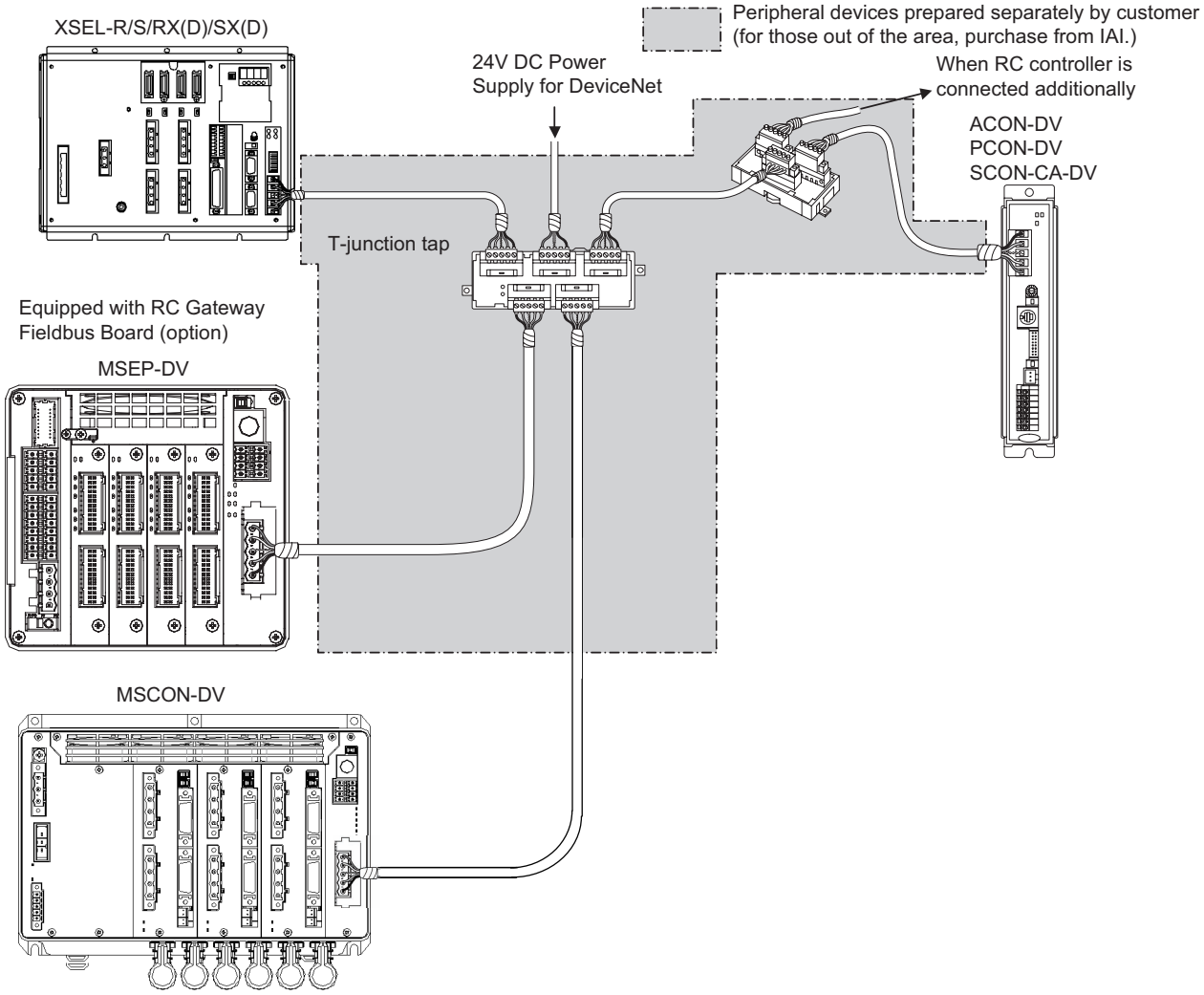
(Note2) Use the contact capacity 0.2A or more.

(Note3) The contact capacity on MC varies depending on the connected actuator. See the instruction manual for the main unit.

- EMG1 and 2 can be used to reflect the status of the emergency stop switch on the teaching pendant in the emergency stop circuit of the system.
  If a teaching pendant is used, turn the PORT switch to the ON side.
  (This enables the emergency stop circuit of the teaching pendant.)
- To comply with the safety categories, make sure to follow the instructions in the operation manual of each controller for the emergency stop and driving source cutoff for each controller.

3.2.2 Wiring Method of Fieldbus type

[1]-1 Wiring



⚠ Caution:
Prepare the peripheral devices for DeviceNet (T-junction tap, cable, etc.) separately.
Unless otherwise specified, follow DeviceNet Standard for the contents related to the wiring and network power supply.
Use a common 0V line for the 24V power supply for each controller. (Except for SCON)
When using SCON-CA, an actuator of the direct drive motor type cannot be connected.

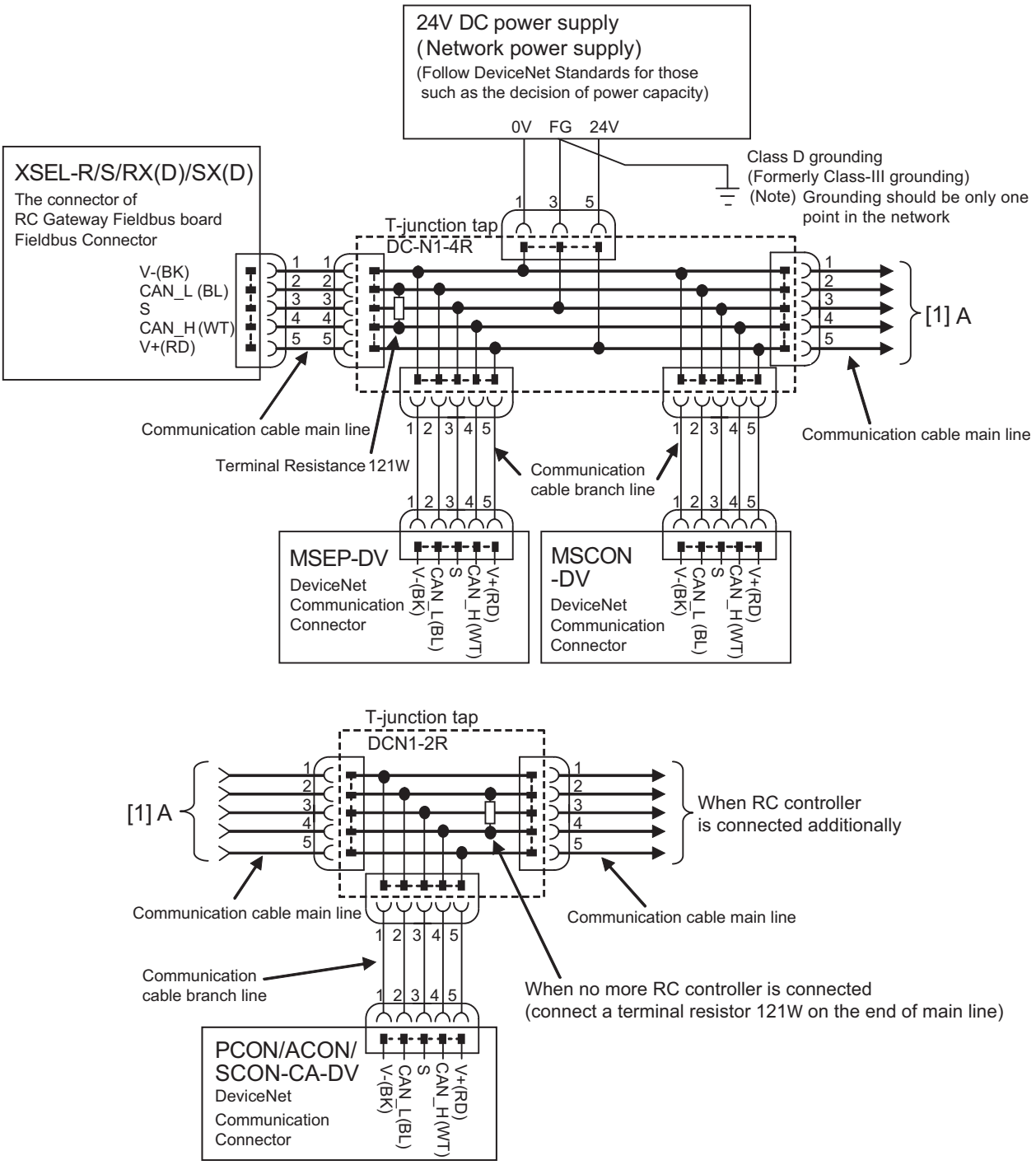
Components Necessary to Construct Layout in Example

The following is just an example. Prepare the wiring components dedicated for DeviceNet specifications.

	Name	Model	Quantity
Provided by the customerr	Communications cable	(Thick) DCA2-5C10 (OMRON)	Lm
		(Thin) DCA1-5C10 (OMRON)	Lm
	T-junction tap	DCN1-2R (OMRON)	1
	T-junction tap	DCN1-4R (OMRON)	1
	Terminal resistance	121Ω ±1% 1/4W	2
	Communication power supply	Voltage: 24V DC ±10% Current: DeviceNet Master + Slave Total of communication power supply	1

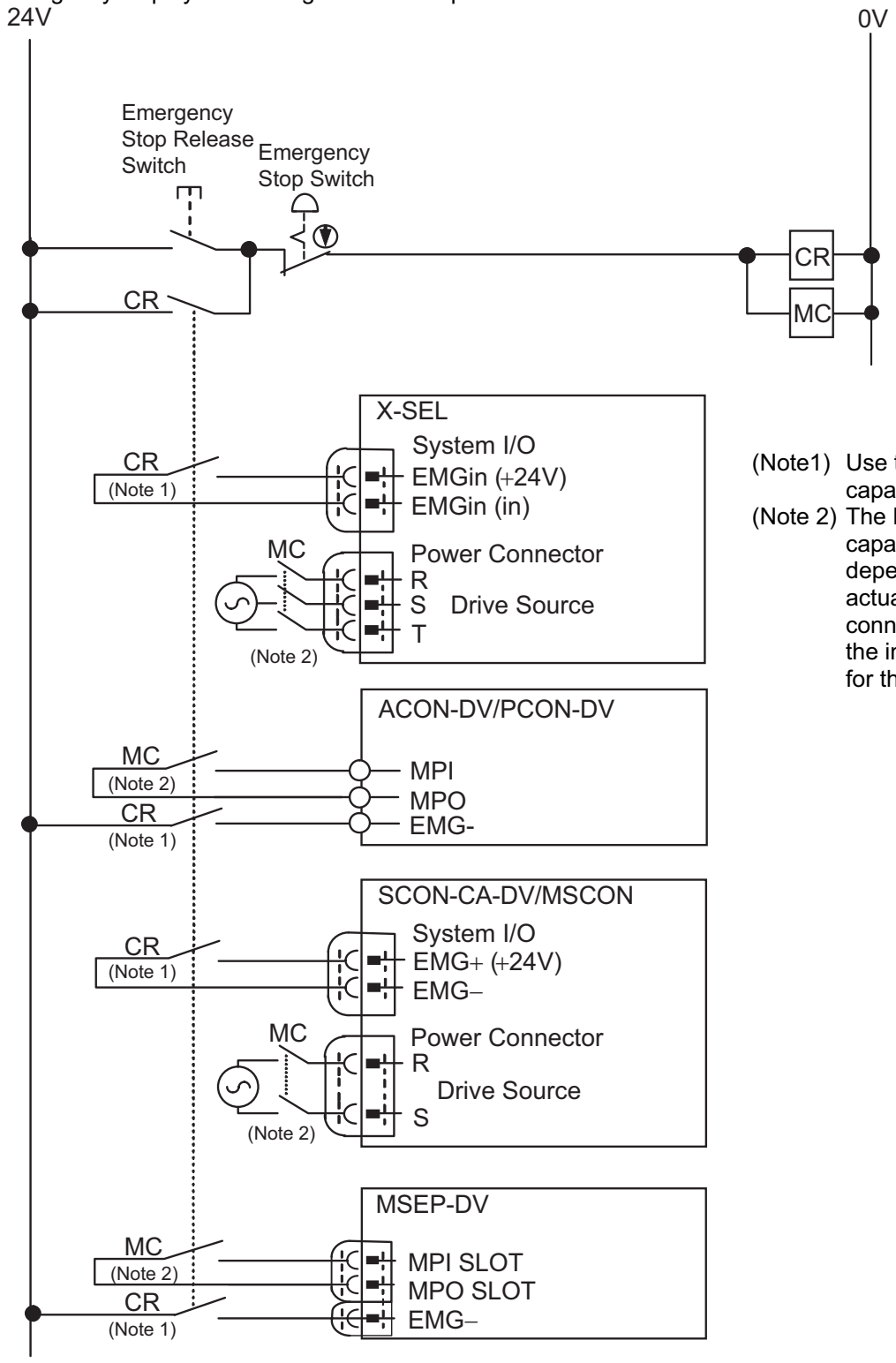
In the table above, shows only the wiring components for Fieldbus Type.
Prepare separately the other necessary components such as the power device.

[1]-2 Connection diagram



⚠ Caution: Use a common 0V line for the 24V power supply for each controller. (Except for SCON-CA)

[2] Emergency stop system configuration example



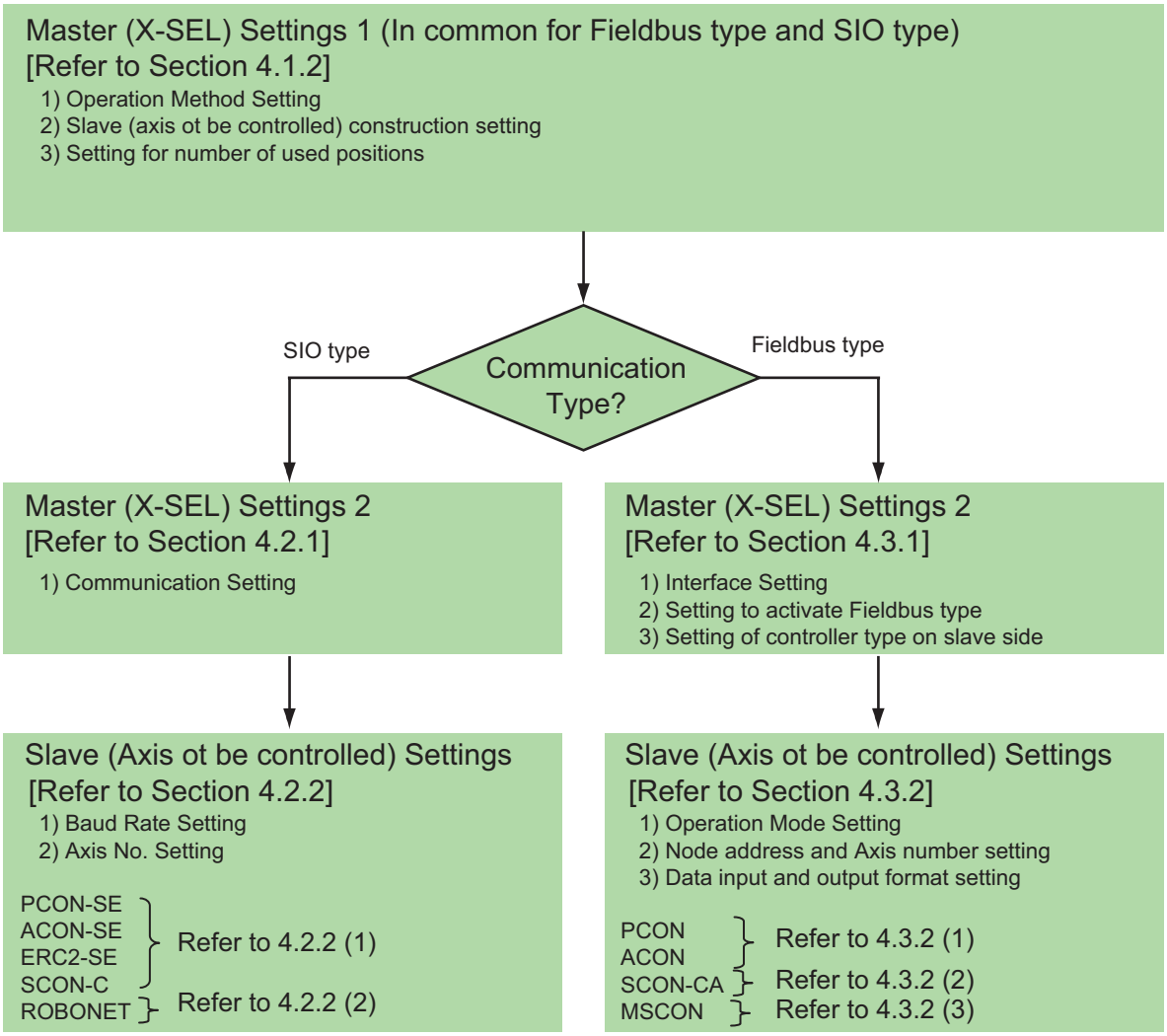
(Note1) Use the contact capacity 0.2A or more.
(Note 2) The MC's contact capacity varies depending on the actuator to be connected. Check it in the instruction manual for the main machine.

- To comply with the safety categories, make sure to follow the instructions in the instruction manual of each controller for the emergency stop and driving source cutoff for each controller.

4. RC Gateway Function setting

4.1 Setting Procedure

Conduct the settings for the master (X-SEL) and the slaves (axis to be controlled: ROBO Cylinder (RC) controller, etc.) following the procedure stated below.



4.1.1 Before Starting Setup (Regarding Binary and Hexadecimal Numbers)

Inputting parameters of RC Gateway setting are in decimal numbers, binary and hexadecimal numbers. Have the setting done by referring to the following. (if the last digit of the set value is H set in a hexadecimal number, while in a binary number if the last digit is b.)

- Binary number

Binary number expresses all numeral figures with using two symbols: 0 and 1.
The number increases in the order of 0, 1, and then the digit changes next and becomes 10.
In such way, binary number proceeds as 2^0 (1), 2^1 (2), 2^2 (4), 2^3 (8). The numbers in brackets are decimal numbers. For example, a number 1101 can be expressed as shown below in the binary number.

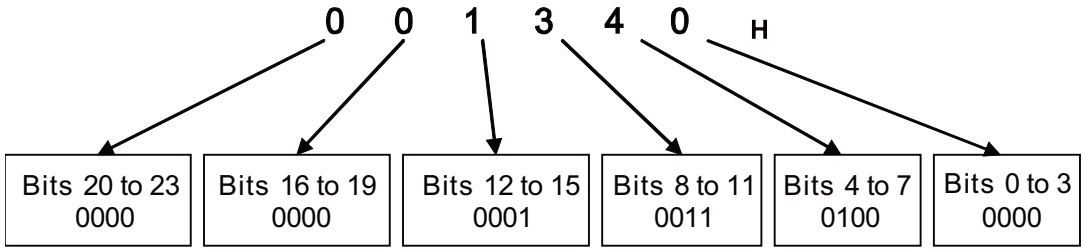
Digit of 2^3's place	Digit of 2^2's place	Digit of 2^1's place	Digit of 2^0's place
1	1	0	1

$1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1 = 13$ (the decimal system)

- Hexadecimal numbers

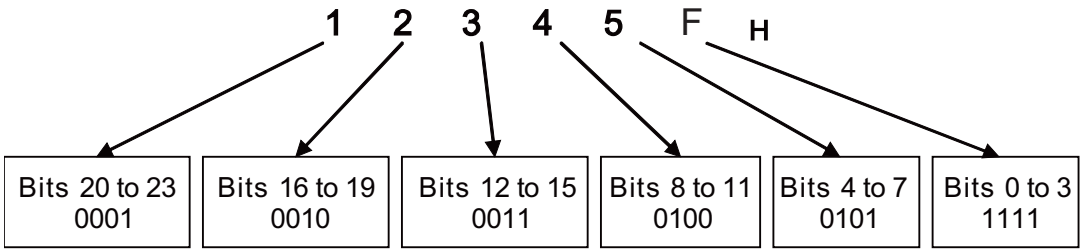
Hexadecimal number expresses a numeral figure with using numbers from 0 to 9 and alphabets from A to F. the number increases in the order of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A (10), B (11), C (12), D (13), E (14), F (15), and then the digit changes for the next value (16) and becomes 10. The numbers in brackets are decimal numbers.

Example 1 : 001340_H is expressed in the binary number;



In the decimal number it is 4,928.

Example 2 : $12345F_H$ is expressed in the binary number;

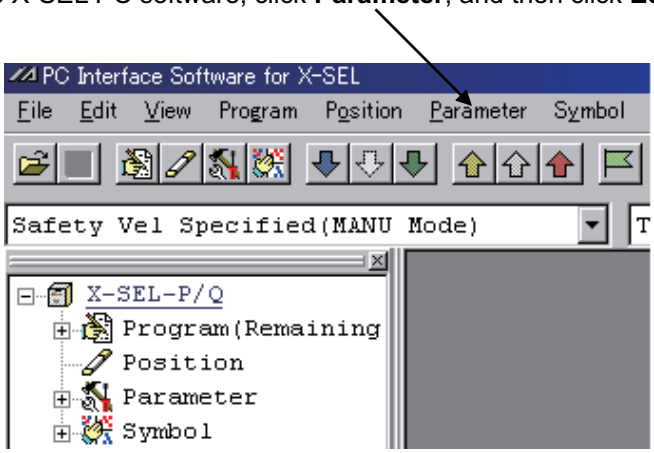


In the decimal number it is 1,193,055.

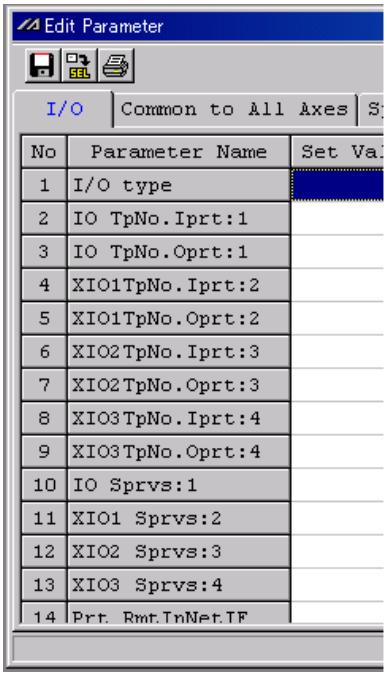
4.1.2 Master (X-SEL) Settings 1 (In common for Fieldbus type and SIO type)

The setting should be conducted following the procedure indicated below after connecting the PC software (IA-101-X-□□□) to X-SEL controller.

[Preparation 1] Displaying the parameter setting screen
Start the X-SEL PC software, click **Parameter**, and then click **Edit**.



[Preparation 2] When the parameter edit screen appears, select the I/O tab.



[Procedure 1] Operation method setting
Select using position data in from the master (X-SEL) controller memory or slave (RC controller) controller memories.

No.	I/O Parameter	Unit	Set Value	Default factory setting
216	RC Gateway Function Select	-	0: To use position data in X-SEL 1: To use position data in RC	0

[Procedure 2] Settings for Slave (Controlled Side) Axes pattern
Set the axis number for each slave.

No.	I/O Parameter	Unit	Set Value	Default factory setting
217	RC Gateway Link Axes Pattern (15-8)	-	00000000b to 11111111b	00000000b
218	RC Gateway Link Axes Pattern (7-0)			

Assign an axis number from 0 to 15 to each of the connected slave axes. Set the bit corresponding to the assigned axis number to “1”. This parameter indicates the axis number that conducts an operation.
Set “0” for those axes that are connected but will not be used.

Parameter No.217							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Axis No 15 1: Used 0: Not used	Axis No 14 1: Used 0: Not used	Axis No 13 1: Used 0: Not used	Axis No 12 1: Used 0: Not used	Axis No 11 1: Used 0: Not used	Axis No 10 1: Used 0: Not used	Axis No 9 1: Used 0: Not used	Axis No 8 1: Used 0: Not used

Parameter No.218							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Axis No 7 1: Used 0: Not used	Axis No 6 1: Used 0: Not used	Axis No 5 1: Used 0: Not used	Axis No 4 1: Used 0: Not used	Axis No 3 1: Used 0: Not used	Axis No 2 1: Used 0: Not used	Axis No 1 1: Used 0: Not used	Axis No 0 1: Used 0: Not used

(Example 1) When axis of Axis No.0 to 7 is used:
I/O Parameter No.217 = 00000000b
I/O Parameter No.218 = 11111111b

(Example 2) When axis of Axis No.0 to 11 is used:
I/O Parameter No.217 = 00001111b
I/O Parameter No.218 = 11111111b

For the setting of this parameter, refer to the list below and match the settings to those for the slave (axis to be controlled).

Communication System	Slave Side Controller	Remarks
SIO type	PCON-SE/ACON-SE/SCON-C/ERC2-SE	Refer to 4.2.2 (1) [Procedure 1]
	ROBONET_SIO type	Refer to 4.2.2 (2) [Procedure 4]
Fieldbus type	PCON-DV/ACON-DV/SCON-CA-DV	Refer to 4.3.2 (1) [Procedure 1]
	MSEP-DV	Refer to 4.3.2 (2) [Procedure 2 to 4]
	MSCON-DV	Refer to 4.3.2 (3) [Procedure 2 to 4]

[Procedure 3] Setting of number of used positions (Set this only in method to use position data in X-SEL)
Set the number of positions to be used and the maximum value of the axis number for when using the position data in X-SEL.

No.	I/O Parameter	Unit	Set Value	Default factory setting
501	Number of RC Gateway Position Data	-	1 to 512	0
502	Maximum Axis Number for RC Gateway Position Data Definition	-	0 to 15	0
503	Number of Position Data for RC Gateway Position Data Definition	-	1 to 512	0

(1) I/O Parameter No.501
Input the number of positions of the axis that has the most positioning points among the connected axes. However, there is a restriction to the maximum number of positions for each axis depending on the number of connected axes. Have the setting done by referring to the following.

Number of connected axes	Number of positions (per axis)
0 to 7	512
8	455
9	409
10	372
11	341
12	315
13	292
14	273
15	256

(2) I/O Parameter No.502
Input the maximum value of the used axis number.

(3) I/O Parameter No.503
Input the same value as that in No. 501.

* Go ahead to Section 4.2 for SIO type and 4.3 for Fieldbus type.

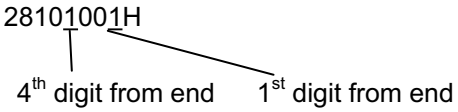
4.2 Settings for SIO type

4.2.1 Master (X-SEL) Setting 2

Continued from the previous page, X-SEL PC software is used in the setting process.

[Procedure 1] Communication setting
Have the setting done to use RS232C Communication Port in RC Gateway Function. Set "1" to the 1st and 4th digits from the end. Do not change the other digits.

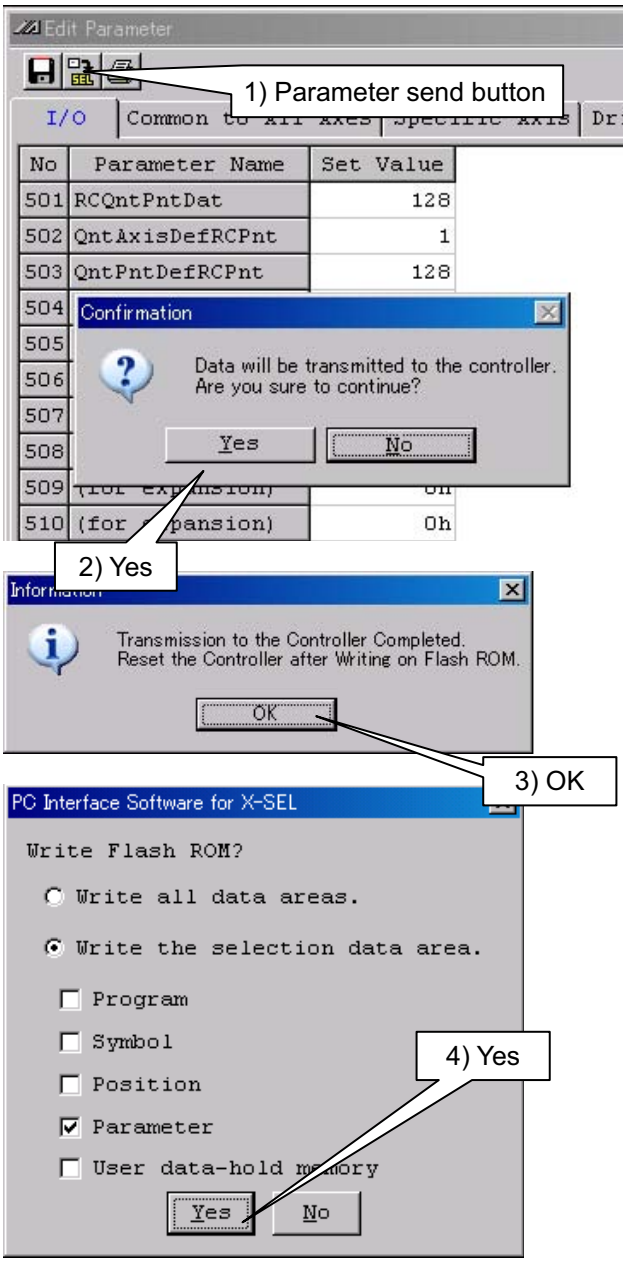
No.	I/O Parameter	Unit	Set Value	Default factory setting
213	Free-for-User SIO Channel 2 Attribute 1 (Mount Standard)	-	28101001H	28100001H



1st digit from end 0 : Communication port not to be used
1 : Communication port allowed to be used

4th digit from end 0 : RS232C mode
1 : RC Gateway mode (Baud Rate 230.4kbps)

[Procedure 2] Reflection of changed parameters
Click the parameter send button to send the changed parameters to X-SEL and then write into the flash ROM.
After that, a message appears to ask whether to software reset X-SEL. Have the reset.



> ⚠ Caution: After the parameters are written in the flash ROM, Error Code 6A1 (UBM Data Construction Change Error) will be generated if conducting a software reset. The way how to solve in case this error is generated is as described below.
> Click on Controller (C) → Memory Initializing (I) → User Data Retaining Memory (U) in XSEL PC Software to perform an initializing of the memory. After writing into the flash ROM, perform a software reset or reboot the power. Conduct a software reset or reboot the power after writing to flash ROM. By initializing the memory, the capacity in RC position data is ensured and the error will be solved.!

4.2.2 Slave (axis to be controlled) Setting (SCON-C, PCON-SE, ACON-SE, ERC2-SE, ROBONET)

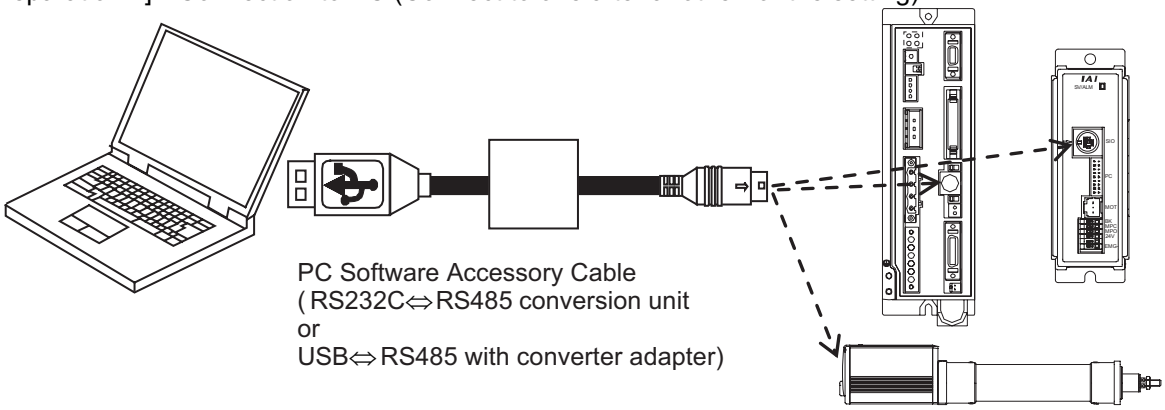
(1) SCON-C, PCON-SE, ACON-SE and ERC2-SE.

* Refer to (2) in this section for ROBONET.

The setting of the slave axis controllers is to be conducted by connecting a teaching tool such as the PC software to one controller after another. In this section, explains how to conduct the settings with using the PC software (RC PC Software: RCM-101-□□□).

Set the mode-changeover switch to MANU side for SCON.

[Preparation 1] Connection to PC (Connect to one after another for the setting)

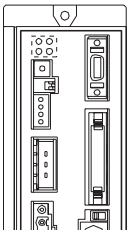


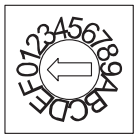
[Procedure 1] Axis No. Setting

The setting of the axis numbers differ for each SCON-C, PCON-SE, ACON-SE and ERC2-SE.
In the below, describes the setting for SCON-C first, and then the settings for PCON-SE, ACON-SE and ERC2-SE.

- SCON-C setting
  Set the axis number with the hexadecimal rotary switch allocated on the front panel.
  Set the arrow to the desired axis number with using a slotted screw driver.

> ⚠ Caution: Have the setting of the axis number not duplicated. It should also not duplicate with the ROBONET construction units.
> It is not necessarily be in numbers in a row.



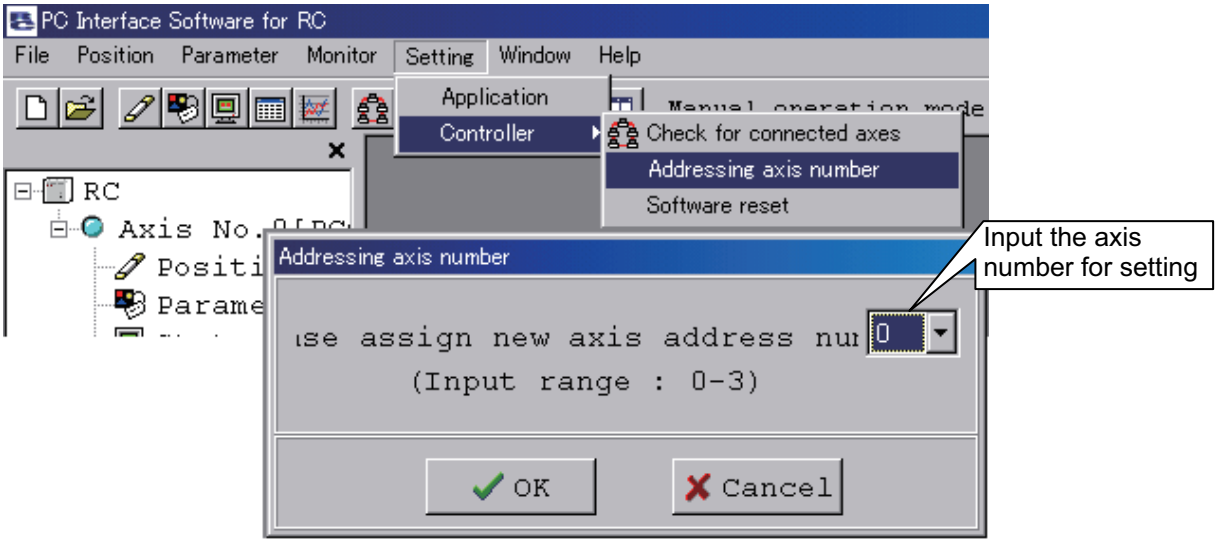


Setting axis number 0

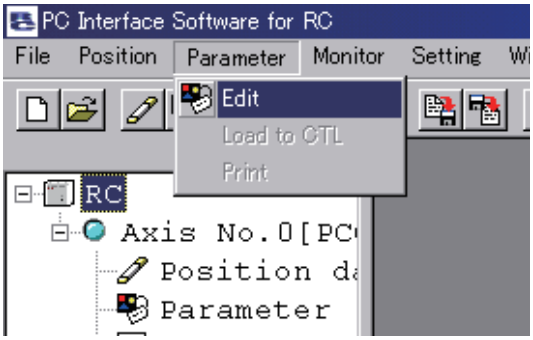
Setting axis number 1

Setting axis number 10

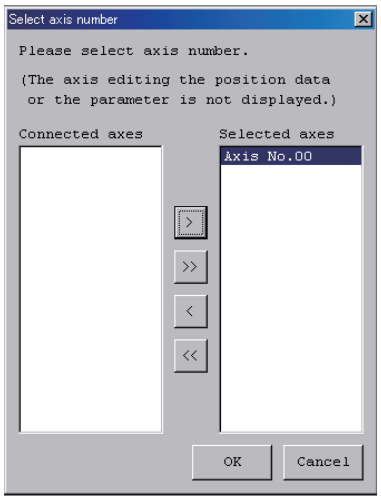
- The Setting of PCON-SE, ACON-SE and ERC2-SE
  Click **Setting** → **Controller** → **Addressing axis number** in RC PC Software.
  In Addressing axis number window, input the axis numbers (from 0 to 15) and click **OK**.



[Procedure 2] Display of Parameter Setting Window
Start the RC PC software, click **Parameter**, and then click **Edit**.



[Procedure 3] Selecting axis to set parameters
Select the axis number of the controller that the setting is to be conducted, and click **OK**.
If asked for the password to be provided, input the password (5119).



From the “Connected axes” box, select the axis number to be set up, and click **>**.
Confirm that the axis number is moved to the “Selected axes” box, and click **OK**.

[Procedure 4] Baud rate setting
Have the setting for Parameter No.16 SIO Baud Rate to 230400bps.
Have the setting for Parameter No.17 Slave Station Transmitter Activation Minimum Waiting Time (RTIM) to 2msec.

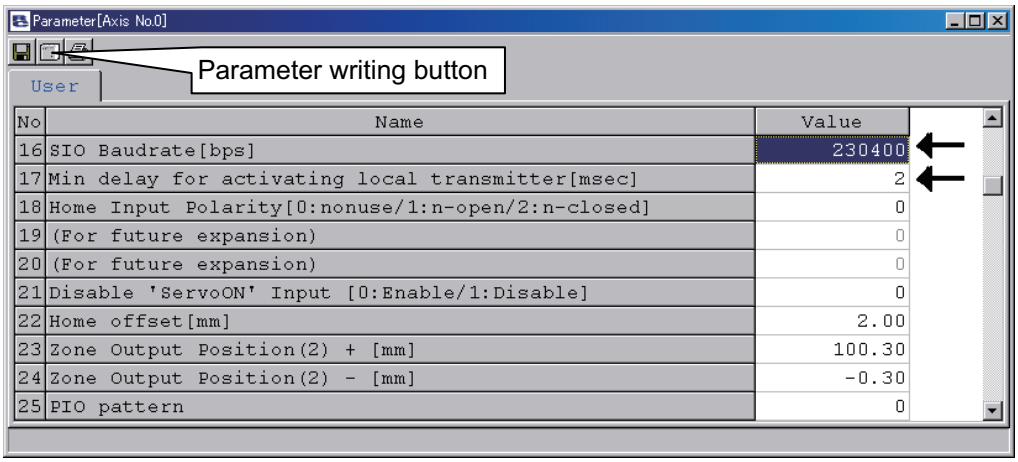
No.	Parameter	Unit	Set Value	Default factory setting
16	SIO baud rate [bps]	bps	230400	38400
17	Slave station transmitter activation minimum waiting time (RTIM)	msec	2	5

If a number other than indicated above is set in Parameter No.16 or 17, the communication cannot be performed.

[Procedures 5] Reflection of Changed Parameters

After writing the parameter by clicking the parameter writing button, reboot the power to the slave axis controller.

Set the mode-changeover switch to AUTO side for SCON.

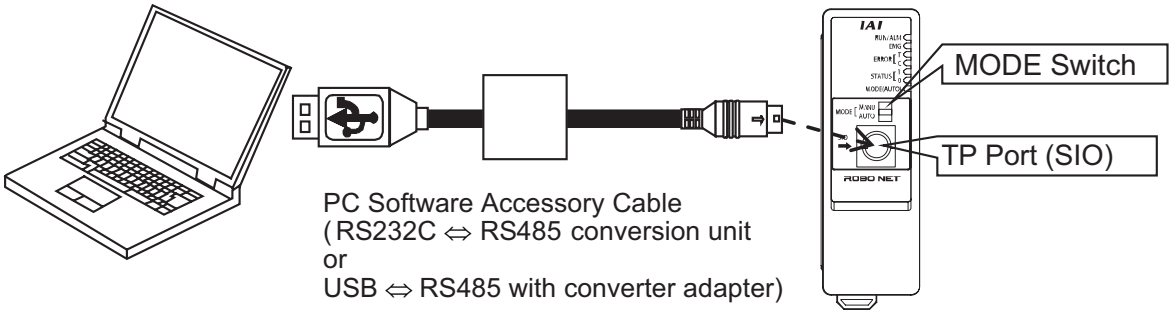


No	Name	Value
16	SIO Baudrate[bps]	230400
17	Min delay for activating local transmitter[msec]	2
18	Home Input Polarity[0:nonuse/1:n-open/2:n-closed]	0
19	(For future expansion)	0
20	(For future expansion)	0
21	Disable 'ServoON' Input [0:Enable/1:Disable]	0
22	Home offset[mm]	2.00
23	Zone Output Position(2) + [mm]	100.30
24	Zone Output Position(2) - [mm]	-0.30
25	PIO pattern	0

(2) For ROBONET

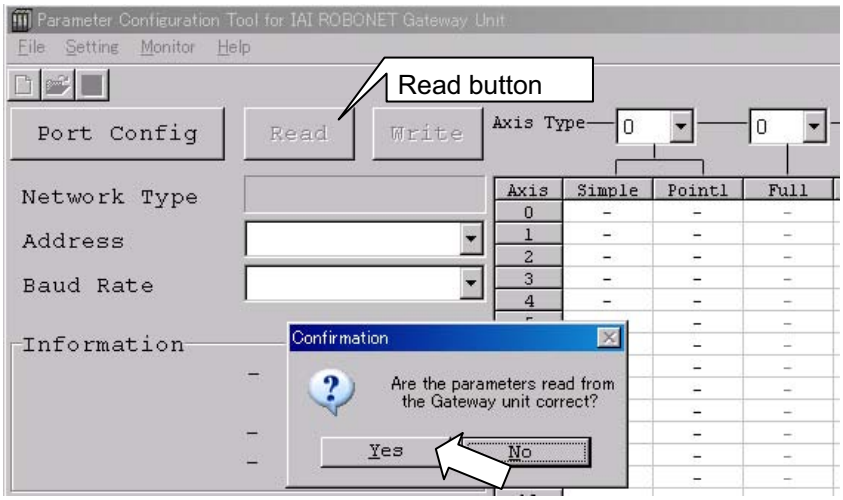
* Refer to (1) in this section for SCON-C, PCON-SE, ACON-SE and ERC2-SE.
The setting of ROBONET is to be conducted with connecting Gateway Parameter Setting Tool to the TP port (SIO) provided on the front panel of GateWayR Unit.
Set the MODE switch on the front panel of GateWayR Unit to MANU side.

[Preparation 1] Connection to PC



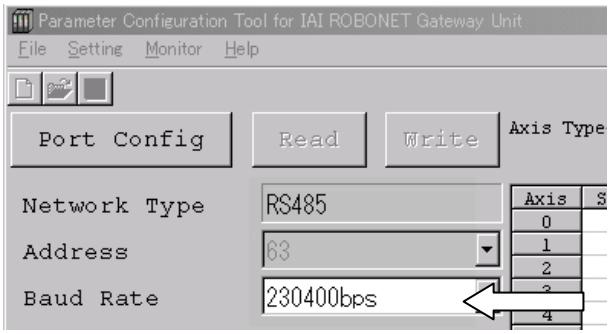
[Preparation 2] Display of Parameter Setting Window

Open Gateway Parameter Setting Tool, and click **Read** button and then **Yes**.

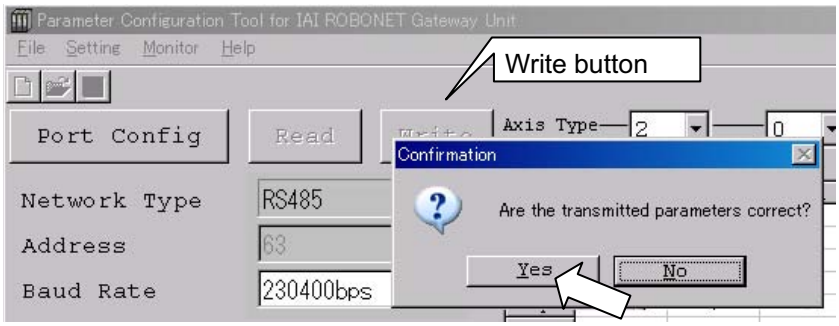


[Procedures 1] Baud Rate Setting

Set the baud rate to 230400bps.

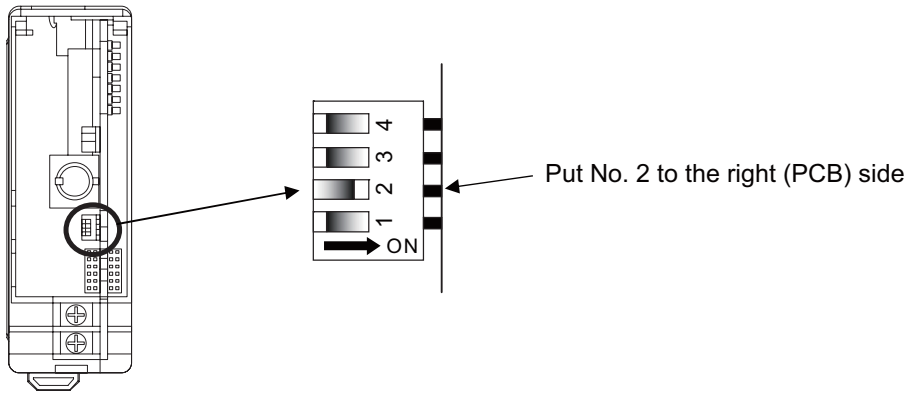


[Procedures 2] Writing the Set Baud Rate
Click **Write** button and then **Yes**.



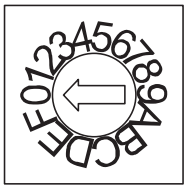
[Procedures 3] Setting of User Setting Switch
Open the front cover on GateWayR Unit and Turn ON Switch No.2 in the user setting switches (DIPSW) inside the front cover (and leave it on from now ON).

(Condition the front cover being open)

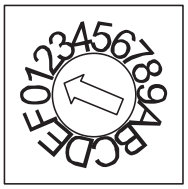


[Procedures 4] Setting axis number of ROBONET
Set the axis number to each unit (RACON and RPCON) constructing ROBONET. Set the axis number to each unit with using the rotary switch (hexadecimal number) on the front panel.
Set the arrow to the desired axis number with using a slotted screw driver.

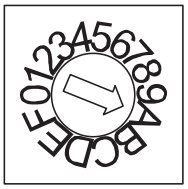
> ⚠ Caution: Have the setting of the axis number not duplicated. It should also not duplicate with the slave axis controllers other than ROBONET construction units.
> It is not necessarily be in numbers in a row.



Setting axis number 0



Setting axis number 1



Setting axis number 10

[Procedures 5] Rebooting
Set the MODE switch on the front panel of GateWayR Unit to AUTO side.
Re-input the power to the ROBONET.

4.3 Settings for Fieldbus type

4.3.1 Master (X-SEL) Setting 2

X-SEL PC software is used in the setting process.

[Procedure 1] Interface setting

This parameter is set at the shipment from the factory, and is available only for reference.

No.	I/O Parameter	Unit	Set Value	Default factory setting
225	Network I/F Module Control	-	000H : RC Gateway Fieldbus board not used 5H : Mounting RC Gateway Fieldbus board to network dedicated slot 500H : Mounting RC Gateway Fieldbus board to I/O 1	Installed before delivery in accordance with mounted position.

[Procedure 2] Fieldbus type valid setting

Set whether to valid/invalid RC Gateway Fieldbus Function. Set the following parameter to "1".

No.	I/O Parameter Name	Unit	Set Value	Default factory setting
431	Fieldbus Master Function Select	-	0: RC Gateway Invalid Fieldbus Function 1: RC Gateway Valid Fieldbus Function	0H

[Procedure 3] Setting for controller definition on slave (axis to be controlled)
Have the settings for the construction definitions of Fieldbus Slaves 0 to 15 (I/O Parameters No. 432 to 447).
Establish the settings for the node addresses of each slave connected to X-SEL.

Explanation for setting values 00 00 00 H
3) 2) 1)

(1) : Connected Controller Type Setting
Not used : 00 MSEP : 01 ACON/PCON : 02 SCON-CA : 03 MSCON: 04

(2) : Slave Input Size Setting
- In the case of MSEP or MSCON: The slave input size is calculated using the following formula and the value converted from decimal one to hexadecimal one is set.
Slave Input Size [byte] = Header Capacity (Note 1) + (Capacity per axis (Note 2) × No. of Connected Axes)
* 1: Header Capacity = Fixed 16 bytes
* 2: Capacity per axis (Method to use position data in XSEL) = 16 bytes
Capacity per axis (Method to use position data in RC) = 8 bytes
For the method to use position data in XSEL for ACON/PCON/SCON-CA: 10
For the method to use position data in RC for ACON/PCON/SCON-CA : 08

(3) : Slave Output Size Setting
- In the case of MSEP or MSCON: The slave output size is calculated using the following formula and the value converted from decimal one to hexadecimal one is set.
Slave output Size [byte] = Header Capacity (Note 1) + (Capacity per axis (Note 2) × No. of Connected Axes)
* 1: Header Capacity = Fixed 16 bytes
* 2: Capacity per axis (Method to use position data in XSEL) = 16 bytes
Capacity per axis (Method to use position data in RC) = 8 bytes
For the method to use position data in XSEL for ACON/PCON/SCON-CA: 10
For the method to use position data in RC for ACON/PCON/SCON-CA : 08

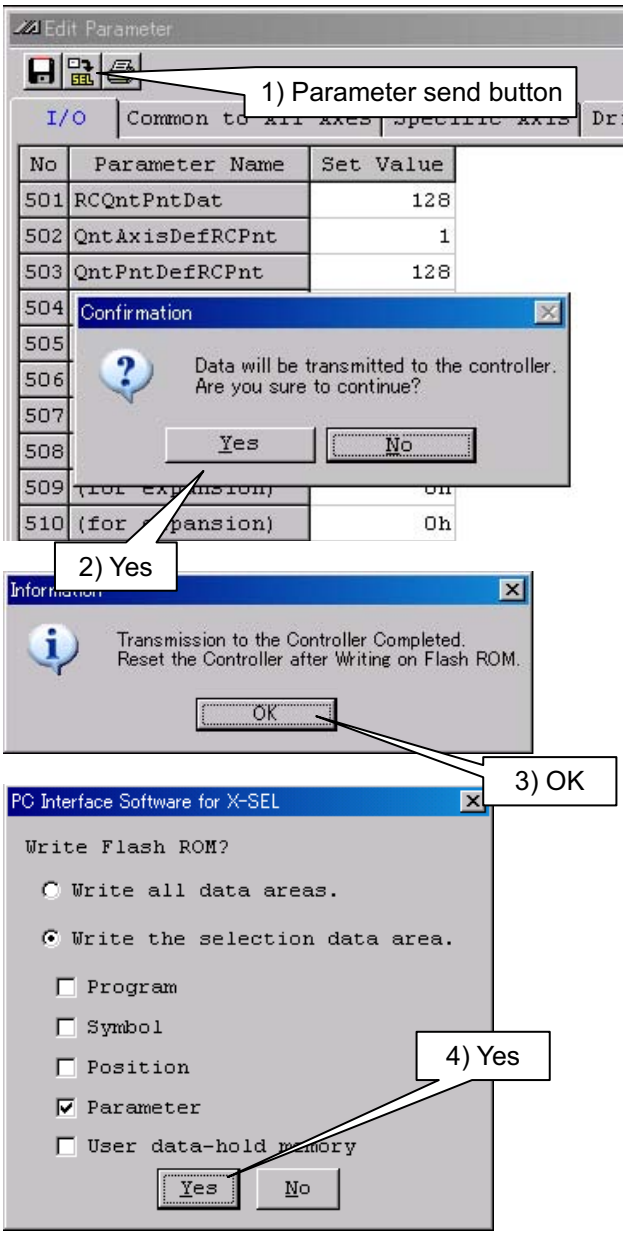
Example)

First Unit	MSEP	8-axis type Method to use position data in XSEL Slave input output Size = 144 bytes	Set Value No.432...909001H No.440...101002H No.441...101003H
Second Unit	ACON	Method to use position data in XSEL	
Third Unit	SCON-CA	Method to use position data in XSEL	

No.	I/O Parameter	Unit	Set Value	Default factory setting
432	Fieldbus Slave 0 Construction Definition (Registration of controller type connected to Node Address 0)	-	Refer to explanation for setting values	000000H
433	Fieldbus Slave 1 Construction Definition (Registration of controller type connected to Node Address 1)	-	Refer to explanation for setting values	000000H
434	Fieldbus Slave 2 Construction Definition (Registration of controller type connected to Node Address 2)	-	Refer to explanation for setting values	000000H
435	Fieldbus Slave 3 Construction Definition (Registration of controller type connected to Node Address 3)	-	Refer to explanation for setting values	000000H
436	Fieldbus Slave 4 Construction Definition (Registration of controller type connected to Node Address 4)	-	Refer to explanation for setting values	000000H
437	Fieldbus Slave 5 Construction Definition (Registration of controller type connected to Node Address 5)	-	Refer to explanation for setting values	000000H
438	Fieldbus Slave 6 Construction Definition (Registration of controller type connected to Node Address 6)	-	Refer to explanation for setting values	000000H
439	Fieldbus Slave 7 Construction Definition (Registration of controller type connected to Node Address 7)	-	Refer to explanation for setting values	000000H
440	Fieldbus Slave 8 Construction Definition (Registration of controller type connected to Node Address 8)	-	Refer to explanation for setting values	000000H
441	Fieldbus Slave 9 Construction Definition (Registration of controller type connected to Node Address 9)	-	Refer to explanation for setting values	000000H
442	Fieldbus Slave 10 Construction Definition (Registration of controller type connected to Node Address 10)	-	Refer to explanation for setting values	000000H

No.	I/O Parameter	Unit	Set Value	Default factory setting
443	Fieldbus Slave 11 Construction Definition (Registration of controller type connected to Node Address 11)	-	Refer to explanation for setting values	000000H
444	Fieldbus Slave 12 Construction Definition (Registration of controller type connected to Node Address 12)	-	Refer to explanation for setting values	000000H
445	Fieldbus Slave 13 Construction Definition (Registration of controller type connected to Node Address 13)	-	Refer to explanation for setting values	000000H
446	Fieldbus Slave 14 Construction Definition (Registration of controller type connected to Node Address 14)	-	Refer to explanation for setting values	000000H
447	Fieldbus Slave 15 Construction Definition (Registration of controller type connected to Node Address 15)	-	Refer to explanation for setting values	000000H

[Procedure 4] Writing Process of Changed Parameters to Memory
Click the parameter send button to send the changed parameters to X-SEL and then write into the flash ROM.
A confirmation window appears to ask whether to software reset X-SEL. Select the reset.

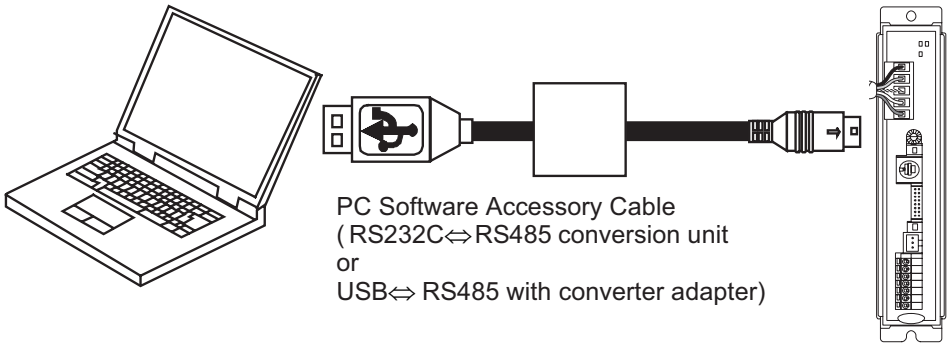


⚠Caution‡	After the parameter is written to the Flash ROM, Error Code 6A1 (UBM Data Construction Change Error) will be generated if the software reset is performed. In case this error is issued, see below for how to cancel the error. In such a case, click on Controller (C) → Memory Initializing (I) → User Data Retaining Memory (U) in XSEL PC Software to perform an initializing of the memory. After writing into the flash ROM, perform a software reset or reboot the power. By initializing the memory, the capacity in RC position data is ensured and the error will be solved.

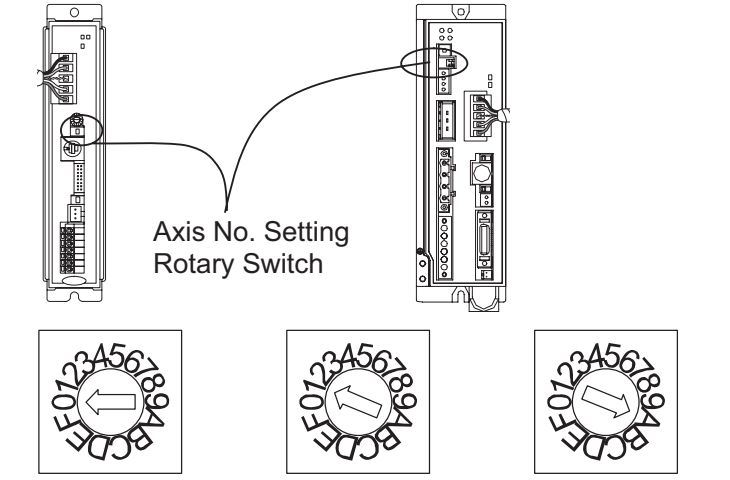
4.3.2 Slave (axis to be controlled) Setting

(1) In the case of PCON, ACON, SCON-CA
The setting of the slave axis controllers is to be conducted by connecting a teaching tool such as the PC software to one controller after another. In this section, explains how to conduct the settings with using the PC software (RC PC Software: RCM-101-□□□).

[Preparation 1] Connection to PC

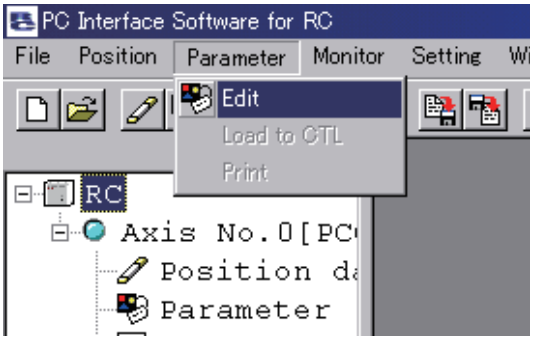


[Procedure 1] Axis number setting
Set the axis number of the slave controller in a hexadecimal number to the rotary switch on the front panel.

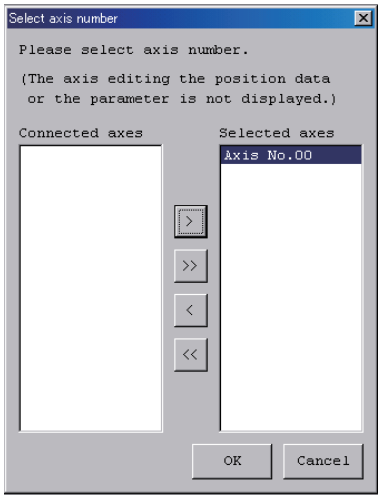


Setting axis number 0 Setting axis number 1 Setting axis number 10

[Procedure 2] Display of Parameter Setting Window
Start the RC PC software, click **Parameter**, and then click **Edit**.



[Procedure 3] Selecting axis to set parameters
Select the axis number of the controller that the setting is to be conducted, and click **OK**.
If asked for the password to be provided, input the password (5119).



From the “Connected axes” box, select the axis number to be set up, and click **>**.
Confirm that the axis number is moved to the “Selected axes” box, and Click **OK**.

[Procedure 4] Operation mode setting
Set the same method as the operation method selected in Section 4.1.2 [Procedure 1] in Parameter No. 84.
• Set to “2” when using the position data in X-SEL.
• Set to “1” when using the position data in RC.

No.	Parameter	Unit	Set Value	Default factory setting
84	Fieldbus operation mode	-	1: Position / Simple Direct Mode 2: Half Direct Mode	0

[Procedure 5] Axis number and Node address setting
Set the node address set in Section 4.3.1 [Procedure 3] to Parameter No. 85.

No.	Parameter	Unit	Set Value	Default factory setting
85	Fieldbus Node address	-	0 to 15	0

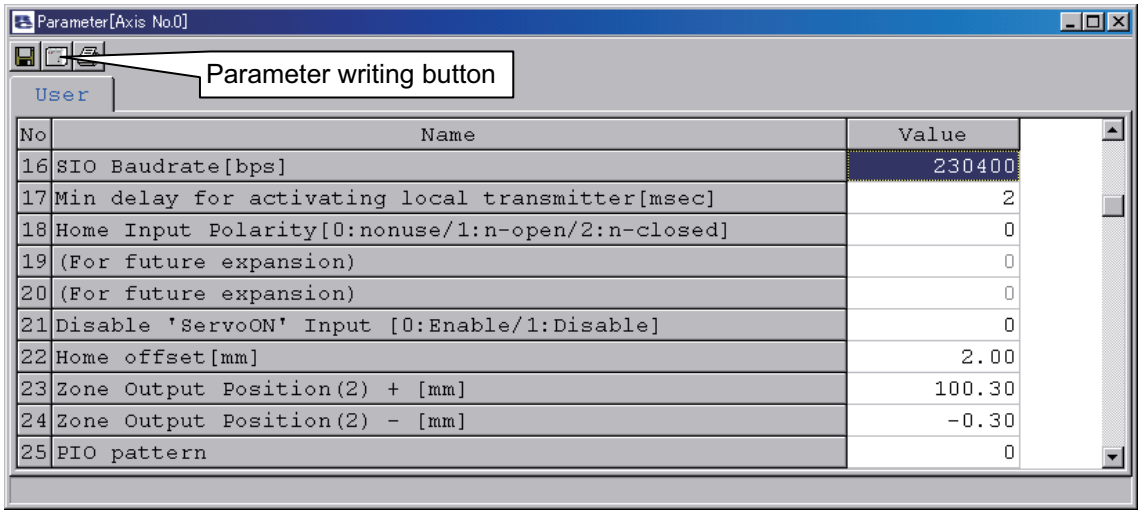
(Example) When connecting ACON to Axes No.0 to 2 and SCON-CA to No.3, and operating with the method to use position data in X-SEL:

Slave controller model	Node address (Slave controller parameter No.85)	Axis No. setting rotary switch setting	Setting of I/O Parameter No.218 on XSEL [Refer to 4.1.2 [Procedure 2]]	Setting of I/O Parameter No.432 to 435 on XSEL [Refer to 4.2.1 [Procedure 3]]
ACON first unit	0	0	00001111b	No.432 to 434 101002H
ACON second unit	1	1		
ACON third unit	2	2		
SCON-CA	3	3		No.435 101003H

[Procedure 6] Data input and output format setting
Set the order to send and receive the communication data. In this parameter, set 2.
If setting a number other than 2, the communication cannot be performed.

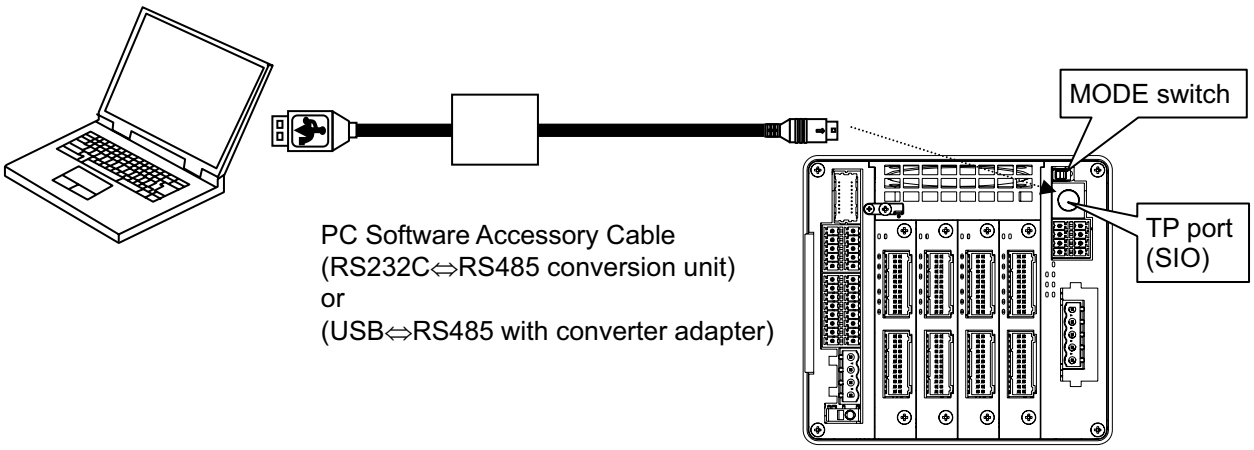
No.	Parameter	Unit	Set Value	Default factory setting
90	Fieldbus I/O format	-	2	3

[Procedure 7] Reflection of changed parameters
After writing the parameter by clicking the parameter writing button, reboot the power to the slave axis controller.
Set the Mode Changeover Switch to “AUTO” side.



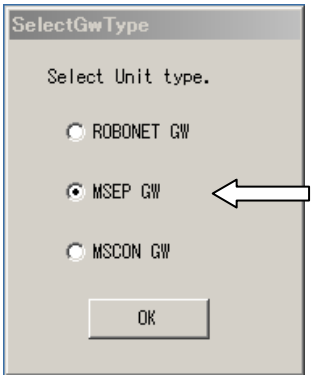
(2) MSEP
The setting of MSEP is to be carried out with being connected to PC with the enclosed cable, and with using “Gateway Parameter Setting Tool” and “RC PC Software”.
Set the MODE switch on the front panel of MSEP main machine to MANU side.

[Preparation] Connection to PC

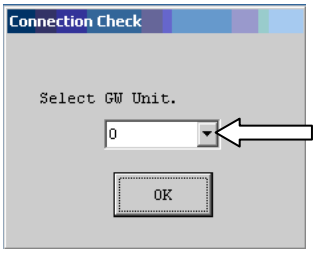


[Procedure 1] Gateway Parameter Setting Tool Startup

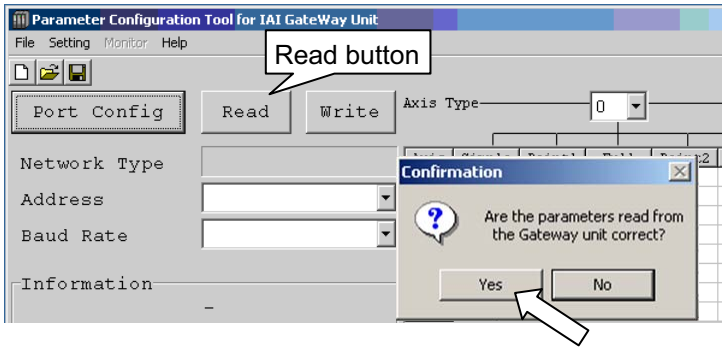
1) Start up ROBONET Gateway Parameter Setting Tool, select MSEP GW and click on **OK** button.



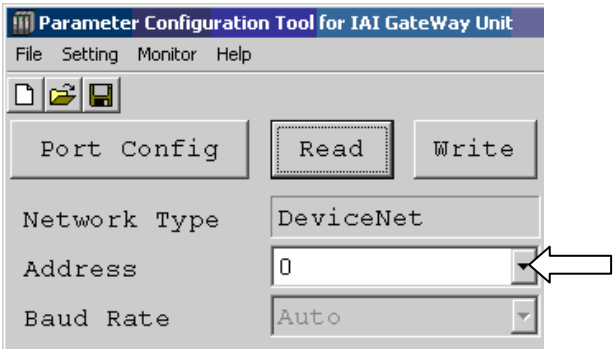
2) MSEP (unit number) becomes available to select. Select the unit number to be connected and click on the **OK** button. If MSEP is connected to PC one to one, select 0.



3) Once the main window is open, click on **Read** button and then click **Yes**.



[Procedure 2] Setting for Address
Set the Fieldbus node address within the range from 0 to 14.
Set the top axis number (Axis No.) of MSEP set in the master (X-SEL) as the node address.



Example 1) When connecting 2 units of MSEP to a slave controller

Model Code of Slave Controller		Address setting value (Node Address)	Axis number on slave side (Axis No.)	Axis number on master side (X-SEL) (Axis No.)
1	MSEP	0	0	0
			1	1
			2	2
			3	3
			4	4
			5	5
			6	6
			7	7
2	MSEP	8	0	8
			1	9
			2	10
			3	11
			4	12
			5	13
			6	14
			7	15

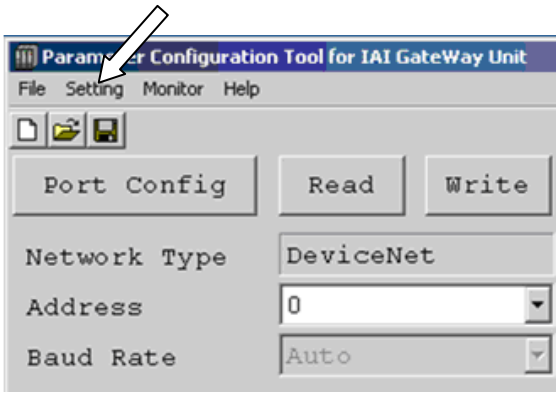
Example 2) When connecting PCON, MSEP, SCON-CA to a slave controller

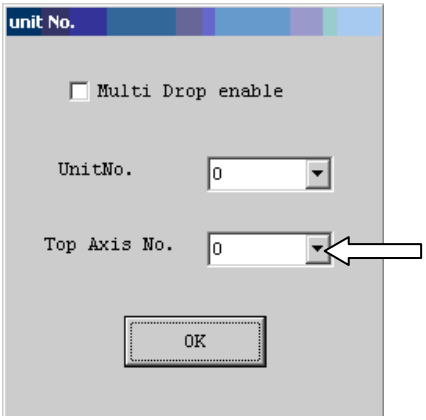
Model Code of Slave Controller		Address setting value (Node Address)	Axis number on slave side (Axis No.)	Axis number on master side (X-SEL) (Axis No.)
1	PCON	0	0	0
2	MSEP	1	0	1
			1	2
			2	3
			3	4
			4	5
			5	6
			6	7
			7	8
3	SCON-CA	9	9	9

⚠ Caution: When connecting MSEP to the slave controller, eight axes at the maximum are able to be connected to one unit of MSEP controller. Therefore, the node addresses and the axis numbers (Axis No.) would not be the same unlike in a case to use multiple controllers that is capable to connect one axis. Refer to Examples 1 and 2 above and pay attention not to duplicate the node address.

[Procedure 3] Setting of Top Axis Number

Click “Setting (S)” → “Unit Number” in the main window, and set the same number as the top axis number (Axis No.) input in [Procedure 2] in the Unit Number window shown below.





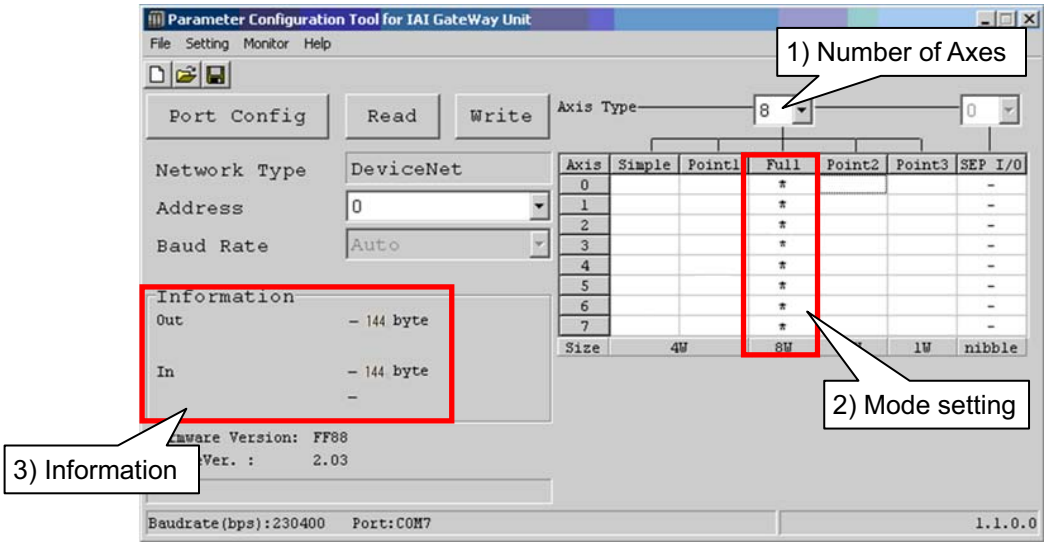
[Procedure 4] Setting for Number of Axes and Map Setting

1) Set the number of axes to be used.

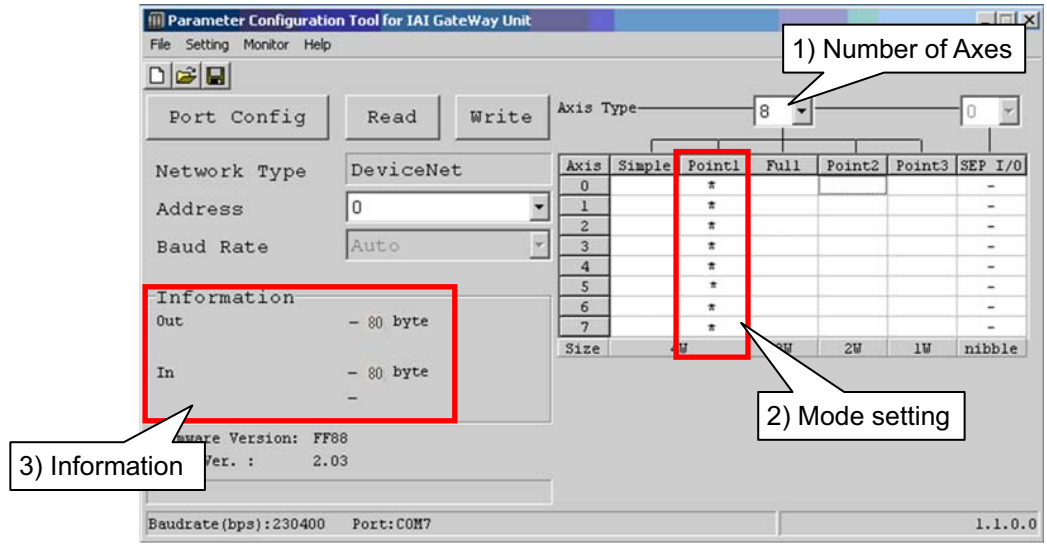
2) For the map setting, have the setting following the operation methods below.
   - Method to use position data in XSEL : Set all the axes to Positioning Mode (Refer to Example 1)
   - Method to use position data in RC : Set all the axes to Positioner Mode 1 (Refer to Example 2)

3) Once the setting for the number of axes and map setting are conducted, the number of input and output bytes is displayed automatically to the occupation information. Convert these displayed values (decimal system) to the hexadecimal values and make sure that the (hexadecimal) values set for the XSEL parameters (I/O parameter Nos. 432 to 447) using the “Procedure 3” in Item 4.3.1, are the same. The displayed values are decimal values.

Example 1. Method to use position data in XSEL

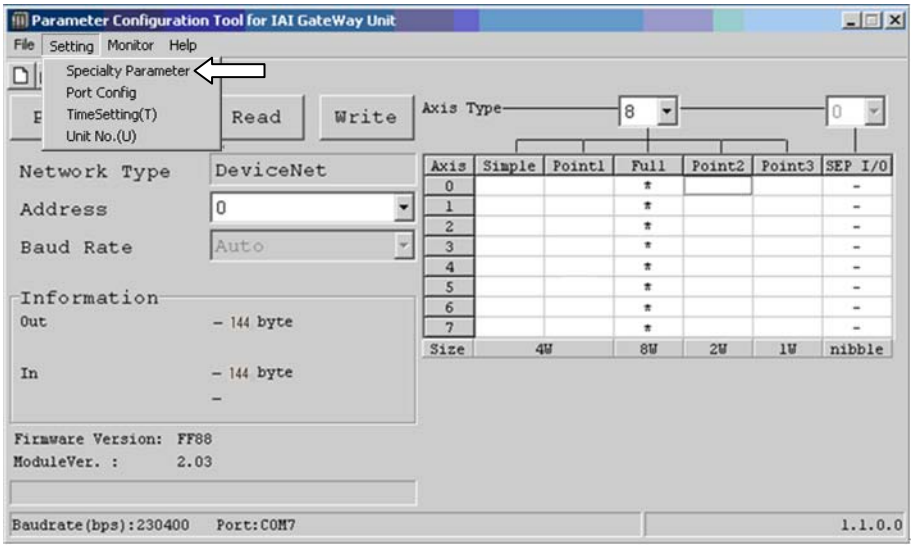


Example 2. Method to use position data in RC

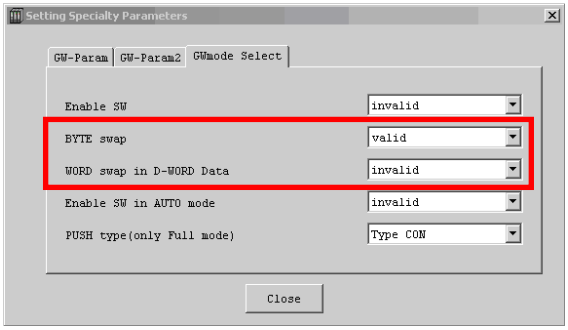


[Procedure 5] Swap setting

1) Click on **Setting** button and then click **Specialty Parameter**.



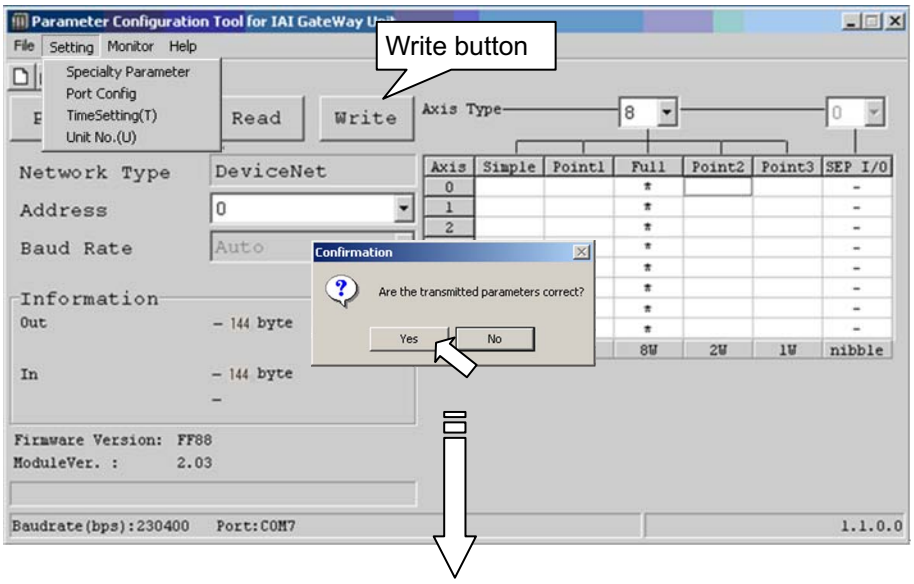
2) Make BYTE swap “valid”.
Make WORD swap in D-WORD Data “invalid”.



[Procedure 6] Parameter Writing

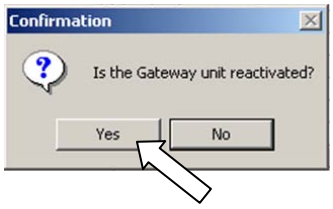
Write the edited operation mode setting parameters to MSEP. Click on the **Write** button shown below and a confirmation window pops up. Click on the **Yes** button.

If the writing is finished in normal condition, writing complete window appears. Click **OK**.



[Procedure 7] MSEP Rebooting

A confirmation window for Gateway unit reboot opens. Click **Yes** to accept the reboot.



[Procedure 8] Parameter Writing Check

After rebooting, a confirmation window for parameter reading appears for confirmation of the written contents. Click “Yes” to accept the reading.

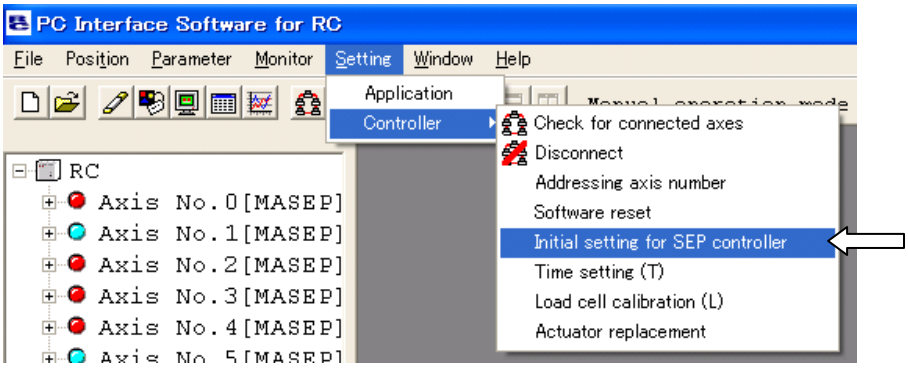
Once the reading process is complete, confirm that the written contents are reflected.

If the writing process is not completed properly, have the setting complete again from Procedure 1.

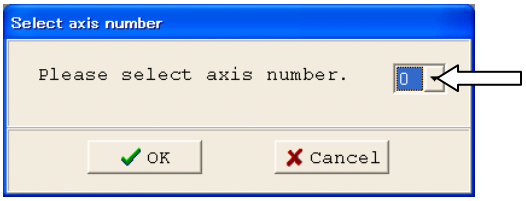
Establish the setting in ROBONET Gateway Parameter Setting Tool.

[Procedure 9] RC PC Software Startup
Start up RC PC Software.
[Refer to the operation manual of the PC software for the details of the RC PC software.]

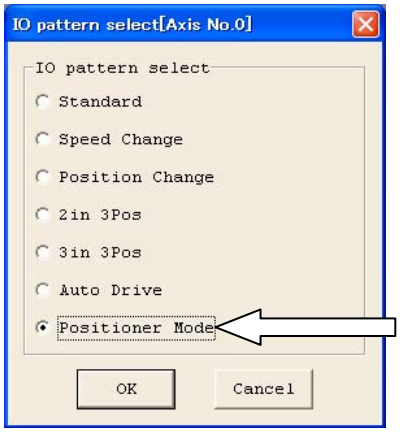
[Procedure 10] Operation Pattern Selected
1) Select the initial setting of SEP from the controller menu.



2) Select the axis number which the setting is to be conducted.



3) Select Positioner Mode in IO pattern select and click on **OK** button.



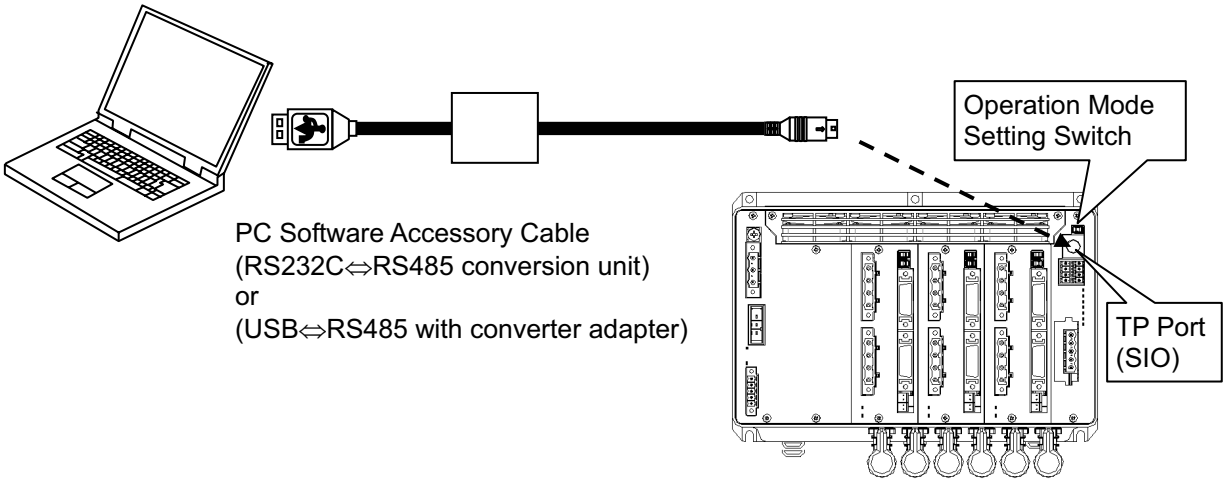
4) The confirmation window for controller reboot opens. Click **Yes**.

5) The operation pattern setting is required on all the MSEP constructing axes. Repeat the procedures 1) to 4) if multiple axes are connected.

[Procedure 11] Rebooting
Set the MODE switch on the front panel of MSEP main machine to AUTO side.
Reboot the MSEP power.

(3) In case of MSCON
The setting of MSCON is to be carried out with being connected to PC with the enclosed cable, and with using “Gateway Parameter Setting Tool”.
Set the operation mode setting switch located on the front panel on the MSCOM main machine, to MANU side.

[Preparation] Connection to PC

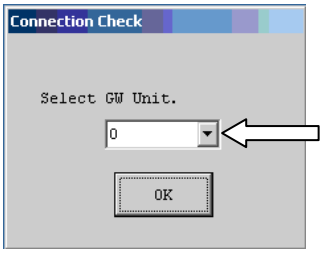


PC Software Accessory Cable
(RS232C⇔RS485 conversion unit)
or
(USB⇔RS485 with converter adapter)

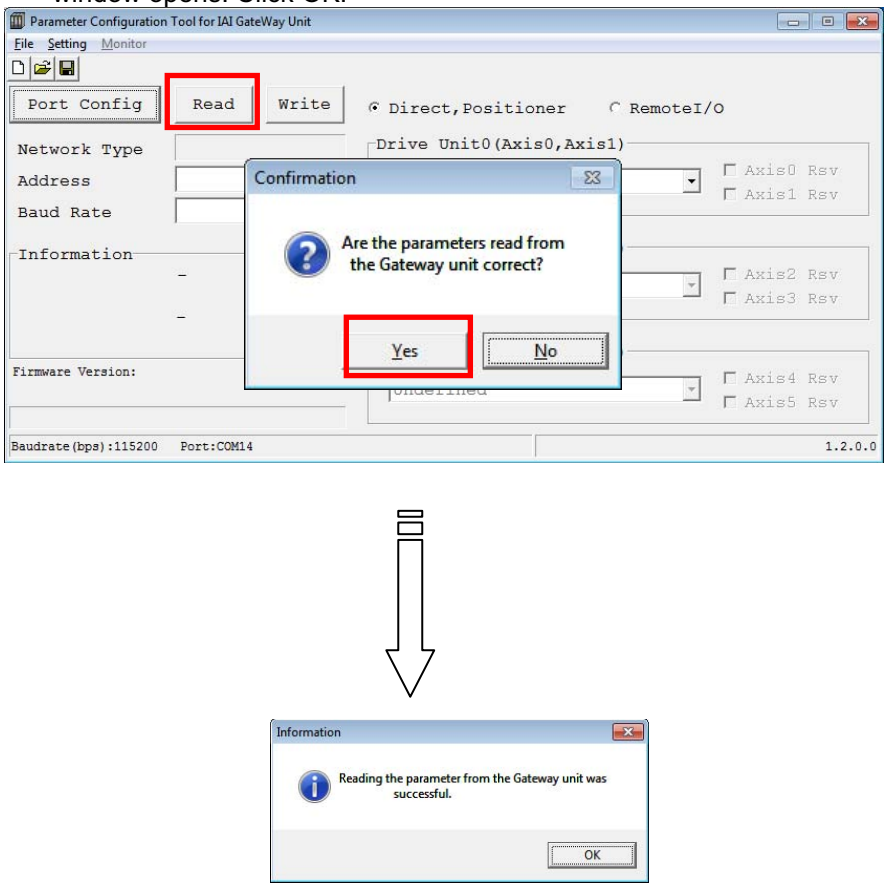
[Procedure 1] Gateway Parameter Setting Tool Startup

1) Start up Gateway Parameter Setting Tool, select MSCON GW and click on **OK** button.

2) Now, the MSCON (Unit No.) can be selected. Select the unit No. to be connected and click the **OK** button. If MSCON is connected to PC one to one, select 0.

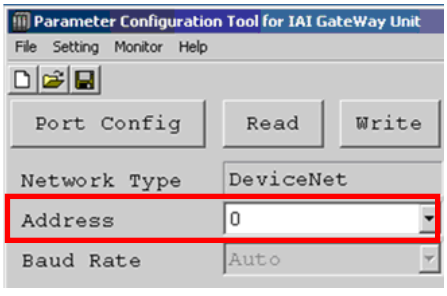


3) The main screen will be displayed. When the **Read** button is pressed, the confirmation window opens. Click **Yes**.
Once the parameter reading is completed in normal condition, the reading complete window opens. Click OK.



[Procedure 2] Address Setting

Set the Fieldbus node address within the range from 0 to 14.
Set the head axis No. (Axis No.) of MSCON set in the master side (X-SEL) as the node address.



Example 1) Two MSCONs are connected to the Slave Controller

Slave Controller Model No.		Value set for Address (Node address)	Axis number on slave side (Axis No.)	Axis number on master side (X-SEL) (Axis No.)
1	MSCON	⓪	0	0
			1	1
			2	2
			3	3
			4	4
			5	5
2	MSCON	⑥	0	6
			1	7
			2	8
			3	9
			4	10
			5	11

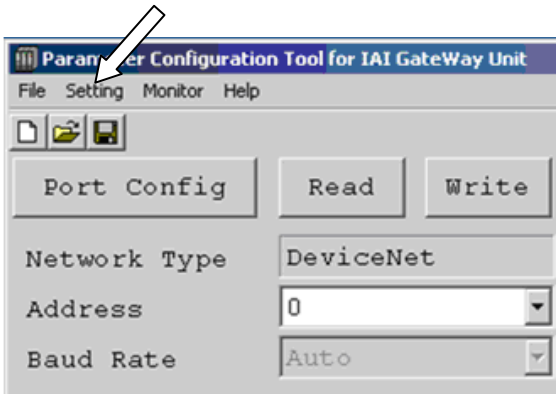
Example 2) PCON, MSCON or SCON-CA are connected to the Slave Controller

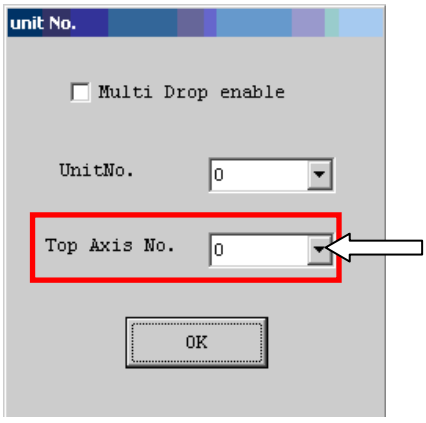
Slave Controller Model No.		Value set for Address (Node address)	Axis number on slave side (Axis No.)	Axis number on master side (X-SEL) (Axis No.)
1	PCON	0	0	0
2	MSCON	①	0	1
			1	2
			2	3
			3	4
			4	5
			5	6
3	SCON-CA	7	7	7

⚠ Caution: When MSCON is connected to the slave controller, max. 6 axes can be connected to a single MSCON controller. Therefore, unlike the case where two or more controllers each of which can be connected to only one axis, is used, the node address is not the same as the axis No. (Axis No.).
Be careful not to set the duplicate node address No., referring to the above Examples 1 and 2.

[Procedure 3] Setting of Top Axis Number

Click “Setting (S)” → “Unit Number” in the main window, and set the same number as the top axis number (Axis No.) input in [Procedure 2] in the Unit Number window shown below.





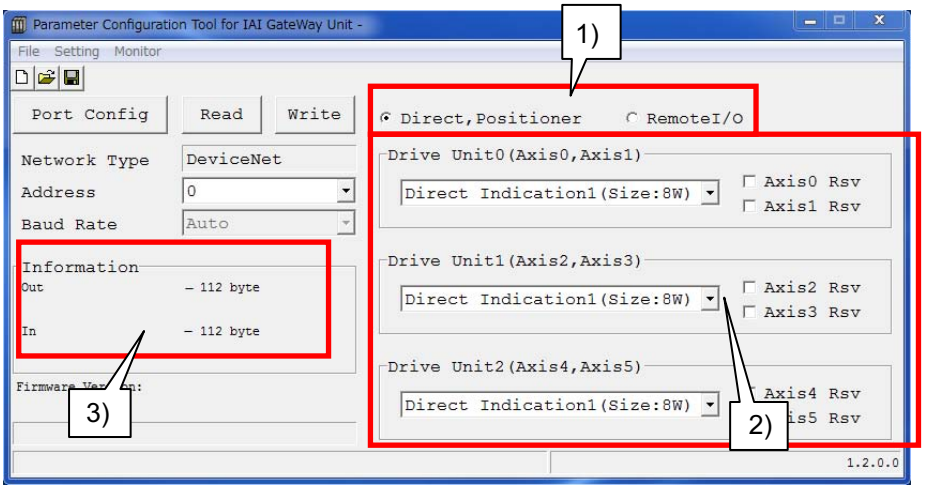
[Procedure 4] Operation Mode Setting and Occupation Information Confirmation

1) Select “Direct Value, Positioner Mode”.

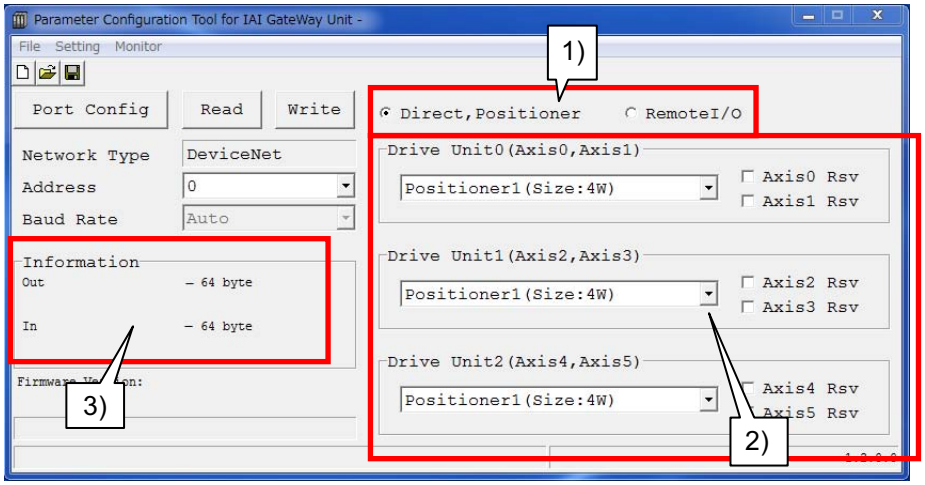
2) Perform the following setting based on the Method to use position data.
   - Method to use position data in XSEL : Set it to All Axes “Direct Value Setting (Positioning)”. (Refer to Example 1)
   - Method to use position data in RC : Set it to All Axes “Positioner 1”. (Refer to Example 2)

3) When the operation mode setting 1 or 2 is performed, the I/O byte count is displayed automatically in the Occupation Information area.
   Convert these displayed values (decimal system) to the hexadecimal values and make sure that the (hexadecimal) values set for the XSEL parameters (I/O parameter Nos. 432 to 447) using the “Procedure 3” in Item 4.3.1, are the same. The displayed values are decimal values.

Example 1. Method to use position data in XSEL

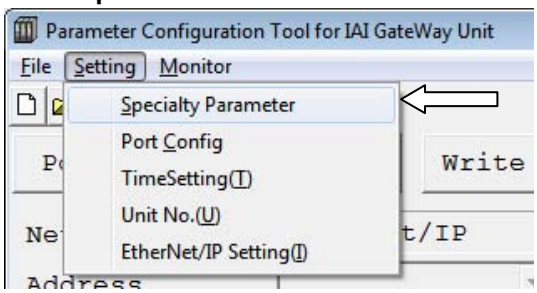


Example 2. Method to use position data in RC

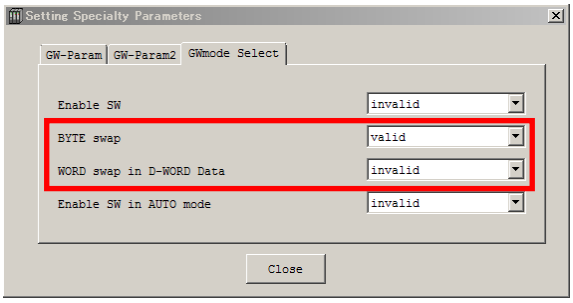


[Procedure 5] Set the byte

1) Setting ⇗ Click **Special Parameters**.

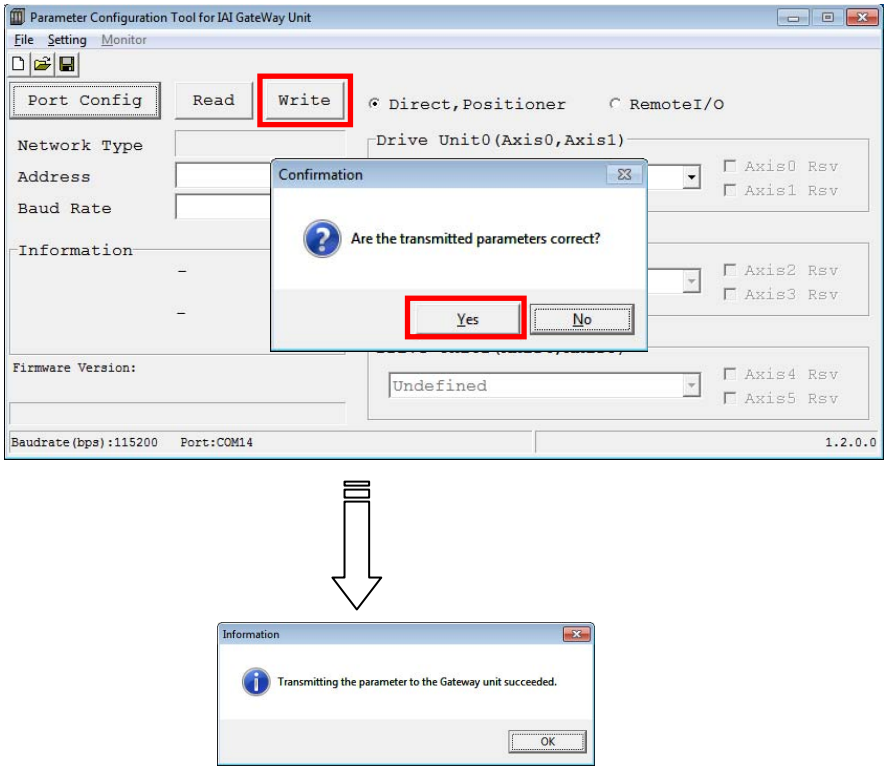


2) Make Byte Swap effective.
Make Byte Swap ineffective.



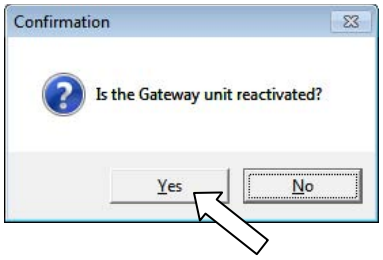
[Procedure 6] Parameter Writing

Write the edited operation mode setting parameters to MSCON. Click on the **Write** button shown below and a confirmation window pops up. Click on the **Yes** button.
If the writing is finished in normal condition, writing complete window appears. Click **OK**.



[Procedure 7] MSCON Re-start

A confirmation window for Gateway Unit reboot opens. Click “Yes” to accept the reboot.



[Procedure 8] Confirmation of Written Parameters

After rebooting, a confirmation window for parameter reading appears for confirmation of the written contents.
Once the reading process is complete, confirm that the written contents are reflected.
If the writing process is not completed properly, have the setting complete again from Step 1.
When the confirmation is done, end the Gateway Parameter Setting Tool.

[Procedure 9] PIO Pattern Confirmation
Confirm that the MSCON parameter No. 25 “PIO Pattern Selection” has been set to “8” (Initial Value set in the factory before shipping), using the RC PC software. If not, the communication is not available.

5. Program Creating

Operations are performed using a program that sets positioning data and determines the operation sequence and how each operation is performed. How operations are performed in each of the two operation modes used by the RC gateway function is explained below.
The program is in common for Fieldbus and SIO Types.

Method to use position data in X-SEL
Operations are performed by setting the position data of the slave axis in the master controller (X-SEL controller).
Although up to 512 points can be set per axis, take note that increasing the number of effective axes decreases the number of specifiable positions.
The table below shows the relationship of the largest axis number among the connected axes and the maximum number of position data points that can be set.
(The same relationship applies to the number of positions available with each ROBONET, MSEP and MSCON axis.)

Largest axis number	Number of positions
0 to 7	512
8	455
9	409
10	372
11	341
12	315
13	292
14	273
15	256

Method to use position data in RC
Operations are performed with an X-SEL program using the position data set in each slave-axis controller (RC controller or ROBONET, MSEP and MSCON).
The number of positions corresponds to whatever is permitted for the each slave controller.
The maximum number of positions for each axis is determined by each controller as well as the applicable parameters set in the controller. Refer to the operation manual for each controller.

<Reference>
The maximum number of position data for each axis when using the method to use the position data in RC in Fieldbus Type

Controller	Operation Mode	Max. Number of Position Data
MSEP	Positioner 1 Mode	256
MSCON	Positioner 1 Mode	256
A/PCON	Position / Simple Direct Mode	768
SCON-CA	Position / Simple Direct Mode	768

Comparison table of two operation modes

Key function		Method to use RC position data in X-SEL	Method to use RC position data in RC
Number of connectable axes		16 axes	16 axes
Storage location of position data		User-data backup memory in the X-SEL	Backup memory in the RC controller
Number of positions		Maximum 512 points (maximum 64 kb)	Varies according to the RC controller specification.
Management of position data		X-SEL PC software is used.	RC PC software is used.
Management of RC controller parameters		RC PC software is used.	RC PC software is used.
Specification of travel speed		Set in the RC position data table in the X-SEL.	Set in the position data table in the RC.
Setting of acceleration/deceleration		Set in the “acceleration/deceleration” field of the RC position data table in the X-SEL.	Set separately in the “acceleration” and “deceleration” fields of the position data table in the RC.
SEL language commands	Management of position data	RPGT command, etc.	Not supported.
	Servo ON/OFF	RSON command, RSOF command	RSON command, RSOF command
	Home return	RHOM command	RHOM command
	Positioning	RMVP command, etc.	RMVP command only. Operation details are set in the position data table in the RC.
	Positioning (incremental)	RMPI command, etc. (for SIO type only)	
	Push	RPUS command	
	Deceleration stop	RSTP command	RSTP command
PC software operations	Management of position data	X-SEL PC software can be used. RC PC software cannot be used.	X-SEL PC software cannot be used. RC PC software can be used.
	Servo ON/OFF	X-SEL PC software can be used. RC PC software can be used.	X-SEL PC software cannot be used. RC PC software can be used.
	Home return	X-SEL PC software can be used. RC PC software can be used.	X-SEL PC software cannot be used. RC PC software can be used.
	Positioning	X-SEL PC software can be used. RC PC software can be used.	X-SEL PC software cannot be used. RC PC software can be used.
	Jogging	X-SEL PC software can be used. RC PC software can be used.	X-SEL PC software cannot be used. RC PC software can be used.
	Inching operation	X-SEL PC software can be used. RC PC software can be used.	X-SEL PC software cannot be used. RC PC software can be used.
Zone setting		Set by a user parameter of the RC controller.	Set by a user parameter of the RC controller for each position.
Zone output		ZONE1, ZONE2	PZONE (Note 1), ZONE1, ZONE2

Note 1 There is no PZONE when the slave controller is MSEP.

Comparison of Functions between Fieldbus type and SIO type (Different part limitation)

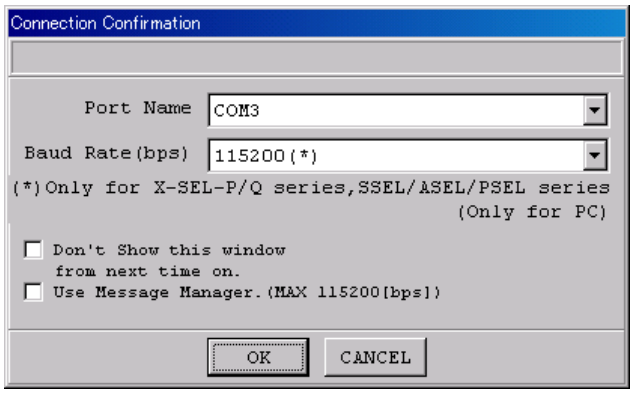
Function	Fieldbus type	SIO type
Safety speed of each slave axis	Disable (No matter whether AUTO or MANU on XSEL)	Enable (When in MANU mode for RC controller equipped with MODE switch)
Relative movement command (Method to use position data in XSEL)	RMPI and RMDI command not available to use	Enable
Error Code (For method to use position data in RC)	Simple Alarm Code	None
Position data edit (For method to use position data in RC)	Set for each RC (slave axis) controller (Not enable to connect RC PC Software via teaching port on XSEL)	Enable for setting with connection of RC PC Software via teaching port on XSEL (Enable to set with the wiring condition of RC Gateway)

5.1 Operation Using the X-SEL Position Data Mode

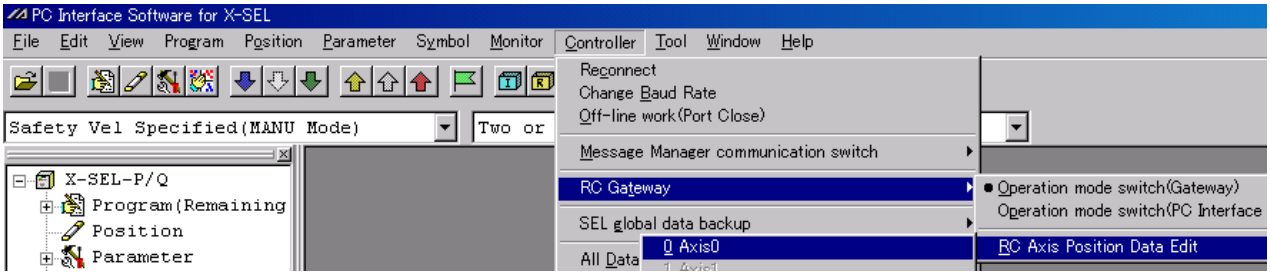
An example of operation in which one RC controller is used to move an actuator back and forth between position data Nos. 0 and 1 is explained.
Install the X-SEL PC software beforehand.
Enter position data first, and then create a program.

> ⚠ Caution: When supplying the power, turn ON the slave controller (RC Controller, ROBONET, MSEP or MSCON) prior to or at the same time as X-SEL.
> If the X-SEL is started first, it will recognize an slave controller power error and generate an RC gateway major failure error.

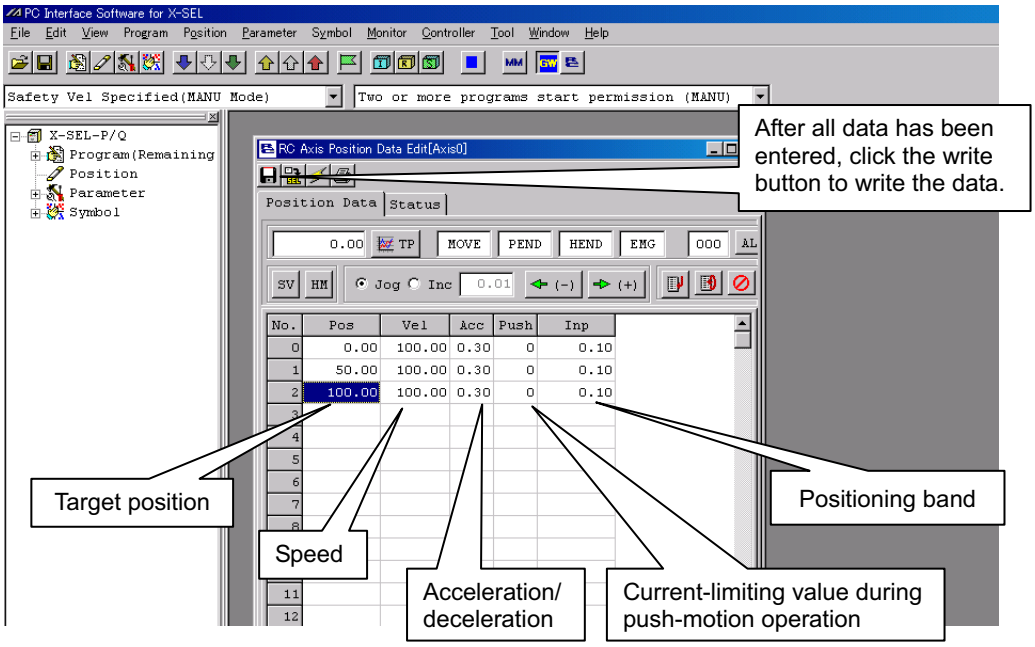
(1) Starting the PC software
Click **Start**, point to **Programs**, point to **IAI**, point to **X_SEL**, and then select **X-SEL PC Software**.
When the connection confirmation screen appears, click **OK** to start the PC software.



(2) Editing position data
Follow the procedure below to edit position data:
1) Click **Controller**, point to **RC Gateway**, point to **RC Axis Position Data Edit**, and then select **0 Axis0** to open the RC axis position data edit screen.



2) Enter the following data, starting from position No. 0.



- Pos (target position) [mm]
  Input the target position that the actuator is to be moved towards.
  Absolute coordinate specification: Distance from the actuator home
  Incremental coordinate specification: Incremental distance from the current position (travel)
  Whether the target position is specified in absolute coordinates or incremental coordinates (Note1) is determined by the applicable SEL language command.
  (Example: RMVP command → Absolute coordinate specification / RMPI command → Incremental coordinate specification)
- Vel (speed) [mm/s]
  Enter the speed at which to move the actuator.
- Acc (acceleration/deceleration) [G]
  Enter the acceleration/deceleration at which to move the actuator.
  Separate values cannot be set for acceleration and deceleration.
- Push (current-limiting value during push-motion operation) [%]
  Enter the current-limiting value during push-motion operation (RPUS command). Enter “0” if push-motion operation is not used.
- Inp (positioning band) [mm]
  Enter how long before the target position will the controller recognize completion of positioning. In the case of push-motion operation (RPUS command), enter the maximum push distance from the target position.
  When you are finished with No.0, enter the same set of data for No.1 in the same manner. If there are multiple positioning points, enter data one by one in a desired positioning sequence, starting from No.0.

Note 1 The relative coordinate commands (RMPI and RMDI) cannot be used in Fieldbus Type.

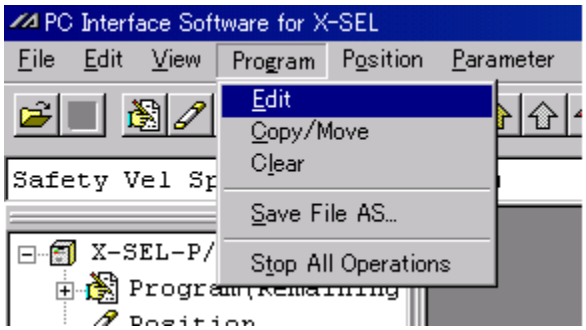
After all data has been entered, click the data write button to write the data.

⚠ Caution:
- Set position data value within each actuator spec.
- Position data starts from No.0, which is different on the X-SEL.

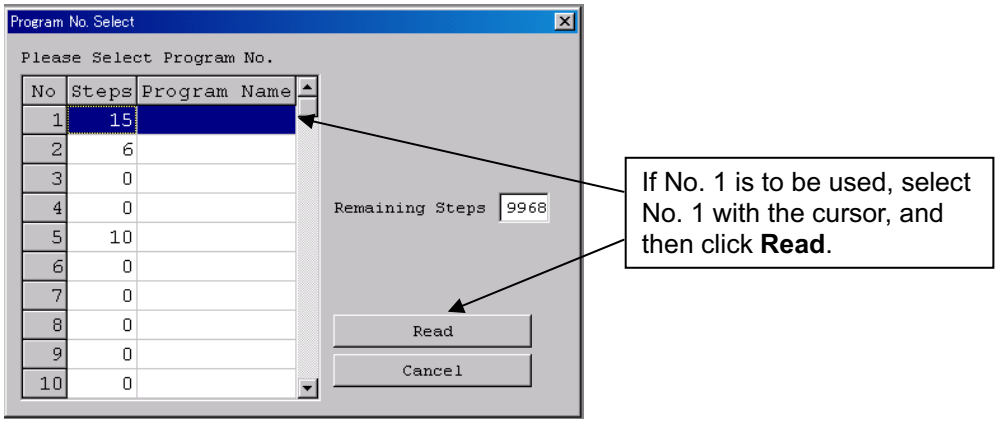
(3) Editing a program

Follow the procedure below to edit a program:

1) Click **Program** and then select **Edit** to open the program edit screen.

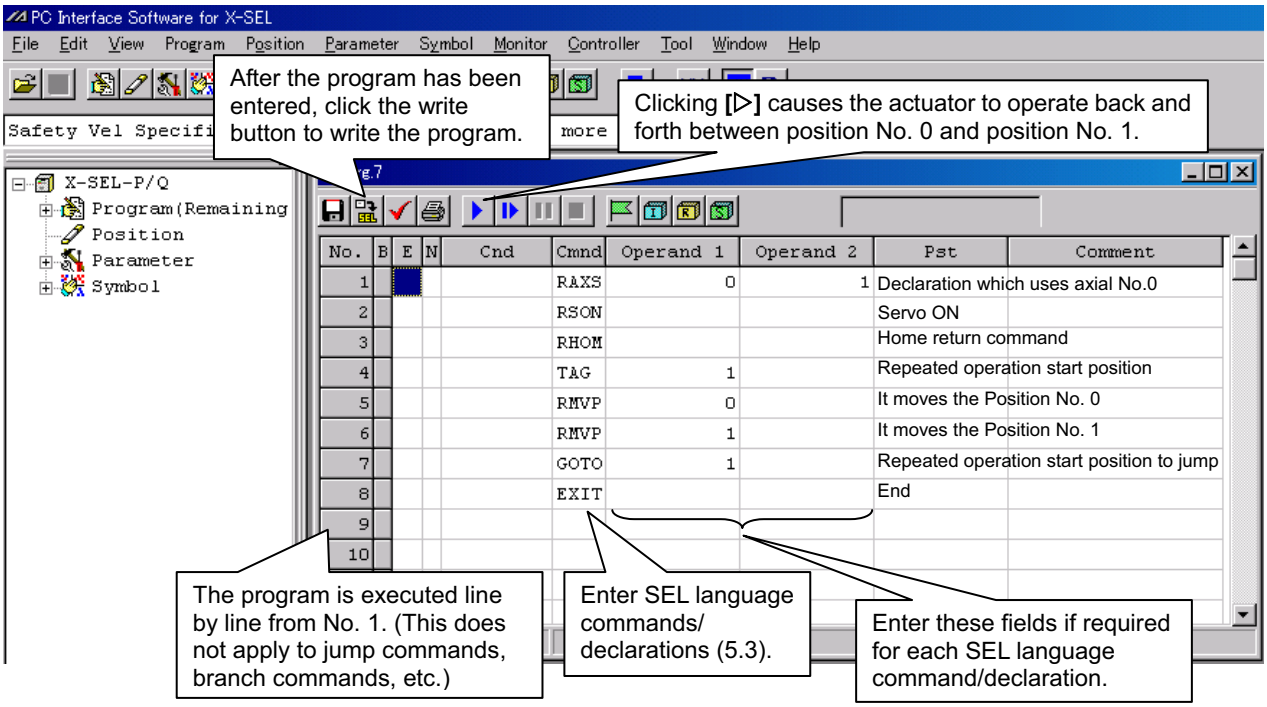


2) Select the program number of the program you want to use.



3) Next, enter the program. Since it is a back and forth operation between Position No. 0 and No. 1, the detail of the program will be as shown in the figure below.

After the program has been entered, click the write button to write the program.



For other operations, create programs by referring to 5.3, “Program Language Used by the RC Gateway.”

⚠ Caution: If the following error occurs, the causes listed below are suspected:

[Causes]

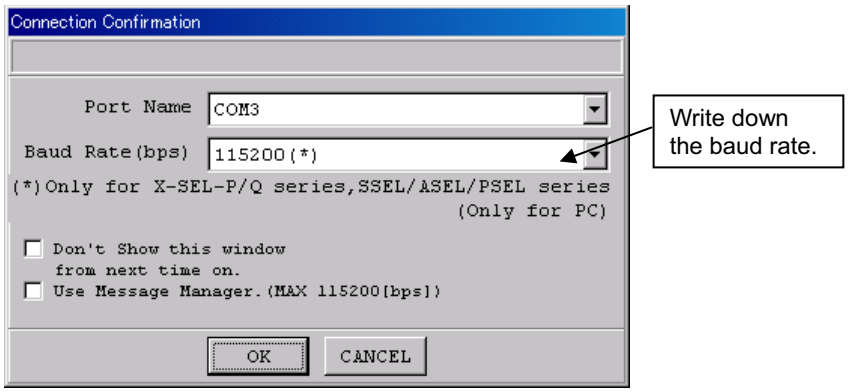
- Other SEL program is currently running.
- There is an RC axis whose servo is turned ON.

5.2 Operation with Method to Use Position Data in RC

For Fieldbus Type, edit the position data of the RC controllers on each RC controller using the RC PC software. Therefore, it is unnecessary to have the process in 2) of procedures (1) to (3), and start from 3) in Procedure (3).
An example of operation in which one RC controller is used to move an actuator back and forth between position data Nos. 0 and 1 is explained.
Install the X-SEL PC software and RC PC software beforehand. (If the SEL-T or SEL-TD is used, refer to the operation manual for the SEL-T or SEL-TD.)
Enter position data first, and then create a program.

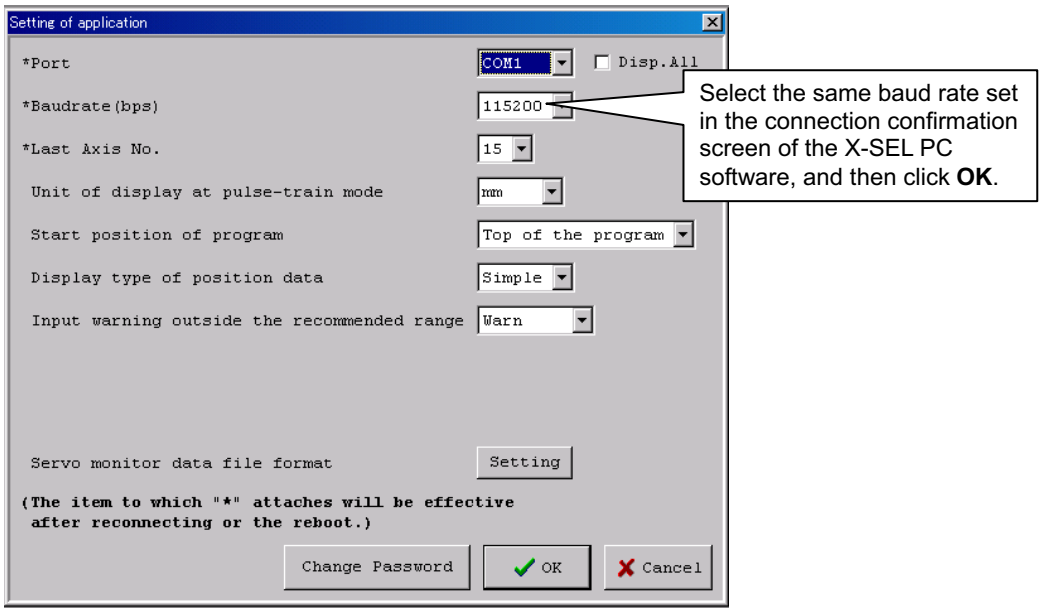
> ⚠ Caution: When supplying the power, turn ON the slave controller (RC Controller, ROBONET, MSEP or MSCON) prior to or at the same time as X-SEL.
> If the X-SEL is started first, it will recognize an slave controller power error and generate an RC gateway major failure error.

(1) Starting the X-SEL PC software (checking the baud rate) (Not necessary for Fieldbus Type)
Click **Start**, point to **Programs**, point to **IAI**, point to **X_SEL**, and then select **X-SEL PC Software**. When the connection confirmation screen appears, write down the Baud Rate (bps). Next, select **CANCEL**, restart the PC software, and then shut it down immediately.



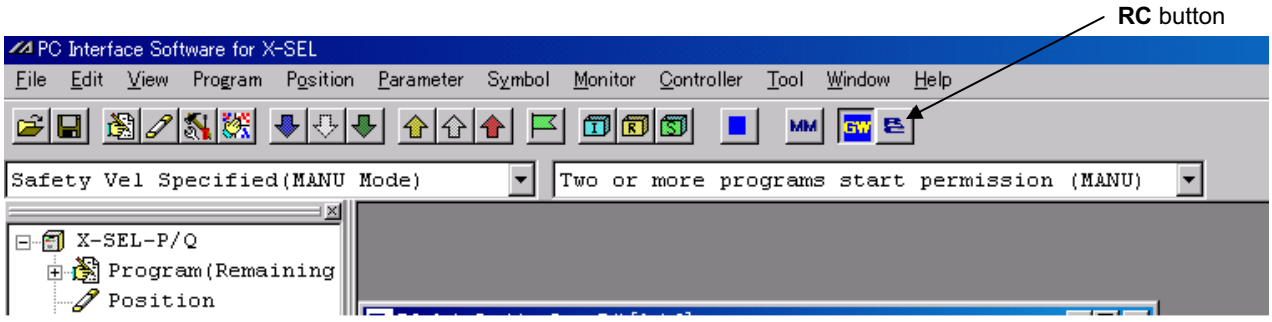
(2) Setting the baud rate in the RC PC software (Not necessary for Fieldbus Type)
Set the baud rate for each connected RC controller or ROBONET.
1) Click **Start**, point to **Programs**, point to **IAI**, point to **RoboCylinder**, and then select **RC PC Software**.
2) When the RC PC software is started, click **Setting**, and then select **Application**.

3) In the Baud Rate (bps) field, set the same value specified in the connection confirmation screen of the X-SEL PC software (refer to 5.2 (1)).



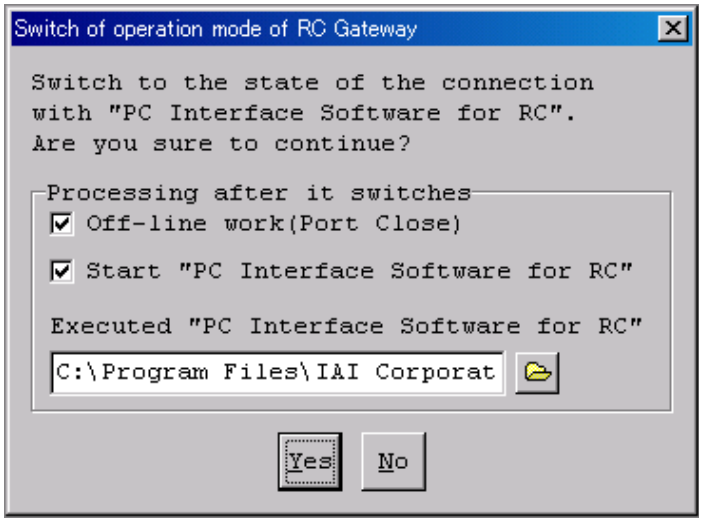
4) After the setting is finished, shut down the RC PC software.
5) Connect the X-SEL and PC using the communication cable supplied with the PC software.

(3) Editing position data (For Fieldbus Type, connect RC PC Software to each RC controller, start them up, and proceed to 3).)
Follow the procedure below to edit position data:
Turn ON the RC controller power and ROBONET power before or simultaneously as the X-SEL power.
Click **Start**, point to **Programs**, point to **IAI**, point to **X-SEL**, and then select **X-SEL PC Software** to start the PC software.
For the SCON, set the mode selector switch on the controller to the MANU position.
For the ROBONET, set the mode selector switch on the GateWayR unit to the MANU (top) position.
1) Click the **RC** button in the menu bar.



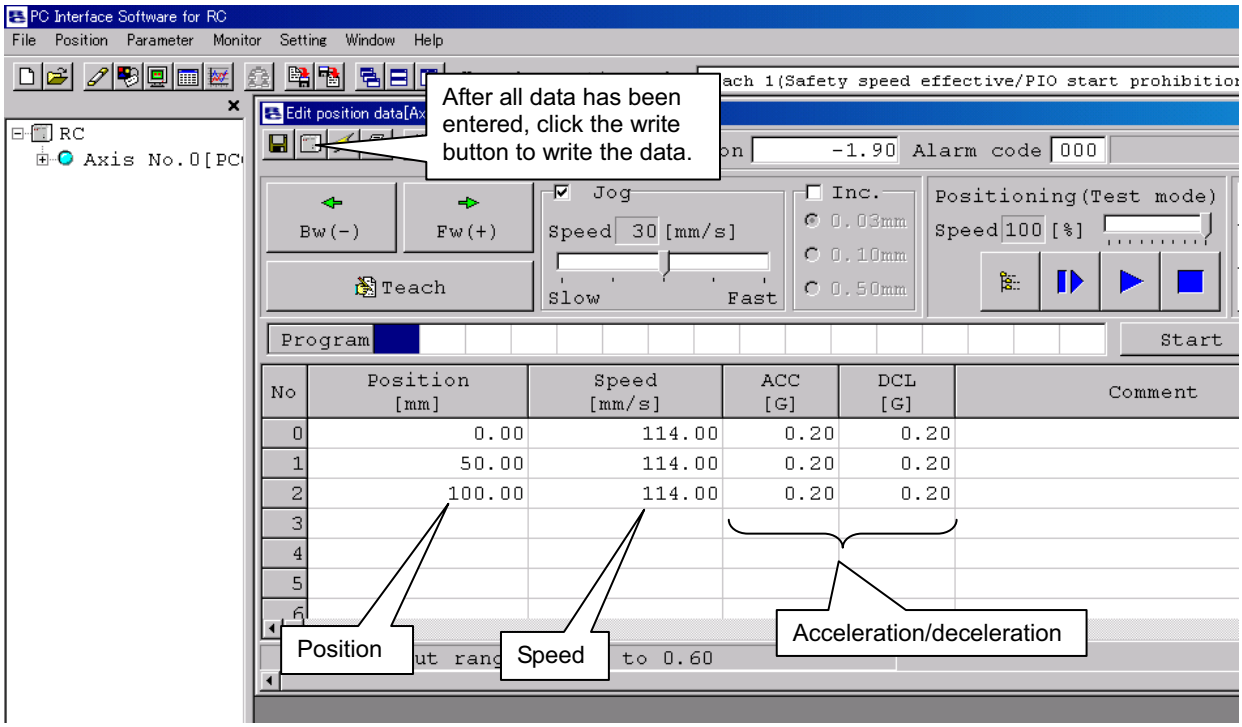
⚠ Caution:
- For the details of parameters and positions of your RC controller or ROBONET, refer to the operation manual for each controller.
- You can also connect a PC to the RC controller directly and change parameters or edit position data using the RC PC software.
  → In this case, you must reconnect the power after setting parameters/position data.

2) When the following screen appears, select both **Start "PC Interface Software for RC"** and **Off-line Work (Port Close)**, and then click the **Yes** button.



Notice: If the RC PC software is not yet installed, a file non-detection error will occur. Install the RC PC software.

3) The RC PC software is started.



Click **Position**, click **Edit/Teaching**, and then select the axis number of the axis whose data you want to edit, to open the position data edit screen.

- Position [mm]
  Enter the target position to move the actuator to.
  Absolute coordinate specification: Distance from the actuator home
  Incremental coordinate specification: Incremental distance from the current position (travel)
  Whether the target position is specified in absolute coordinates or incremental coordinates is determined by the applicable position data.
  For details on position data, refer to the operation manual for each RC controller.
- Speed [mm/s]
  Enter the speed at which to move the actuator.
- ACC [G]
  Enter the acceleration at which to move the actuator.
- DCL [G]
  Enter the deceleration at which to move the actuator.
  When you are finished with No. 0, enter the same set of data for No.1 in the same manner. If there are multiple positioning points, enter data one by one in the desired positioning sequence, starting from No.0.

After all data has been entered, click the data write button to write the data.

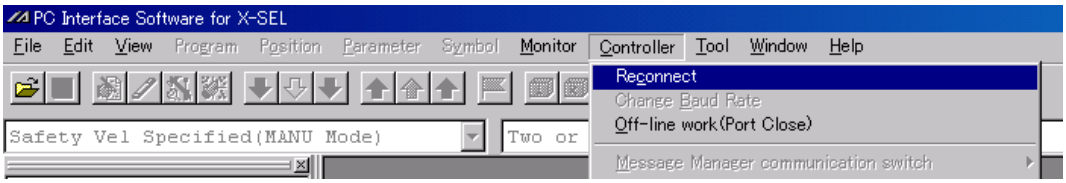
⚠ Caution:
- Set each position data value within the applicable specification range of the actuator.
- The numbers of the position data column start from No. 0 unlike X-SEL.
- If no slave controller is set, the RC PC software cannot be connected. (Refer to 4.2.2.)
- If the baud rate set in the X-SEL PC software does not match the baud rate of the RC controller, the RC PC software cannot be connected. (Refer to 5.2 (1) and 5.2 (2).)

4) Shut down the RC PC software. For the SCON, ROBONET, MSEP or MSCON, return the mode selector switch to the AUTO position.

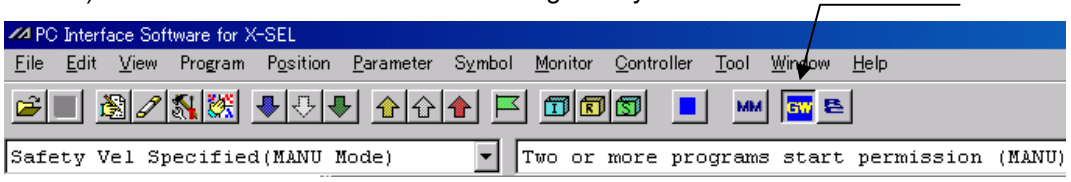
(4) Editing a program

Follow the procedure below to edit a program:

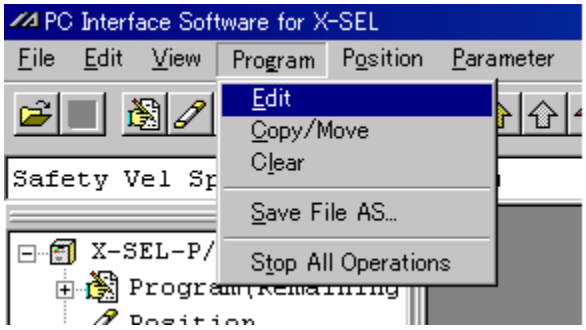
1) Click **Controller**, point to **Reconnect**, and then select **OK** to connect to the X-SEL PC software.



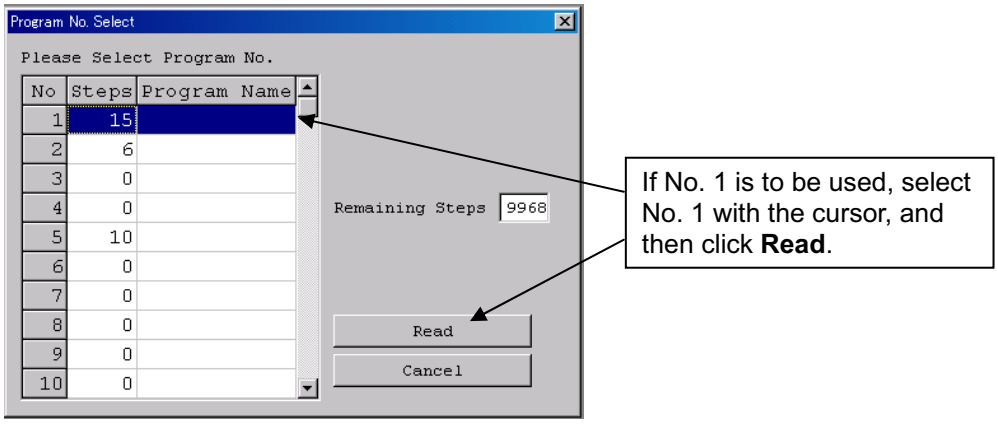
2) Click the **GW** button to switch to the gateway mode.



3) Click **Program** and then select **Edit** to open the program edit screen.

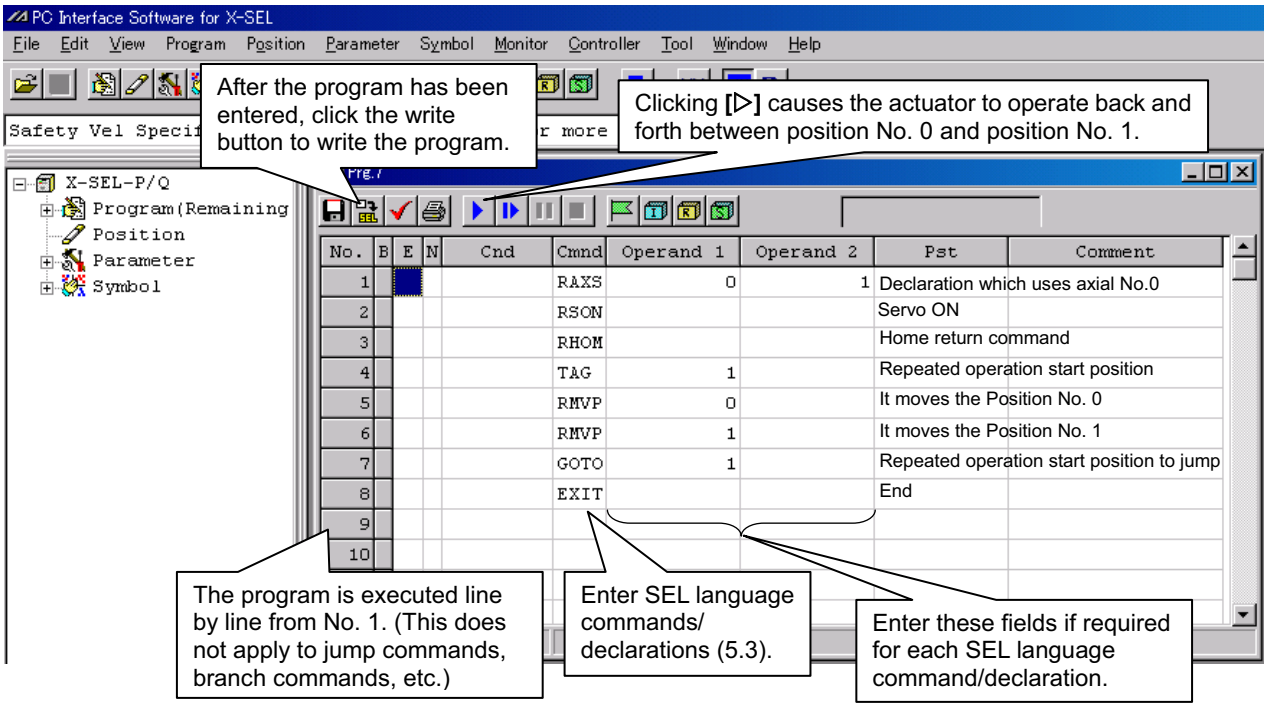


4) Select the program number of the program you want to use.



5) Next, enter the program. Since the actuator is operated continuously between position Nos. 0 and 1 in this example, the program should look like the one shown below.

After the program has been entered, click the write button to write the program.



* For other operations, create programs by referring to 5.3, “Program Language Used by the RC Gateway.”

⚠ Caution: If the following error occurs, the causes listed below are suspected:

[Causes]

- Other SEL program is currently running.
- There is an RC axis whose servo is turned ON.

5.3 Program Language Used by the RC Gateway

5.3.1 List of Program Language Commands

A list of program language (SEL language) commands relating to the RC gateway is shown.
This manual only covers those commands needed by the RC gateway function to operate RC axes. For more information on X-SEL controller programming and commands, refer to the operation manual for your X-SEL controller.
In the list, shows whether each command language can be used or not in each method of RC position data use with ○ and ×.
(Available: ○, Unavailable: ×)

Category	Condition	Command	RC position data mode		Operand 1	Operand 2	Output	Function	Page
			X-SEL	RC					
RC axis position operations	Free	RPGT	○	×	RC axis number	Position number	CC	Assign the RC axis position to variable 199	100
	Free	RPPT	○	×	RC axis number	Position number	CP	Assign the value of variable 199 as the position in the RC axis position table	101
	Free	RPCR	○	×	RC axis number	Variable number	CP	Clear RC axis position data	102
	Free	RPCP	○	×	RC axis number	Variable number	CP	Copy RC axis position data	103
	Free	RPRD	○	×	Position number	Prohibited	CP	Read the current RC axis position	104
	Free	RPRQ	○	○	RC axis number	Variable number	CP	Read the current RC axis position (direct reading of 1 axis)	105
	Free	RPVL	○	×	RC axis number	Position number	CP	Assign the value of variable 199 as the speed in the RC axis position table	106
	Free	RPAD	○	×	RC axis number	Position number	CP	Assign the value of variable 199 as the acceleration/deceleration in the RC axis position table	107
	Free	RPIP	○	×	RC axis number	Position number	CP	Assign the value of variable 199 as the positioning band in the RC axis position table	108
	Free	RPTQ	○	×	RC axis number	Position number	CP	Assign the value of variable 199 as the current-limiting value in the RC axis position table	109
	Free	RGVL	○	×	RC axis number	Position number	CP	Assign the speed in the RC axis position table to variable 199	110
	Free	RGAD	○	×	RC axis number	Position number	CP	Assign the acceleration/deceleration in the RC axis position table to variable 199	110
	Free	RGIP	○	×	RC axis number	Position number	CP	Assign the positioning band in the RC axis position table to variable 199	111
	Free	RGTQ	○	×	RC axis number	Position number	CP	Assign the current-limiting value in the RC axis position table to variable 199	111
RC actuator control commands	Free	RAXS	○	○	Upper byte of axis pattern	Lower byte of axis pattern	CP	Set the RC axis pattern	112
	Free	RSON	○	○	Prohibited	Prohibited	PE	Turn ON the RC axis servo	113
	Free	RSOF	○	○	Prohibited	Prohibited	PE	Turn OFF the RC axis servo	113
	Free	RHOM	○	○	Prohibited	Prohibited	PE	Perform home return of the RC axis	114
	Free	RMVP	○	○	Position number	Prohibited	PE	Move the RC axis via position specification	115
	Free	RMPI	○(Note 1)	×	Position number	Prohibited	PE	Move the RC axis incrementally	116
	Free	RMVD	○	×	RC axis number	Variable number	PE	Move the RC axis via direct value specification	117
	Free	RMDI	○(Note 1)	×	RC axis number	Variable number	PE	Move the RC axis incrementally via direct value specification	118
	Free	RPUS	○	×	RC axis number	Position number	PE	Move the RC axis via push-motion operation	119
	Free	RSTP	○	○	Prohibited	Prohibited	PE	Decelerate the RC axis to a stop	120
Acquisition of RC axis information	Free	RCST	○	○	Variable number	RC axis number	CP	Get the RC axis status	121

Output operation type
CC: Command successful, CP: Command accepted, PE: Operation complete
(Note 1) RMPI and RMDI are invalid for Fieldbus Type. Using them would generate (405) RC Gateway Communication Identification Error (SEL).

● Reference: Relationships between Existing SEL Commands and RC Gateway Function

The relationships between the RC gateway function and existing commands are listed below.

Command category	Commands	How each command is affected by RC gateway function
Variable assignment	LET, TRN, CLR	Not affected
Arithmetic operation	ADD, SUB, MULT, DIV, MOD	Not affected
Function operation	SIN, COS, TAN, ATN, SQR	Not affected
Logic operation	AND, OR, EOR	Not affected
Comparison	CPEQ, CPNE, CPGT, CPGE, CPLT, CPLE	Not affected
I/O port & flag operation	BTON, BTOF, BTNT, WTON, WTOF, IN, INB, OUT, OUTB, BTPN, BTPF, FMIO	Not affected
Position operation	PGET, PPUT, PCLR, PCPY, PRED, PTST, PVEL, PACC, PDCL, PAXS, PSIZ, GVEL, GACC, GDCL, PRDQ	Invalid (Use the corresponding RC commands specified in 2.3.1.)
Timer	TIMW, TIMC, GTTM	Not affected
Actuator control declaration (normal)	VEL, ACC, DCL, PAPR	Invalid (Specify using RC position data)
	OVRD	Valid
	OFST, DEG, BASE, GRP	Invalid
	HOLD	Valid (The operation specified by HOLD type 2 becomes exactly the same as the operation specified by HOLD type 1 (= the servo does not Turn OFF).)
	CANC	Valid
	VLMX, DIS, POTP	Invalid
	QRTN	Invalid (A similar operation can be performed by increasing the positioning band.)
Actuator control command (normal)	SVON, SVOF, HOME, MOVP, MOVL, MVPI, MVLI, PATH, CIR, ARC, JBWF, JBWN, JFWF, JFWN, STOP, PSPL, PUSH, CIR2, ARC2, CHVL, ARCD, ARCC, PBND, CIRS, ARCS, PTRQ, MOVD, MVDI	Invalid
Palletizing	ACHZ, ATRG, OFPZ, BGPA, EDPA, PASE, PAPT, PAPS, PAPN, PSLI, PAPI, ARCH, PACH, PMVP, PMVL, PTNG, PINC, PDEC, PSET, PAPG, PCHZ, PTRG, OFAZ, PEXT, AEXT, PARG, PAST	Invalid (Palletizing cannot be performed using RC axes.)
Zone	WZNA, WZNO, WZFA, WZFO	Not affected (Set on the RC controller side.)
System information acquisition	AXST, PGST, SYST	Not affected
Communication	OPEN, CLOS, READ, WRIT	If the RC gateway function is enabled, any attempt to establish communication using standard SIO channel 2 will generate an error. (Communication using standard SIO channel 1 is possible even when the RC gateway is enabled.)
	SCHA, TMRD, TMRW, IPCN	Not affected

Command category	Commands	How each command is affected by RC gateway function
String operation	SCPY, SCMP, SGET, SPUT, STR, STRH, VAL, VALH, SLEN	Not affected
Task control	EXIT, EXPG, ABPG, SSPG, RSPG	Not affected
Simulated ladder task build	TPCD, CHPR, TSLP, OUTR, TIMR	Not affected
Program control	GOTO, TAG, EXSR, BGSR, EDSR	Not affected
Structured IF	IFEQ, IFNE, IFGT, IFGE, IFLT, IFLE, ISEQ, ISNE, ELSE, EDIF	Not affected
Structured DO	DWEQ, DWNE, DWGT, DWGE, DWLT, DWLE, LEAV, ITER, EDDO	Not affected
Multi-branching	SLCT, WHEQ, WHNE, WHGT, WHGE, WHLT, WHLE, WSEQ, WSNE, OTHE, EDSL	Not affected
Expanded command	ECMD	Not affected
Memory operation	MRUW, MRSW, MRID, MRBW, MRBD, MRMW, MRMD, MWIW, MWID, MWBW, MWBD, MWMW, MWMD, MBOW, MBOD, MBFW, MBFD, MBNW, MBND, MBTW, MBTD, MDCW, MDCD, MECW, MECD, SUMB	Not affected

5.3.2 Explanation of Commands

(1) Position data operation commands

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPGT (Read RC axis position data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPGT	RC axis number	Position number	CC

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the position of RC axis into variable 199.

[Example 1] RPGT 1 2 Read the position of RC position No.2 of axis 1 into variable 199.

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	200.00	300	0.3	0	0.10

! → "200.00" is stored in variable 199.

[Example 2] LET 1 2 Assign "2" to variable 1.
LET 2 3 Assign "3" to variable 2.
RPGT *1 *2 Read the RC position corresponding to the content "3" of variable 2 of the axis specified by the content "2" of variable 1, into variable 199.

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPPT (Write RC axis position data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPPT	RC axis number	Position number	CP

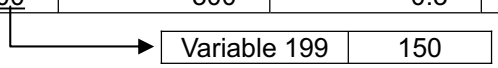
Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Write the value of variable 199 to the specified position data position [mm].

[Example 1]
```
LET     199     150     Assign “150” to variable 199.
RPPT    1       2       Write the content “150” of variable 199 to RC position No.2
                        of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	150.00	300	0.3	0	0.10



[Example 2]
```
LET     199     150     Assign “150” to variable 199.
LET     1       2       Assign “2” to variable 1.
LET     2       3       Assign “3” to variable 2.
RPPT    *1      *2      Write the content “150” of variable 199 to the RC position
                        corresponding to the content “3” of variable 2 of the axis
                        specified by the content “2” of variable 1.
```

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPCR (Clear RC axis position data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPCR	RC axis number	Variable number n	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Clear the position data in the range specified by variable No.n and variable No.n+1
Once the data is cleared, the applicable fields will become blank.

Variable number	Set item
n	Position number from which to start clearing data
n + 1	Position number at which to end clearing data

[Example]
```
LET   200   0     Assign “0” to variable 200.
LET   201   1     Assign “1” to variable 201.
RPCR  1     200   Clear “1” from position No.0 of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp	
0						} Cleared.
1						
2	200.00	300	0.3	0	0.10	

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPCP (Copy RC position data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPCP	RC axis number	Variable number n	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Copy the position data in variable No.n+1 to variable No.n.

Variable number	Set item
n	Position number to copy to
n + 1	Position number to copy from

[Example]
```
LET   200   2     Assign “2” to variable 200.
LET   201   0     Assign “0” to variable 201.
RPCP  1     200   Copy the data of position No.0 of axis 1 to No.2.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	100	0.2	0	0.20
1	380.00	300	0.3	0	0.10
2	5.00	100	0.2	0	0.20

Copied.

!

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPRD (Read current RC axis position)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPRD	Position number	Prohibited	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the current position of the axis specified in the RAXS command explained in 2.3.2 (2) of the “Software” chapter in this manual, into a position number.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command.
If the RAXS is not yet executed, an error “(43B) RC axis pattern not yet set error” will occur.

[Example 1]

```
RAXS    0       111     Set the axis pattern as axes 0, 1 and 2.
RPRD    100             Read the current positions of axes 0 to 2 each into RC
                        position No.100.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
100	5.00	300	0.3	0	0.10

The current position of axis 1 is input.

Position data of axis 2

No.	Pos	Vel	Acc	Push	Inp
100	500.00	200	0.3	0	0.10

The current position of axis 2 is input.

Position data of axis 3

No.	Pos	Vel	Acc	Push	Inp
100	100.00	300	0.3	0	0.10

The current position of axis 3 is input.

[Example 2]

```
RAXS    0       111     Set the axis pattern as axes 0, 1 and 2.
LET     1       100     Set “100” in variable 1.
RPRD    *1      0 to 2  Read the current positions of axes 0 to 2 each into the RC
                        position corresponding to the content “100” of variable 1.
```

● RPRQ (Read current RC axis position [direct reading of 1 axis])

RC position data mode	X-SEL	○: Valid
	RC	○: Valid

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPDQ	RC axis number	Variable number	CP

[Function] Read the current position of the RC axis into the variable specified by operand 2.
With this command, the current position can be acquired more quickly than when the RPRD command is used.

[Example] RPDQ 2 100 Read the current position of axis 2 into variable No.100.

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPVL (Write RC axis speed data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPVL	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Write the value of variable 199 as the speed [mm/s] for the position data specified by operand 2.

[Example 1]
```
LET   199   100   Assign “100” to variable 199.
RPVL  1     2     Write the speed in variable 199, or “100” mm/s, to RC
                  position No.2 of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	200.00	100	0.3	0	0.10

Variable 199	100

[Example 2]
```
LET   199   100   Assign “100” to variable 199.
LET   1     2     Assign “2” to variable 1.
LET   2     3     Assign “3” to variable 2.
RPVL  *1    *2    Write the speed in variable 199, or “100” mm/s, to the RC
                  position number corresponding to the content “3” of variable
                  2 of the axis specified by the content “2” of variable 1.
```

● RPAD (Write RC axis acceleration/deceleration data)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPAD	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Write the value of variable 199 as the acceleration/deceleration [G] for the position data specified by operand 2.

[Example 1]
```
LET    199   0.1   Assign "0.1" to variable 199.
RPAD   1     2     Write the acceleration/deceleration in variable 199, or "0.1" G, to RC position No. 2 of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	200.00	300	0.1	0	0.10

Variable 199	0.1

[Example 2]
```
LET    199   0.3   Assign "0.3" to variable 199.
LET    1     2     Assign "2" to variable 1.
LET    2     3     Assign "3" to variable 2.
RPAD   *1    *2    Write the acceleration/deceleration in variable 199, or "0.3" G, to the RC position number corresponding to the content "3" of variable 2 of the axis specified by the content "2" of variable 1.
```

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

● RPIP (Write RC axis positioning band data)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPIP	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Write the value of variable 199 as the positioning band [mm] for the position data specified by operand 2.

[Example 1]
```
LET   199   0.2   Assign “0.2” to variable 199.
PRIP  1     2     Write the positioning band in variable 199, or “0.2” mm, to
                  RC position No.2 of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	200.00	300	0.3	0	0.20

Variable 199	0.2

[Example 2]
```
LET   199   0.2   Assign “0.2” to variable 199.
LET   1     2     Assign “2” to variable 1.
LET   2     3     Assign “3” to variable 2.
RPIP  *1    *2    Write the positioning band in variable 199, or “0.2” mm, to the
                  RC position number corresponding to the content “3” of
                  variable 2 of the axis specified by the content “2” of variable 1.
```

● RPTQ (Write RC axis current-limiting value data during push-motion operation)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPTQ	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Write the value of variable 199 as the current-limiting value during push-motion operation [%] for the position data specified by operand 2.

[Example 1]
```
LET     199     50      Assign “50” to variable 199.
RPTQ    1       2       Write the current-limiting value in variable 199, or “50” %, to
                        RC position No.2 of axis 1.
```

Position data of axis 1

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.3	0	0.10
2	200.00	300	0.3	50	0.10

Variable 199	50

[Example 2]
```
LET     199     50      Assign “50” to variable 199.
LET     1       2       Assign “2” to variable 1.
LET     2       3       Assign “3” to variable 2.
RPTQ    *1      *2      Write the current-limiting value in variable 199, or “50” %, to
                        the RC position number corresponding to the content “3” of
                        variable 2 of the axis specified by the content “2” of variable 1.
```

● RGVL (Read RC axis speed data)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RGVL	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the speed [mm/s] for the position data specified by operand 2, into variable 199.

[Example] RGVL 2 1 Read the speed for RC position No.1 of axis 2 into variable 199.

Position data of axis 2

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	200	0.3	0	0.10

Variable 199	200

● RGAD (Read RC axis acceleration/deceleration data)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RGAD	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the acceleration/deceleration [G] for the position data specified by operand 2, into variable 199.

[Example] RGAD 2 1 Read the acceleration/deceleration for RC position No.1 of axis 2 into variable 199.

Position data of axis 2

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.2	0	0.10

Variable 199	0.2

● RGIP (Read RC axis positioning band data)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RGIP	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the positioning band [mm] for the position data specified by operand 2, into variable 199.

[Example] RGIP 2 1 Read the positioning band for RC position No.1 of axis 2 into variable 199.

Position data of axis 2

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.2	0	0.10

Variable 199	0.10

● RGTQ (Read RC axis current-limiting value data during push-motion operation)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RGTQ	RC axis number	Position number	CP

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Read the current-limiting value during push-motion operation [%] for the position data specified by operand 2, into variable 199.

[Example] RGTQ 2 1 Read the current-limiting value for RC position No.1 of axis 2 into variable 199.

Position data of axis 2

No.	Pos	Vel	Acc	Push	Inp
0	5.00	300	0.3	0	0.10
1	380.00	300	0.2	30	0.10

Variable 199	30

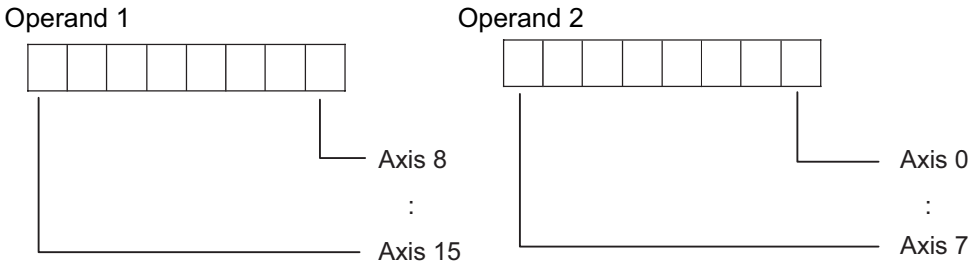
(2) Operation commands

RC position data mode	X-SEL	○: Valid
	RC	○: Valid

● RAXS (Set RC axis pattern)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RAXS	Upper byte of axis pattern	Lower byte of axis pattern	CP

[Function] Set the axis pattern for axes 8 to 15 in operand 1 and that for axes 0 to 7 in operand 2.
The axes specified by the total axis pattern are operated simultaneously.



Be sure to set the axis pattern if any of the commands listed below is used.
(Set “1” for the axes numbers corresponding to the axes that are used, or set “0” for the axes numbers corresponding to the axes that are not used.)
If no axis pattern is set, an error “(43B) RC axis pattern not yet set error” will occur.

- RPRD : Read current RC axis position
- RSON : Turn ON RC axis servo
- RSOF : Turn OFF RC axis servo
- RHOM : Return RC axis to home
- RMVP : Move RC axis via position specification
- RMPI : Move RC axis incrementally
- RSTP : Decelerate RC axis to stop

[Example]

RAXS	1010101	10101010	Set the axis pattern as axes 1, 3, 5, 7, 8, 10, 12 and 14.
RSON			Turn ON the servos for the specified axes.
RMVP	20		Move the specified axes to position No.20.

● RSON (Turn ON RC axis servo)

RC position data mode	X-SEL	○: Valid
	RC	○: Valid

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RSON	Prohibited	Prohibited	PE

[Function] Turn ON the servo for the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command. If the RAXS is not yet executed, an error "(43B) RC axis pattern not yet set error" will occur.

[Example] RAXS 0 1100 Set the axis pattern as using axes 2 and 3.

RSON Turn ON the servos for the specified axes.

● RSOF (Turn OFF RC axis servo)

RC position data mode	X-SEL	○: Valid
	RC	○: Valid

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RSOF	Prohibited	Prohibited	PE

[Function] Turn OFF the servo for the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command. If the RAXS is not yet executed, an error "(43B) RC axis pattern not yet set error" will occur.

[Example] RAXS 0 1100 Set the axis pattern as using axes 2 and 3.

RSOF Turn OFF the servos for the specified axes.

RC position data mode	X-SEL	○: Valid	
	RC	○: Valid	

● RHOM (Return RC axis to home)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RHOM	Prohibited	Prohibited	PE

[Function] Return to its home the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual.
The servo will turn ON automatically for each axis returning to its home.

[Example]
```
RAXS    0    1100    Set the axis pattern as using axes 2 and 3.
RHOM                 Return the specified axes to their home.
```

RC position data mode	X-SEL	○: Valid	
	RC	○: Valid	

● RMVP (Move RC axis via position specification)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RMVP	Position number	Prohibited	PE

[Function] Move the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual, to the position number specified by operand 1.
The output turns OFF when the axis movement is started, and will turn ON when the movement is completed.

⚠ Caution: The specific operation varies depending on whether the X-SEL position data mode or RC position data mode is used.
[1] Method to use position data in X-SEL
→ The actuator moves to the position number specified by operand 1 via PTP operation.
[2] Method to use position data in RC
→ The specific operation varies depending on the applicable RC position data.

No.	RC position data item		
	Push	Incremental	Description of operation
1	0	0	Move to the position number specified by operand 1 via PTP operation.
2	0	1	Move incrementally by the travel equivalent to the position number specified by operand 1 (PTP).
3	Other than 0	0	Move to the position number specified by operand 1, and then perform push-motion operation. If the load is missed by a single axis in push-motion operation, the output will Turn OFF.
4	Other than 0	1	Move to the position number specified by operand 1, and then perform push-motion operation. If the load is missed by a single axis in push-motion operation, the output will Turn OFF.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command.
If the RAXS is not yet executed, an error “(43B) RC axis pattern not yet set error” will occur.

[Example 1]
```
RAXS   0    11    Set the axis pattern as axes 0 and 1.
RMVP   10        Move the specified axes to position No.10.
```

[Example 2]
```
RAXS   0    11    Set the axis pattern as axes 0 and 1.
LET    1    10    Assign “10” to variable 1.
RMVP   *1        Move the specified axes to position No.10 corresponding to
                 the content “10” of variable 1.
```

RC position data mode	X-SEL	○: Valid (Note 2)
	RC	×: Invalid (Note 1)

● RMPI (Move RC axis incrementally)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RMPI	Position number	Prohibited	PE

Note 1 If the command is executed, an RC position data use method error (439) will occur.
Note 2 For Fieldbus Type, (405) RC Gateway Communication Classification Error will be generated

[Function] Move the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual, by the travel equivalent to the position data specified by operand 1.
The output turns OFF when the axis movement is started, and will turn ON when the movement is completed.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command.
If the RAXS is not yet executed, an error “(43B) RC axis pattern not yet set error” will occur.

```
[Example 1] RAXS   0    11    Set the axis pattern as axes 0 and 1.
            RMPI   10        Move the axes by the travel equivalent to position No.10.

[Example 2] RAXS   0    11    Set the axis pattern as axes 0 and 1.
            LET    1    10    Assign “10” to variable 1.
            RMPI   *1        Move the specified axes by the travel equivalent to position
                             No.10 corresponding to the content “10” of variable 1.
```

● RMVD (Move RC axis via absolute direct-value position specification)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RMVD	RC axis number	Variable number n	PE

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Perform absolute position movement using the values of variable Nos. n to n+3.
The output turns OFF when the axis movement is started, and will turn ON when the movement is completed.

Variable number	Set item
n	Target position
n + 1	Speed [mm/s]
n + 2	Acceleration/deceleration [G]
n + 3	Positioning band [mm]

[Setting types of operation 1]

Operation 1	Specification of executing axis
0 to 15	The RC axis of the specified number moves by absolute positioning.
-1	The RC axis specified in the RAXS command moves by absolute positioning.

* The specification of “-1” is valid only with X-SEL P/Q controllers of V0.87 or later and X-SEL PX/QX controllers of V0.42 or later.

[Example]

```
LET   300   100   Set the target position as “100” mm.
LET   301   200   Set the speed as “200” mm/s.
LET   302   0.3   Set the acceleration/deceleration as “0.3” G.
LET   303   0.1   Set the positioning band as “0.1” mm.
RMVD  1     300   Move RC axis 1 via absolute position specification.
```

● RMDI (Move RC axis via incremental direct-value position specification)

RC position data mode	X-SEL	○: Valid (Note 2)
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RMDI	RC axis number	Variable number	PE

Note 1 If the command is executed, an RC position data use method error (439) will occur.
Note 2 For Fieldbus Type, (405) RC Gateway Communication Classification Error will be generated

[Function] Perform incremental position movement using the values of variable Nos. n to n+3. The output turns OFF when the axis movement is started, and will turn ON when the movement is completed.

Variable number	Set item
n	Travel
n + 1	Speed [mm/s]
n + 2	Acceleration/deceleration [G]
n + 3	Positioning band [mm]

[Setting types of operation 1]

Operation 1	Specification of executing axis
0 to 15	The RC axis of the specified number moves by absolute positioning.
-1	The RC axis specified in the RAXS command moves by absolute positioning.

* The specification of “-1” is valid only with X-SEL P/Q controllers of V0.87 or later and X-SEL PX/QX controllers of V0.42 or later.

[Example]

```
LET   300   50    Set the travel as “50” mm.
LET   301   200   Set the speed as “200” mm/s.
LET   302   0.3   Set the acceleration/deceleration as “0.3” G.
LET   303   0.1   Set the positioning band as “0.1” mm.
RMDI  1     300   Move RC axis 1 via incremental position specification.
```

● RPUS (Move RC axis via push-motion operation)

RC position data mode	X-SEL	○: Valid
	RC	×: Invalid (Note 1)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RPUS	RC axis number	Position number	PE

Note 1 If the command is executed, an RC position data use method error (439) will occur.

[Function] Move the axis to the target position corresponding to the position number specified by operand 2, and then cause the axis to push the load by the positioning band specified by the position data.
Set the push force as the current-limiting value during push-motion operation for the position data.
The output will turn ON if the load is confirmed as being pushed, and turn OFF if a missed load is detected.

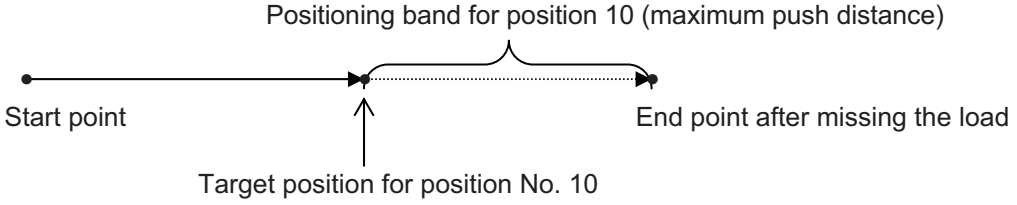
[Setting types of operation 1]

Operation 1	Specification of executing axis	
0 to 15	The RC axis of the specified number moves in the push-motion operation mode.	The output turns ON if a load is confirmed as being pushed by the specified axis.
-1	The all RC axes specified in the RAXS command move in the push-motion operation mode.	The output turns ON if loads are confirmed as being pushed by all specified axes.
-2	The RC axis specified in the RAXS command moves in the push-motion operation mode.	The output turns ON if a load is confirmed as being pushed by any one of all specified axes.

* The specification of “-1” is valid only with X-SEL P/Q controllers of V0.87 or later and X-SEL PX/QX controllers of V0.42 or later.

⚠ Caution:
- If a positive sign is appended to the positioning band data, the load will be pushed in the direction of increasing coordinates from the start point of the RPUS command toward the target position.
- Appending a negative sign pushes the load in the direction of decreasing coordinates. (The operation differs from the PUSH command.)

[Example] RPUS 3 10 Move RC axis 3 to position No.10 and cause it to push the load.



RC position data mode	X-SEL	○: Valid
	RC	○: Valid

● RSTP (Stop RC axis movement)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RSTP	Prohibited	Prohibited	PE

[Function] Decelerate the RC axis specified in the RAXS command explained in 5.3.2 (2) of the chapter in this manual, to a stop.
This command is effective on RC axis control commands other than RSOF.

(!) Notice: Before executing this command, set the axis pattern using the RAXS command.
If the RAXS is not yet executed, an error “(43B) RC axis pattern not yet set error” will occur.

[Example]

RAXS	0		11	Set the axis pattern as axes 0 and 1.
RSTP				Decelerate the specified axes to a stop.

(3) Information read commands

RC position data mode	X-SEL	○: Valid
	RC	○: Valid

● RCST (Read RC axis status)

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output operation type (output, flag)
		Command, declaration	Operand 1	Operand 2	
Free	Free	RCST	Variable number	RC axis number	CP

[Function] Read the RC axis status into variable No.n specified by operand 1.
Read the completed position number into variable No.n+1. (Refer to Notice 2.)

(!) Notice 1: The specific status varies depending on whether the X-SEL position data mode or RC position data mode is used.

Variable number	Acquired item
n	RC axis status
n + 1	Completed position number

Bit structure of RC axis status

Bit	Method to use position data in X-SEL		Method to use position data in RC	
	Name	Explanation	Name	Explanation
27-31	-	Reserved.	-	Reserved.
26	ALMX	RC axis alarm (Alarm detected by the X-SEL) * ALMX is a RC-axis alarm that ALM + X-SEL have detected.	ALMX	RC axis alarm (Alarm detected by the X-SEL) * ALMX is a RC-axis alarm that ALM + X-SEL have detected.
25	USE	RC axis in use	USE	RC axis in use
24	LNK	RC axis link status	LNK	RC axis link status
16-23	-	Reserved.	-	Reserved.
15	RMDS	Operation Mode	RMDS	Operation Mode
14	ALML	Light Error Alarm	ALML	Light Error Alarm
13	ZON2	Zone 2	ZON2	Zone 2
12	ZON1	Zone 1	ZON1	Zone 1
11	-	Reserved.	PZON	Position zone
10	-	Reserved.	MODS	Teaching mode status
9	SFTY	Safety speed enabled status	SFTY	Safety speed enabled status
8	BALM	Low battery voltage	BALM	Low battery voltage
7	EMG	Emergency stop status	EMG	Emergency stop status
6	PSFL	Load missed during push-motion operation	PSFL	Load missed during push-motion operation
5	CRDY	Controller ready	CRDY	Controller ready
4	SON	Servo ON status	SON	Servo ON status
3	MOVE	Moving	MOVE	Moving
2	HEND	Home return complete	HEND	Home return complete
1	PEND	Positioning complete	PEND	Positioning complete
0	ALM	An alarm occurred that makes it impossible to continue operation. (Alarm detected by the RC axis)	ALM	An alarm occurred that makes it impossible to continue operation. (Alarm detected by the RC axis)

(!) Notice 2: Completed position numbers are set only in the RC position data mode.
In the X-SEL position data mode, “0” is always set.

[Example] RCST 200 10 Get the status of RC axis 10 into variable 200.

5.4 Notes on Resuming Interrupted Operation

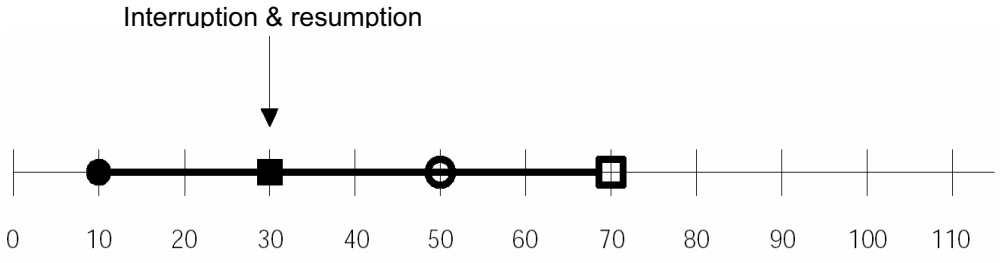
If any RC axis movement specified in a SEL program was interrupted and then the operation is subsequently resumed according to any of the conditions listed in [1], [2] and [3] below, the RC axis will not resume its operation from the point of interruption, but it will start an entirely new operation instead (= restart the movement command to the specified position):

[1] Turn OFF the servo for the current RC axis while the SEL program is paused, and then restart the program.
[2] Operation is continued due to the recovery processing after an emergency stop was cancelled (other parameter No.10 = 2).
[3] Operation is continued due the recovery processing upon switching of the enable switch from OFF to ON (other parameter No.11 = 2).

⚠ Caution: When an incremental movement command is interrupted and then the operation is subsequently resumed, the axis will move by the incremental travel from the position of resumption. Accordingly, exercise due caution that the target position will change and contact may occur.
(This is not the problem with an absolute movement command, in which case the axis will move to the initial target position.)

■ Example

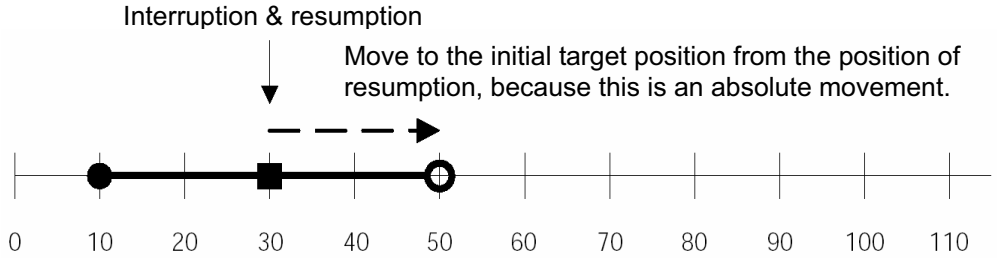
- Interruption/resumption of relative movement command for RC axis



● Current position ■ Position of interruption & resumption
○ Target position □ Target position after resumption

If the movement is interrupted after 30mm while the axis is moving by 40mm incrementally from the current position of 10mm, the recovery operation may cause the axis to move by 40mm from the 30mm position to reach the 70mm position.

- Interruption/resumption of absolute movement command for RC axis

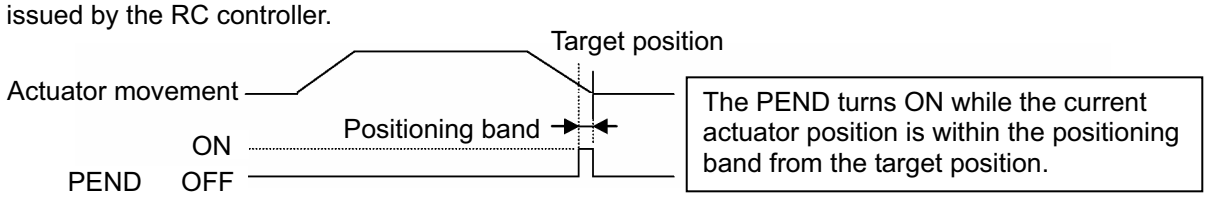


● Current position ■ Position of interruption & resumption
○ Target position

In the case of absolute movement, the axis will move to the initial target position (coordinate: 50 mm) from the position of resumption (coordinate: 30 mm). (The target position will not change.)

5.5 Checking the Completed Position (Positioning Band)

In the “Method to use position data in X-SEL”, whether or not the positioning command (RMVP, RMPI, RMVD or RMDI) has completed is checked only based on the output signal PEND (positioning complete signal) issued by the RC controller.



Accordingly, follow the example below if you want to check whether the current position is within the positioning band after the positioning command has completed.

⚠ Caution: In the “Method to use position data in RC”, the output signal PEND is output while the current actuator position is inside the positioning band set in the position table. Accordingly, there is no need to check the completed position.
(Example) Program that performs completed position check
RC axis 4 moves back and forth between position No.0 and position No.1.

- Position data of RC axis 4

No.	Pos	Vel	Acc	Push	Inp
0	0	75	0.3	0	0.5
1	200.00	75	0.3	0	0.5

Operation of main program

[1] Set a variable number for subroutine preparation
[2] Execute subroutine 1 (get the target position for position No. 0)
[3] Move the axis to position No. 0 via the RMVP command
[4] Execute subroutine 2 (check the completed position for position No. 0)
[5] The program ends due to a completion check error (600 or 601 turns ON)
[6] Set a variable number for subroutine preparation
[7] Execute subroutine 1 (get the target position for position No. 1)
[8] Move the axis to position No. 1 via the RMVP command
[9] Execute subroutine 2 (check the completed position for position No. 1)
[10] The program ends due to a completion check error (602 or 603 turns ON)

Operation of subroutine 1

[1] Get the target position from the position data
[2] Get the positioning band from the position data
[3] Calculate the lower limit of target position
(Lower limit of target position = Target position – Positioning band)
[4] Calculate the upper limit of target position
(Upper limit of target position = Target position + Positioning band)

Operation of subroutine 2

[1] Get the current position of the RC axis
[2] Compare the current position against the lower limit of target position (a flag turns ON if an error is found)
[3] Compare the current position against the upper limit of target position (a flag turns ON if an error is found)

Program examples

• Main program

Step	E	N	Cnd	Cmnd	Operand1	Operand2	Pst	Comment
1				RAXS	0	10000		
2				TAG	1			
3								
4	// Move via PTP to position No.0							
5				LET	100	4		[1] RC axis number
6				LET	101	0		[1] Position number
7				LET	102	110		[1] Lower limit of target position
8				LET	103	111		[1] Upper limit of target position
9				LET	104	600		[1] Lower-limit error flag number
10				LET	105	601		[1] Upper-limit error flag number
11				EXSR	1			[2] Execute subroutine 1
12				RMVP	*101			[3] Move to position No.0 via RMVP command
13				EXSR	2			[4] Execute subroutine 2
14			600					[5] Error detection
15	O		601	GOTO	11			[5] End of program
16								
17	// Move via PTP to position No.1							
18				LET	100	4		[6] RC axis number
19				LET	101	1		[6] Position number
20				LET	102	110		[6] Lower limit of target position
21				LET	103	111		[6] Upper limit of target position
22				LET	104	602		[6] Lower-limit error flag number
23				LET	105	603		[6] Upper-limit error flag number
24				EXSR	1			[7] Execute subroutine 1
25				RMVP	*101			[8] Move to position No.1 via RMVP command
26				EXSR	2			[9] Execute subroutine 2
27			602					[10] Error detection
28	O		603	GOTO	11			[10] End of program
29								
30		N	15	GOTO	1			
31				TAG	11			
32				EXIT				
33								

• Subroutine 1

Step	E	N	Cnd	Cmnd	Operand1	Operand2	Pst	Comment
34	//----------							
35	// Obtain the upper/lower limits of target position.							
36	// * Numbers between 1100 and 1199 are used for task variables within the subroutine.							
37	//							
38	// Argument 1: L real number 100: RC axis number							
39	// Argument 2: L real number 101: Position number							
40	// Argument 3: L real number 102: Variable number for lower limit of target position							
41	// Argument 4: L real number 103: Variable number for upper limit of target position							
42	//----------							
43				BGSR	1			
44				RPGT	*100	*101		[1] Get target position
45				LET	*102	*199		
46				LET	*103	*199		
47				RGIP	*100	*101		[2] Get positioning band
48				LET	1100	*199		
49				SUB	*102	*1100		[3] Lower limit of target position
50				ADD	*103	*1100		[4] Upper limit of target position
51				EDSR				
52								

• Subroutine 2

Step	E	N	Cnd	Cmnd	Operand1	Operand2	Pst	Comment
53	//----------							
54	// Check the completed position against the upper/lower limits.							
55	// * Numbers between 1100 and 1199 are used for task variables within the subroutine.							
56	//							
57	// Argument 1: L real number 100: RC axis number							
58	// Argument 2: L real number 101: Position number (Not used)							
59	// Argument 3: L real number 102: Variable number for lower limit of target position							
60	// Argument 4: L real number 103: Variable number for upper limit of target position							
61	// Argument 5: L real number 104: Lower-limit error flag number							
62	// Argument 6: L real number 105: Upper -limit error flag number							
63	//----------							
64				BGSR	2			
65				BTOF	*104	*105		
66				RPRQ	*100	1100		[1] Get current position of RC axis
67				CPGT	*102	*1100	*104	[2] Check lower limit of target position
68				CPLT	*103	*1100	*105	[3] Check upper limit of target position
69				EDSR				

6. Appendix

6.1 List of Additional I/O Parameters

The shaded parameters in bold are new parameters.
For the parameters in the X-SEL controller, refer to the operation manual for the X-SEL controller.

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
213	Free-for-User SIO Channel 2 Attribute 1 (mounting standard)	28100001_H	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. [8] Bits 28 to 31: Baud rate type for RS232C communication (0: 9.6 / 1: 19.2 / 2: 38.4 3: 57.6 / 4: 76.8 / 5: 115.2 kbps) [7] Bits 24 to 27: Data length for RS232C communication (7 or 8) [6] Bits 20 to 23: Stop bit length for RS232C communication (1 or 2) [5] Bits 16 to 19: Parity type for RS232C communication (0: None / 1: Odd / 2: Even) [4] Bits 12 to 15: Operation mode (0: RS232C / 1: RC gateway) * Only channel 2 is valid in the RC gateway mode. [3] Bits 8 to 11: (Reserved.) [2] Bits 4 to 7: (Reserved.) [1] Bits 0 to 3: SIO use selection (0: Not used / 1: Used)
214	Free-for-User SIO Channel 2 Attribute 2 (mounting standard)	00000001_H	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. [8] [7] Bits 24 to 31: (Reserved.) [6] Bits 20 to 23: Change prohibited. [5] Bits 16 to 19: Character transmission interval [msec] [4] Bits 12 to 15: Communication method (0: Full-duplex / 1: Half-duplex) [3] Bits 8 to 11: Send operation type for half-duplex communication (0: Do not check CTS-ON at send / 1: Check CTS-ON at send) [2] [1] Bits 0 to 7: Minimum receive → send switching delay time in half-duplex communication [msec]

I/O parameters (The shaded parameters in bold are new parameters: Continued)

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
215	Free-for-User SIO Channel 2 Attribute 3 (mounting standard)	01118040_H	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. [8] Bits 28 to 31: Flow control type (0: None / 1: Xon/Xoff / 2: Hardware) * Select a baud rate of 38.4 kbps or below if flow control is performed. * This setting is valid only in full-duplex communication. [7] Bits 24 to 27: Xon send selection when send is enabled after SIO-CPU reset (0: Do not send / 1: Send) * This setting is valid only in full-duplex communication with Xon/Xoff flow control. [6] Bits 20 to 23: Send enable selection at port open (0: Disable / 1: Enable) * This setting is valid only in full-duplex communication with Xon/Xoff flow control. [5] Bits 16 to 19: Xon/Xoff send selection at port close (0: Do not send / 1: Send Xon / 2: Send Xoff) * This setting is valid only in full-duplex communication with Xon/Xoff flow control. [4] [3] Bits 8 to 15: Flow control high limit (byte) [2] [1] Bits 0 to 7: Flow control low limit (byte) * If a value that establishes “Flow control low limit ≥ SCI receive buffer size – Flow control high limit” is set, both the flow control high limit and low limit will be replaced by a value corresponding to one fourth of the SCI receive buffer size and the replaced limits will be used for processing.
216	RC gateway function selection	00000000_H	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. * This parameter is effective only in the RC gateway mode. [8] [7] [6] [5] [4] Bits 12 to 31: (Reserved.) [3] [2] [1] Bits 0 to 11: I/O pattern (0: Method to use position data in X-SEL / 1: Method to use position data in RC)
217	Axis pattern for RC gateway link (15 to 8)	0_B	0_B to 11111111_B		Axis pattern for RC gateway link (axis Nos. 15 to 8)
218	Axis pattern for RC gateway link (7 to 0)	0_B	0_B to 11111111_B		Axis pattern for RC gateway link (axis Nos. 7 to 0)
219	Free-for-User SIO Channel 2 Attribute 7 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		
220	Free-for-User SIO Channel 2 Attribute 8 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		

I/O parameters (The shaded parameters in bold are new parameters: Continued)

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
221	Free-for-User SIO Channel 2 Attribute 9 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		
222	Free-for-User SIO Channel 2 Attribute 10 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		
223	Free-for-User SIO Channel 2 Attribute 11 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		
224	Free-for-User SIO Channel 2 Attribute 12 (mounting standard)	00000000_H	0_H to $FFFFFFFF_H$		
225	Network I/F Module Control	00000000_H	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. Set [8] to [4] to 0. [3] Bits 8 to 11↕ Network Module 3 Station Type (0↕ Not Equipped) (5↕ Fieldbus Master Board) [2] Network I/F Module 2 Station Type (0↕ Not Mounted) [1] Network I/F Module Station Type (0↕ Automatic Identification) (5↕ Fieldbus Master Board)
431	Fieldbus Master Function Select	0_H	0_H to $FFFFFFFF_H$	F	Bits 0-3 ↕ Function Select (0↕ Disable / 1↕ RC gateway) Bits 4-7 ↕ Offline slave data Processing Selection (0↕ Clear / 1↕ Hold (most recent normal retain)
432	Fieldbus slave 0 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	Bits 0-7 ↕ Connection controller Station Type (0↕ Disconnected / 1↕ MSEP 2↕ ACON/PCON / 3↕ SCON-CA) 4↕ MSCON Bits 8-15 ↕ Slave Input size (byte) Bits 16-23 ↕ Slave Output size (byte)
433	Fieldbus slave 1 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
434	Fieldbus slave 2 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
435	Fieldbus slave 3 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
436	Fieldbus slave 4 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
437	Fieldbus slave 5 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
438	Fieldbus slave 6 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
439	Fieldbus slave 7 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
440	Fieldbus slave 8 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)

I/O parameters (The shaded parameters in bold are new parameters: Continued)

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
441	Fieldbus slave 9 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
442	Fieldbus slave 10 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
443	Fieldbus slave 11 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
444	Fieldbus slave 12 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
445	Fieldbus slave 13 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
446	Fieldbus slave 14 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
447	Fieldbus slave 15 Composition definition	0_H	0_H to $FFFFFFFF_H$	F	(I/O Parameter Equivalent to No.432)
448	Fieldbus configuration attribute 1	$4B_H$	0_H to $FFFFFFFF_H$	F	Bits 0-11 ↕ EPR (Expected Packet Rate) Bits 12-19 ↕ ISD (Interscan Delay) * Perform the setting to make ISD*3 < EPR.
501	Number of RC gateway position data points	128	0 to 512		Number of position data points used in the Method to use position data in X-SEL
502	Largest axis number for definition of RC gateway position data	0	0 to 15		Largest axis number used for allocating the RC axis position data area in the user-data backup memory
503	Number of position data points for definition of RC gateway position data	0	0 to 512		Number of position data points used for allocating the RC axis position data area in the user-data backup memory * If “0” is set, the area is not allocated. * If a value other than “0” is set, the area is allocated regardless of whether the RC gateway function is enabled or disabled.
504	Port number of first occupied/shared input port in RC gateway PLC through mode	1000	1000 to 3999		1000 + (multiple of 16)
505	Port number of first occupied/shared output port in RC gateway PLC through mode	4000	4000 to 6999		4000 + (multiple of 16)
506	Timeout period for connection of RC PC software to RC gateway	3000	0 to 99999	ms	Set the connection timeout period for the RC PC software.
507	RC gateway attribute 1	0	0_H to $FFFFFFFF_H$		[8] [7] [6] [5] [4] [3] [2] [1] $_H$ ← Enter as HEX values of 0 to F. Set [8] to [5] to “0.” [4] Bits 12 to 15↕ Time to wait for link in initializing (5 to F [s]) [3] Bits 8 to 11↕ Data refresh delay time (0 to F [10ms]) [2] Bits 4 to 7↕ Data refresh check time (3 to F [Number of times]) [1] Bits 0 to 3↕ Emergency stop non-conformance check (0: Have a check, 1: Not to have a check)

I/O parameters (The shaded parameters in bold are new parameters: Continued)

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
508	(For future expansion)	0			
509	(For future expansion)	0			
510	(For future expansion)	0			
511	Input port number for forced release of RC axis 0 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
512	Input port number for forced release of RC axis 1 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
513	Input port number for forced release of RC axis 2 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
514	Input port number for forced release of RC axis 3 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
515	Input port number for forced release of RC axis 4 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
516	Input port number for forced release of RC axis 5 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
517	Input port number for forced release of RC axis 6 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
518	Input port number for forced release of RC axis 7 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
519	Input port number for forced release of RC axis 8 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
520	Input port number for forced release of RC axis 9 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
521	Input port number for forced release of RC axis 10 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
522	Input port number for forced release of RC axis 11 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
523	Input port number for forced release of RC axis 12 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)

I/O parameters (The shaded parameters in bold are new parameters: Continued)

No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
524	Input port number for forced release of RC axis 13 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
525	Input port number for forced release of RC axis 14 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)
526	Input port number for forced release of RC axis 15 brake	0	0 to 3999		When the applicable port turns ON, the brake is forcibly released. (Pay attention to a falling load.) * Invalid, if “0” is set. (This parameter is invalid if input port No.0 is specified.)

6.2 Troubleshooting for Communication

6.2.1 Error Code List

Level	No.	Error name	Description/action
Message	220	RC axis multiple-use error (SIO)	An attempt was made to get the right of use over an RC axis that is already is in use. → Check if the applicable RC axis is used in multiple programs.
	221	RC axis right-of-use acquisition error	No space is available in the RC-axis use management area. → Contact IAI.
	223	RC gateway operation mode error (SIO)	The applicable operation cannot be performed in the current RC gateway operation mode. → Check Bits 0 to 11 in I/O Parameter No. 216.
	224	RC gateway status command error (SIO)	The applicable operation cannot be performed in the current RC gateway status. About RC Gateway Status • Gateway Status : Condition to perform normal operation • PC Software Connection Status : Condition to connect RC PC Software via X-SEL An operation commands from X-SEL such as RC Gateway SEL Command are prohibited. This error will be generated in such cases. The switchover of conditions is to be conducted with “GW” and “RC” buttons in the menu bar of X-SEL PC Software. → When operating RC axes from X-SEL, press “GW” button in X-SEL PC Software.
	225	RC axis number error (SIO)	The RC axis number is not specified correctly. → Check the RC axis number.
	226	RC position number error (SIO)	The RC position number is not specified correctly. → Check the RC position number.
	22C	RC gateway communication type (SIO)	The system would not operate with the current communication classification. → In Fieldbus type, RC button in X-SEL PC Software cannot be used. Connect to RC PC Software directly.

Level	No.	Error name	Description/action
Operation cancellation	405	RC Gateway Communication Classification Error (SEL)	An operation cannot be made with the current RC Gateway Communication Classification. →RMPI or RMDI cannot be used in Fieldbus type.
	41F	RC axis MANU mode detection	It is detected that Drive Mode Status Signal in RC axis (SCON, etc.) has turned to MANU Mode. → Check MODE switch and turn it to AUTO Mode.
	425	Mounted-SIO communication mode (Purpose of use) error	A communication mode error. Example: A communication command (OPEN, CLOS, READ or WRIT) was executed for a channel currently using the RC gateway function. → Communication commands using RS232C connector (S2) cannot be made when RC Gateway is activated in SIO type.
	430	UBM management area check sum error	The flash ROM data is corrupt. → Save the data in the user-data backup memory to the flash ROM again.
	431	UBM data check sum error	The flash ROM data is corrupt. → Save the data in the user-data backup memory to the flash ROM again.
	432	Backup RAM data (UBM) destruction error	The data backed up to the user-data backup memory is corrupt. → Check the battery.
	433	RC gateway minor failure error	A minor failure occurred in the RC gateway. → Reset the error.
	434	RC gateway RC axis communication error	Communication error of RC axis (disconnection) was detected. → Check the cable connection.
	435	RC gateway RC axis operation impossible error	An alarm occurred that makes it impossible for the RC axis to operation. Example: • The RC position number in the command is outside the specified range. (for method to indicate RC position data in RC) → Check the program. • The RC position No., speed, acceleration/deceleration or other item in the command is outside the specified range. (for method to indicate RC position data in X-SEL) → Check the program and RC position. Data shown below is stored for the error detail information as a reference. Info1: RC axis number that an error has occurred Info2: RC axis status (Detail is the same as status obtainable in RCST Command) Info3: RC axis alarm code Refer to the operation manual of RC controller for details.
	436	RC gateway command alarm	An alarm occurred as a result of a gateway command. → Contact IAI.
	437	RC axis number error (SEL)	The RC axis number is not specified correctly. → Check the RC axis number.

Level	No.	Error name	Description/action
Operation cancellation	438	RC position number error (SEL)	The RC position number is not specified correctly. → Check the RC position number.
	439	RC position data use method error (SEL)	An operation cannot be made with the current position data use method. An unavailable SEL command is executed. → Check the program. Check Bits 0 to 11 in I/O Parameter No. 216.
	43A	RC gateway status error	The applicable operation cannot be performed in the current RC gateway status. • Gateway Status : Condition to perform normal operation • PC Software Connection Status : Condition to connect RC PC Software via X-SEL An operation commands from X-SEL such as RC Gateway SEL Command are prohibited. This error will be generated in such cases. The switchover of conditions is to be conducted with "GW" and "RC" buttons in the menu bar of X-SEL PC Software. → When operating RC axes from X-SEL, press "GW" button in X-SEL PC Software.
	43B	RC axis pattern not yet set error	No PC axis pattern has been set. → Issue the RAXS command.
	43C	Servo OFF for RC axis in use error	The servo for the RC axis in use (= target axis of the processing in progress) turned OFF. → Check if there is duplication in the use of RC axis among multiple programs.
	43D	RC axis multiple-use error (SEL)	An attempt was made to get the right of use over an RC axis that is already is in use. → Check if there is duplication in the use of RC axis among multiple programs.
	43E	Error RC axis used error	An attempt was made to use the RC axis currently generating an error. → Reset the error generated by the applicable RC controller. (For information on how to reset the applicable error, refer to the operation manual for each RC controller.)
	43F	RC axis right-of-use acquisition error	No space is available in the RC-axis use management area. → Contact IAI.
	440	Servo-off RC axis used error	An attempt was made to use an RC axis whose servo is currently turned OFF. → Turn ON the servo.
	441	RC axis not yet completed home return error	The RC axis has not yet completed home return. → Perform home return operation. (Execute the RHOM command.)
	442	Inappropriate RC axis position after positioning error	The RC axis position upon completion of RC axis positioning is inappropriate with respect to the position specified in the X-SEL command. (This error occurs only in the RC position data specification mode.)

Level	No.	Error name	Description/action
Cold start	6A0	UBM flash ROM status error	The data in the user-data backup memory is not correctly written to the flash ROM, or the data written to the flash ROM data was written in an old version not compatible with the current flash ROM. → Save the data in the user-data backup memory to the flash ROM again.
	6A1	UBM data structure change error	The data structure in the user-data backup memory was changed. → Initialize the memory.
	6A2	UBM size overflow error	The settings exceed the size of the user-data backup memory. → Reduce the number of RC gateway positions.
	6A3	Excessive UBM functions error	Too many functions are used that access the user-data backup memory. → Limit the number of applicable functions to 8 or less.
	6A4	RC Axis Position Data Construction Definition Error	RC axis position data is abnormal. Example: • The value of other parameter No.501 is greater than the value of other parameter No.503. • An axis outside the range specified in other parameter No.502 is effective.
	6A5	RC axis position data invalid-address error	An attempt was made to access invalid position data of the RC axis. → Contact IAI.
	6A6	RC gateway DPRAM access error (main)	An error occurred due to illegal DPRAM access between the main board and SIO board. → Contact IAI.
	6A7	RC gateway DPRAM access error (mounted SIO)	An error occurred due to illegal DPRAM access between the main board and SIO board. → Contact IAI.
	6A8	RC gateway major failure error	A major failure occurred in the mounted SIO. Example: • All of the effective RC axes are disconnected (not recognized) (due to cable disconnection, wire breakage, etc.) → Check the wiring. • +5 supply switch on the main CPU board is 0V. → *Refer to 2.3. • The mounted SIO could not obtain the DPRAM access right for a specified period of time. → Contact IAI. • A major error, such has a CPU error, occurred in the mounted SIO. → Contact IAI.
	6A9	RC gateway link initialization timeout error	The link with the RC axis could not be initialized within the specified period of timeout. → Check the RC controller power and wiring.
	6AA	RC gateway DPRAM access-right timeout error	The right to access the DPRAM could not be obtained for a specified period of time. → Contact IAI.
	6AB	RC gateway command issue wait timeout error	The gateway command cannot be issued. → Contact IAI.

Level	No.	Error name	Description/action
Cold start	6AC	RC axis control JOB logic error	A logic error occurred in the RC axis control JOB. →Contact IAI.
	6AD	RC axis control command logic error	A logic error occurred in the RC axis control command. →Contact IAI.
	6AE	Mounted-SIO operation mode specification error	An invalid mode was set for the mounted SIO. →Check Bits 12 to 15 in I/O Parameter No. 213.
	6AF	Mounted-SIO RC gateway function selection parameter error	There is an invalid RC gateway parameter setting. →Check Bits 0 to 11 in I/O Parameter No. 216.
	6B0	Mounted-SIO RC gateway logic error	An invalid logic was detected during RC gateway initialization. →Contact IAI.
	6B1	RC gateway not supported error (mounted SIO)	The system configuration makes the RC gateway invalid. →Contact IAI.
	6B2	RC gateway I/O assignment parameter error	[SIO Type] There is an invalid I/O assignment setting regarding the RC gateway. →Check the settings of parameter Nos. 504 and 505. [Fieldbus Type] There is a wrong setting in the node addresses. →Check the settings of parameter Nos. 217, 218, and 432 to 447.
	6B3	RC axis control JOB timeout error	No response was received from the RC axis for a specified period of time. →Check the RC controller power and wiring. →Check that RC controller is in AUTO Mode.
	6B4	RC gateway emergency-stop inconsistency error	The emergency stop status of the X-SEL controller does not match the emergency stop status of the RC controller. →Check the connection. →To stop this error from generating, set I/O parameter No.507 accordingly by referring to 6.1.
	6CA	Fieldbus master parameter error	There is a fault in Fieldbus Master Parameter Error. Example: • There is a wrong setting in the Fieldbus master equipment parameter. →Check the connection I/O No.225. • The total I/O size of the connected slaves has exceeded the upper limit of the Fieldbus master capacity (288byte). →Check the connection I/O parameter No.432 to 447.
	6CB	Fieldbus master link error	There is an error detected in the network connection between the Fieldbus master and all the slaves. Check the status of the monitor LEDs on the front of the board. Example: • Cable not connected properly, wire breakage, communication power not supplied, terminal resistor not applied. • Node address duplication.

Level	No.	Error name	Description/action
Cold start	6CC	RC Gateway simultaneous use error	Both SIO Type and Fieldbus Type turned effective. →They cannot be used at the same time. Check I/O Parameters No. 213, 225 and 431, and make either of SIO Type or Fieldbus Type effective.
	6CD	RC Gateway Use Method Logic Error	It is a RC Gateway use method logic error. → Contact IAI.

6.2.2 Troubleshooting

- Condition: Communication cannot be performed properly!
  Follow the flowchart to identify the applicable cause and check the corresponding action specified in a box.
  ○=YES, ×=NO

The details of each [Check] item accompanied by an asterisk (*) are explained at the end of the flowchart.

Was communication okay before?

○→ Communication disabled with all controllers?

×↓

○→ Communication is disabled with all controllers →
- [1] Faulty host or X-SEL → [Repair the host or X-SEL]
- [2] Open communication cable or poor contact due to vibration, etc. → [Repair the open cable]
- [3] Cable breakage on DeviceNet communication power supply (24V) (Fieldbus type) → [Repair the open cable]

×→ Communication is disabled with a certain controller →
- [1] Faulty controller → [Replace]
- [2] Open communication cable between the controller and junction → [Repair the open cable]
- [3] Detached terminal resistor → [Install the resistor again]
- [4] Invalid setting of controller axis No. (Controllers have been swapped, parameters were initialized, controller software was updated, etc.) → [Check] *3
- [5] Invalid setting of controller baud rate (Controllers have been swapped, parameters were initialized, controller software was updated, etc.) → [Check] *4
- [6] Invalid setting of transmitter activation time (Controllers have been swapped, parameters were initialized, controller software was updated, etc.) → [Check] *4
- [7] Operation mode is set to MANU Mode on the controller. → [Switch over to AUTO Mode]

Communication cable partially movable?

○ The cable is partially movable → Open communication cable → [Repair the open cable]

Power-supply voltage to each device appropriate? (Each RC controller, SIO converter, etc.)

○ Abnormal power-supply voltage → [Correct the power-supply voltage]

Problem occurred after change in surrounding environment? (Change regarding a nearby device, etc.)

○ Problem occurred after a change → Malfunction due to noise
- → [[1] Check if the wiring route of the communication cable has been changed] *5
- [[2] Check if each RC controller is connected to the FG terminal] *5
- [[3] Install a clamp filter in the power supply line]
- [[4] Check the grounding of the control panel] *5

Continue to the next page

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Problem occurred after relocation?

○ Problem occurred after relocation → [1] Open communication cable → [Repair the open cable]
[2] Loose communication cable connector
→ [Check the connection]

Problem occurred after addition of controller?

○ Problem occurred after a controller was added →

1), 2) and 3) are SIO type
5), 7) and 8) are Fieldbus type

[1] Invalid axis number setting of the added controller → [Check] *3
[2] Invalid baud rate setting of the added controller → [Check] *4
[3] Invalid transmitter activation time setting of the added controller
→ [Check] *4
[4] Inappropriate installation position of the terminal resistor
→ Apply a terminal resistor to the junction (for SIO type) or junction tap (for Fieldbus type) that is furthest from the host
[5] Wrong setting in the slave input and output size
→ [Check Section 4.3.1]
[6] Operation mode is set to MANU Mode on the controller.
→ [Switch over to AUTO Mode]
[7] Wrong setting in the node addresses
→ [Check Section 4.3.1 and 4.3.2]
[8] Wrong setting in the fieldbus operation mode
→ [Check Section 4.3.1]

New system started?
(Here, a new system includes a system that has been assembled anew based on an existing design.)

○ ↓

Communication disabled with all controllers?

○ ↓

[Check the connection using RC PC Software for SIO Type] *1

○→

Communication is disabled with all controllers →

[1] Inappropriate wiring of the communication cable between the host and junction → [Check the wiring] *2
[2] Abnormal power supply of the system
→ [Check the power-supply voltage]
↓
Check if a common 0V line is used
→ [Use a common 0V line]
[3] Duplicate controller axis number → [Check] *3
[4] Inconsistent controller baud rate setting → [Check] *4

Continue to the next page

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×→ Communication is disabled with a certain controller →
- [1] Inappropriate wiring of the communication cable between the controller and junction → [Check the wiring] *2
- [2] Abnormal power supply of the system → [Check the power-supply voltage]
- [3] Duplicate controller axis number → [Check] *3
- [4] Inconsistent controller baud rate setting → [Check] *4

[Check with connecting PC software to each controller for Fieldbus Type]

○→ Communication is disabled with all controllers →
- [1] DeviceNet communication power (24V) not supplied → [Power line connection]
- [2] Abnormal power supply of the system → [Check the power-supply voltage]
  ↓
  Check if a common 0V line is used → [Use a common 0V line]
- [3] Wrong setting in the slave input and output size → [Check Section 4.3.1]
- [4] Wrong setting in the node addresses → [Check Section 4.3.1 and 4.3.2]
- [5] Wrong setting in the fieldbus operation mode → [Check Section 4.3.1]

×→ Communication is disabled with a certain controller →
- [1] Terminal resistor not connected → Connect a terminal resistor to the junction tap close to the controller that is furthest from XSEL or communication connector
- [2] Wrong setting in the slave input and output size → [Check Section 4.3.1]
- [3] Operation mode is set to MANU Mode on the controller. → [Switch over to AUTO Mode]
- [4] Wrong setting in the node addresses → [Check Section 4.3.1 and 4.3.2]
- [5] Wrong setting in the fieldbus operation mode → [Check Section 4.3.1]

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Communication occasionally disabled?

○ Malfunction due to noise → [[1] Check if the wiring route of the communication cable has been changed] *5
[[2] Check if each RC controller is connected to the FG terminal] *5
[[3] Install a clamp filter in the power supply line]
[[4] Check the grounding of the control panel]

*1 Disconnect the X-SEL communication cable from J3 (D-sub, 9-pin connector) on the SIO converter and connect the RC PC software (RCM-101-MW: RS232C type or RCM-101-USB: USB type) to J1 (mini-DIN, 8-pin connector) on the SIO converter.

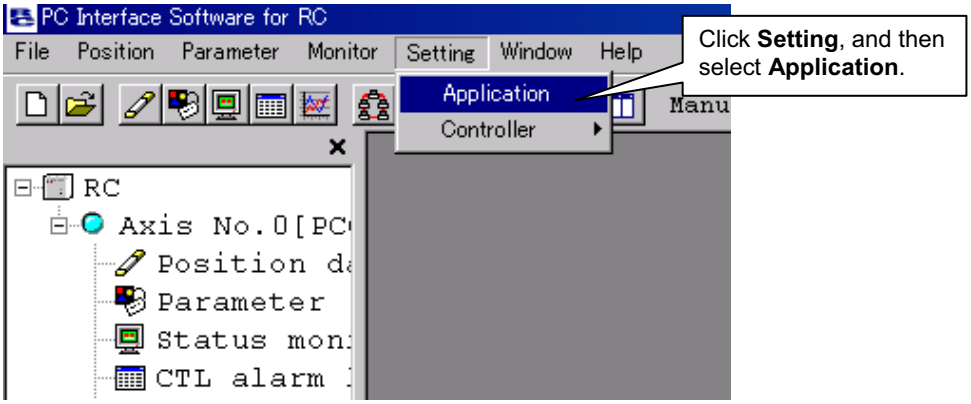
[1] Start the RC PC software.

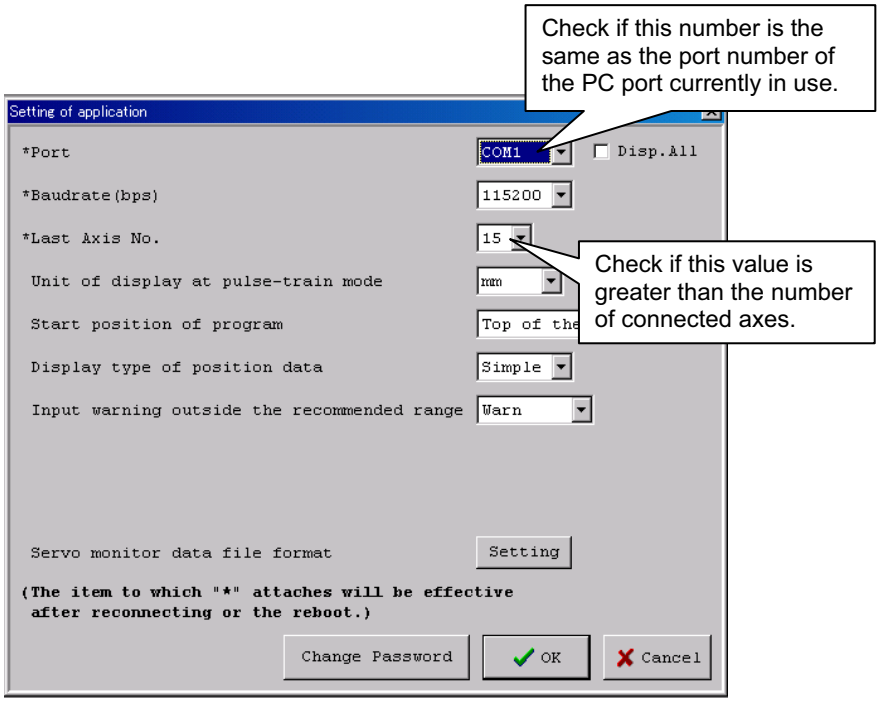
[2] Click **Setting**, and then select **Application**.

Check the following items:

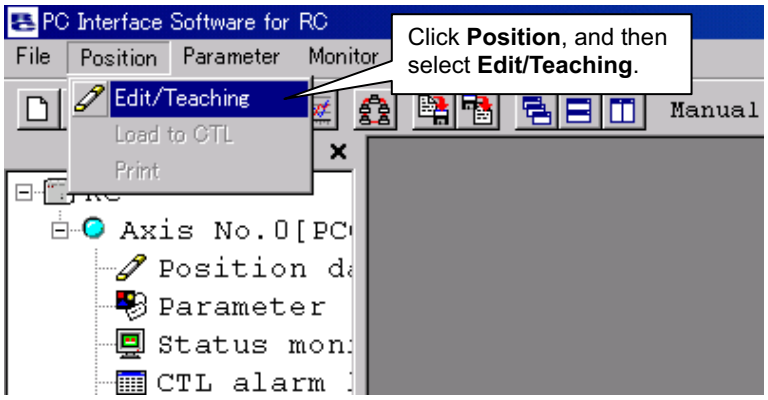
- Does the port shown on the communication setting screen correspond to the port number of the PC port currently in use?
- Isn't the last axis number set to a value greater than the number of connected axes?

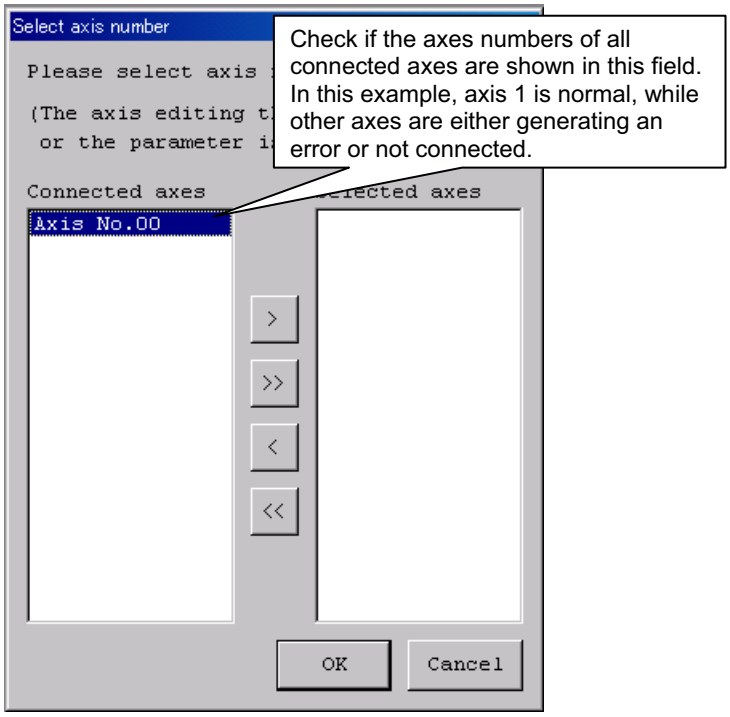
(If any incorrect setting was found, set the item correctly and then restart the RC PC software.)





[3] Click **Position**, and then select **Edit/Teaching**.
The position data edit axis select window appears and the connected axes are listed as shown in the figure below.
Communication is possible with the axes whose axis number is shown in the “Connected axes” field.





[4] Reconnect the power to all connected RC and ROBONET controllers.

- Checking from the teaching pendant
  You can also perform this check using the teaching pendant.
  Select **Connect**, select **TB Operation Mode**, and then select **Teaching 1**. When the “Select axis number” screen appears, check if all of the controllers are shown as connected axis numbers.
  It’s an error if the controller is not displayed on the connected axis numbers.

*2 Check the wiring again by referring chapter of this manual.
*3 Check the axis No. setting again by referring chapter of this manual. (Check for any duplicate axis No..)
*4 Check the baud rate setting again by referring chapter of this manual.
Set the same baud rate (230.4 Kbps) for all controllers including the X-SEL, RC and ROBONET controllers.
*5 Check if the instructions on installation environment and noise prevention in the operation manuals for your X-SEL, RC and ROBONET controllers are observed.
When wiring the communication cable, make sure the cable does not lie parallel with power lines and pulse signal lines.
Check if the communication cable is shielded properly.

If the condition does not improve after checking the applicable items according to the above flowchart, contact IAI.
When contacting IAI, also inform us of the specific phenomenon you are experiencing and the checks performed using the flowchart.

6.3 Adding the Gateway Function to Existing XSEL-P/Q/PX/QX Controllers

If the gateway function is to be added to an existing XSEL controller, the following steps must be followed:
[1] Replace the main CPU board (model: IAMC4802-020).
[2] Update the application software
[3] Obtain a version of X-SEL PC software supporting the gateway.
[4] Add RC Gateway Fieldbus Board if Fieldbus Type is desired

List of software supporting gateway

Software supporting gateway			Version
Controller firmware	Main CPU application (P/Q)	SIO type	V0.68 or later
	Main CPU application (PX/QX)	SIO type	V0.34 or later
	Main CPU core		V0.14 or later
Mounted SIO	Application (RC gateway function support version)		V3.00 or later
PC software	SIO type		V7.02.00.00 or later
Teaching pendant	SEL-T application	SIO type	V1.01 or later

If you wish to add the gateway function to an existing XSEL controller, take note that the controller must be returned to IAI for modification. Contact the IAI sales office near you.

Change History

Revision date	Revision description
2007.11	Released the first edition
2008.09	Second edition
	• Page 2 : Added note stating that no other communication system cannot be used if the general-purposed RS232C Port Connector 2 is used for Gateway Function Correction made to statement in XSEL part for teaching tool
	• Page 15 : Added a wiring drawing for using a RS232C conversion unit to connect only one axis.
	• Page 17 : Changed the system configuration example using SIO converter to one showing the configuration example of an emergency-stop system.
	• Page 28 : Added how the RC axis is affected when X-SEL inputs are set to functions other than “general-purpose input.”
	• Pages 43, 44 : Added the relationships of existing SEL commands and the RC gateway function.
2009.04	Third edition
	• Page 7 : Added an explanation of the additional function relating to the “6B4” error. (applicable version also added)
	• Page 42 : Pages correction
	• Pages 63 to 65 : Added a function
	• Page 75 : Added a function to I/O parameter No.507
	• Page 80 : Added an explanation of the additional function relating to the “6B4” error.
2010.06	Fourth edition : “Before Use” added in the first page after the front cover is opened. : “Safety Guide” added in the first page after the contents pages. : “Change History” added in the last page : Back cover updated
2012.09	Fifth edition : Fieldbus Type added : XSEL-R/S/RX(D)/SX(D) added
2013.07	Sixth edition : Note added to state direct drive motor type actuator cannot be connected to SCON-CA
2015.03	6B edition : Treatment for fact that XSEL-P/Q/PX/QX types cannot be connected for Fieldbus Type Related pages (9, 11, 13, 17, 19, 23, 24, 42, 44, 145)

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