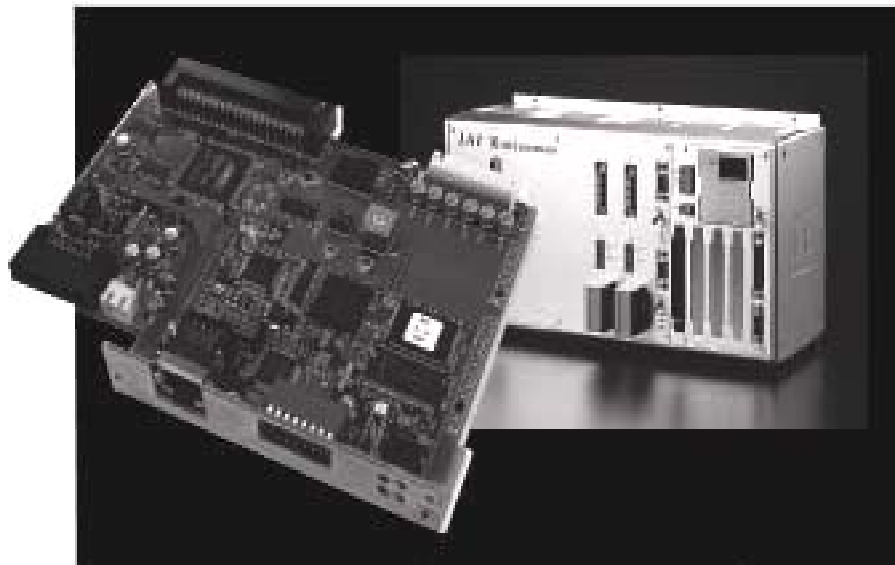


X-SEL

Ethernet

Operation Manual First Edition



IAI America, Inc.

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1. Overview

This option allows the X-SEL controller to perform control in an open network environment using the Ethernet infrastructure, the de-facto standard and most common form of communication media for linking PCs and host computers.

(1) Remote I/O control (Modbus/TCP)

The X-SEL controller supports remote I/O control (a maximum of 256 input points and 256 output points) via Modbus/TCP.

Modbus/TCP is an Ethernet application of the Modbus protocol used in serial communication.

(2) Message communication

The communication capabilities supported by the RS232C communication function of the X-SEL controller can be implemented via Ethernet.

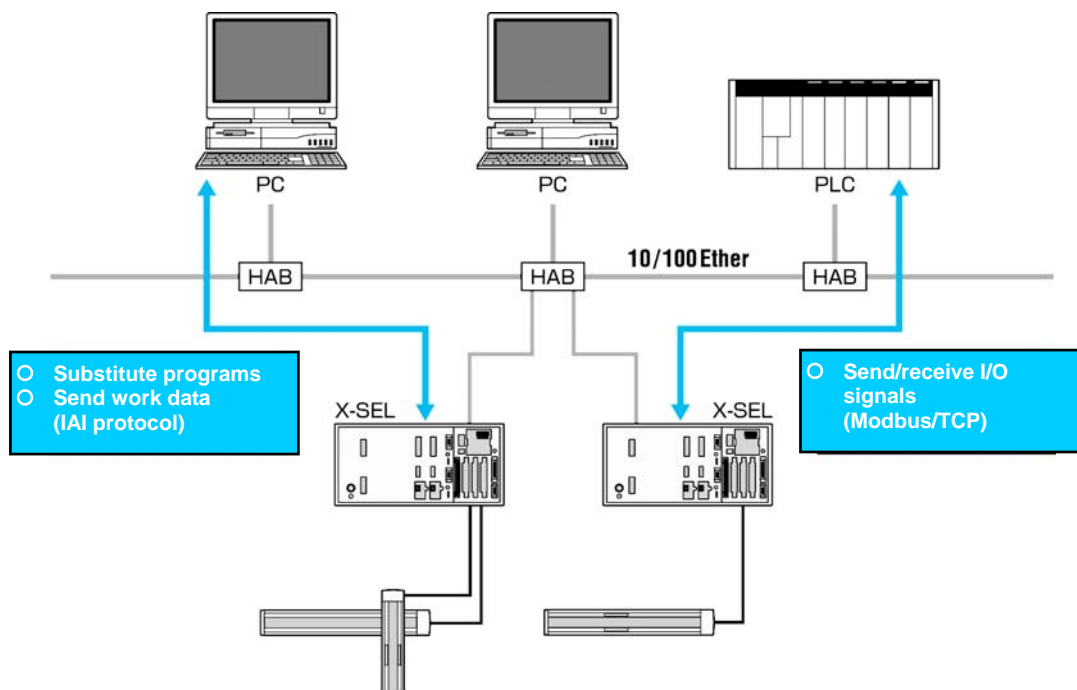
• IAI protocol B/TCP

IAI protocol B for serial communication is supported.

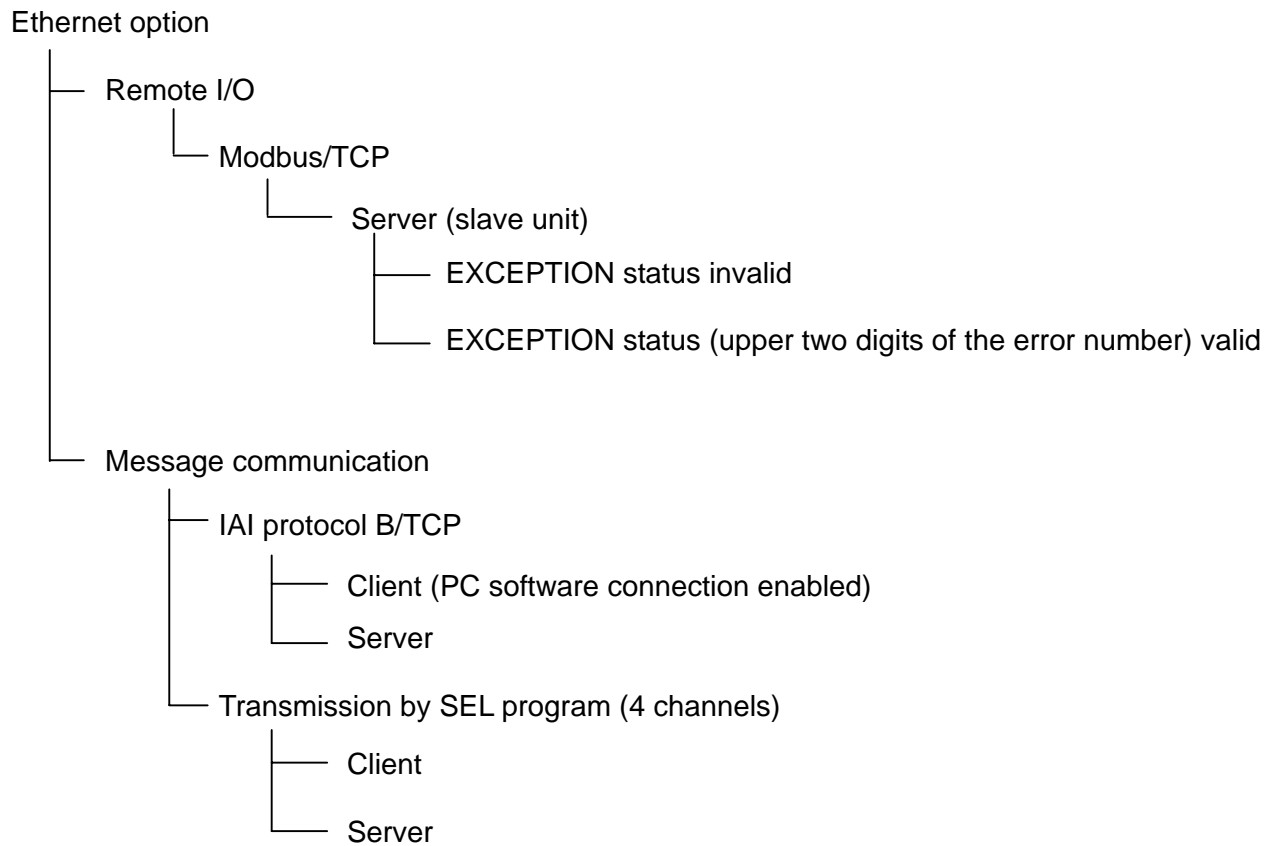
The X-SEL controller can be connected to PC software.

• Transmission by SEL program (4 channels)

Four channels of ASCII-based, delimiter-controlled communication are supported, using a set of transmission commands in a system roughly equivalent to that used in the X-SEL controller's serial communication.



A hierarchy of the functions provided by the X-SEL Ethernet option is shown below.
Functions are selected by parameters. Additionally, the network environment parameters must be set.



2. Interface Specifications

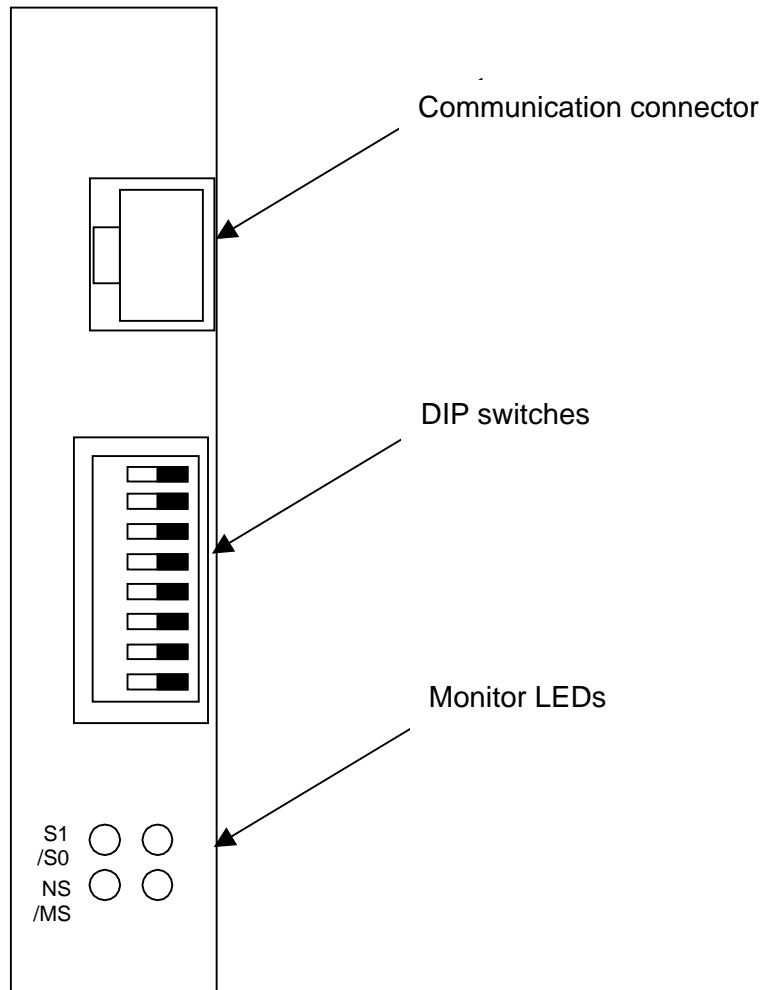
Item	Specification			
Network specification	10BASE-T/100BASE-T (Auto-negotiation)			
Communication standard	IEEE802.3			
Communication speed	10/100 Mbps (Auto-negotiation)			
Protocol	Open Modbus/TCP (Remote I/O)		TCP/IP message communication 1. IAI protocol B/TCP 2. Transmission by SEL program (4 channels)	
	Supported commands	Class 1		Read Coil
		Class 1		Read Input Discretes
		Class 0		Read multiple registers
		Class 1		Read Input registers
		Class 1		Write Coils
		Class 1		Write Single register
		Class 1		Read Exception status
		Class 2		Force multiple Coils
		Class 0		Force multiple registers
		Class 2		Mask Write register
		Class 2		Read/Witer registers
Connector	RJ-45			
Cable	Category 5 UTP twisted cable (see note)			

(Note) Use a straight or crossed Ethernet cable according to the connection environment.
[Normal]

Controller ⇔ HUB:	Straight
Controller ⇔ Controller:	Crossed
Controller ⇔ PC:	Crossed

3. Interface Board

3.1 Name of Each Part




(Note) The DIP switches are used to set the least significant byte of the IP address. With the X-SEL system, however, the IP address is set by a controller parameter without the use of DIP switches.
Set all switches to OFF. (Setting the switches in any other pattern will have no effect.)

3.2 Monitor LED Indications

The operating condition of the interface board and its connection status to Ethernet can be checked via the four LEDs provided on the front panel of the interface board.

LED	Color	Status	Definition	Explanation (factor)	
				Open Modbus/TCP (Remote I/O)	TCP/IP Message Communication
S0 (LINK)	-	Unlit	Not linked	• The system is not connected to Ethernet.	
	Green	Lit	Linked	• The system is connected to Ethernet.	
S1 (TRX)	-	Unlit	No packet	• TCP/IP packets are not being transmitted.	
	Green	Lit	Packet detected	• TCP/IP packets are being transmitted.	
MS	-	Unlit	No power supply	<ul style="list-style-type: none"> Power is not supplied to the board from the X-SEL system. Interface board initialization is not complete. The interface board is being reset. The UTP cable is not connected. 	
	Green	Lit	Default IP operation	• IP address is not specified from the controller during operation. (As a rule, this condition should not occur.)	
		Blinking at 1 Hz	Normal operation	• The server has started normally via the controller.	
	Red	Lit	Duplicate IPs	• Duplicate IP addresses were detected on Ethernet.	
		Blinking	Catastrophic failure	<ul style="list-style-type: none"> Module MAC address error (LED blinking at 1 Hz) Network definition read error (LED blinking at 2 Hz) Other module error (LED blinking at 4 Hz) 	
NS	-	Unlit	No Modbus/TCP connection	• The Modbus/TCP connection has not been established.	• The LED will not be lit in the case of TCP/IP message communication.
	Green	Blinking	Modbus/TCP connection established	<ul style="list-style-type: none"> A Modbus/TCP connection has been established. (The blinking frequency indicates the number of connections: 1 Hz → 1 connection, 2 Hz → 2 connections.) 	—

The sections in  represent indications during normal operation.

4. Modbus/TCP

4.1 Setup of Ethernet Environment

The X-SEL controller provides IP addresses and other network-definition areas in its I/O parameters for control of Modbus/TCP operation.

Set the necessary parameters according to the network environment before connecting to the network. Establishing a connection without setting the parameters may disable normal communication to and from other devices on the network.

[I/O parameters]

No.	Parameter name	Setting	Input range	Remarks
129	Network attribute 10	1H	0H~FFFFFFFFH	Ethernet operation requirement Bits 0 to 3: Modbus/TCP (remote I/O) 0: Do not use 1: Use (EXCEPTION status invalid) 2: Use (EXCEPTION status valid) Bits 4 to 7: TCP/IP message communication (0: Do not use, 1: Use) Bits 8 to 31: Not used
130	Own MAC address (H)	0030H	Reference value (HEX)	Only the lower two bytes are valid. (This parameter is not settable.)
131	Own MAC address (L)	11H	Reference value (HEX)	(This parameter is not settable.)
132	Own IP address (H)	192	1~255	* Setting of "0" and "127" is prohibited.
133	Own IP address (MH)	168	0~255	
134	Own IP address (ML)	0	0~255	
135	Own IP address (L)	1	1~254	* Setting of "0" and "255" is prohibited.
136	Subnet mask (H)	255	0~255	
137	Subnet mask (MH)	255	0~255	
138	Subnet mask (ML)	255	0~255	
139	Subnet mask (L)	0	0~255	
140	Default gateway (H)	0	0~255	
141	Default gateway (MH)	0	0~255	
142	Default gateway (ML)	0	0~255	
143	Default gateway (L)	0	0~255	

- (Note)
1. Always set I/O parameter No. 129 to "1" to perform Modbus/TCP operation.
 2. The Modbus/TCP port number on the controller side is fixed at "502."

4.2 Remote I/O Setup Procedure

The system is configured only with the remote I/Os of Modbus/TCP, with the I/O port numbers being specified according to fixed port assignment.

4.2.1 Configuration with Modbus/TCP Only (No expansion I/O board)

The following settings are applicable when the system is configured only with the remote I/Os of Modbus/TCP and the standard I/O ports are mapped on Modbus/TCP without connections to any external devices via expansion I/O boards.

[I/O parameters]

No.	Parameter name	Setting	Input range	Remarks
1	I/O port assignment type	0	0~20	0: Fixed assignment I/O numbers are specified by parameters. 1: Automatic assignment (priority sequence: slot 1~)
2	Standard I/O input-port start number (I/O1)	0	-1~599	0 + (Multiple of 8) (A negative value is invalid.) 0: Assign Modbus/TCP remote DIs from No. 0.
3	Standard I/O output-port start number (I/O1)	300	-1~599	300 + (Multiple of 8) (A negative value is invalid.) 300: Assign Modbus/TCP remote DOs from No. 300.
4	Expanded I/O1 input-port start number based on fixed assignment (I/O2)	-1	-1~599	0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O1 DI
5	Expanded I/O1 output-port start number based on fixed assignment (I/O2)	-1	-1~599	300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O1 DO
6	Expanded I/O2 input-port start number based on fixed assignment (I/O3)	-1	-1~599	0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DI
7	Expanded I/O2 output-port start number based on fixed assignment (I/O3)	-1	-1~599	300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DO
8	Expanded I/O3 input-port start number based on fixed assignment (I/O4)	-1	-1~599	0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DI
9	Expanded I/O3 output-port start number based on fixed assignment (I/O3)	-1	-1~599	300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DO
10	Standard I/O error monitor (I/O1)	1	0~5	0: Do not monitor 1: Monitor 2: Monitor (Do not monitor 24 V I/O power error) 3: Monitor (Monitor 24 V I/O power error only)
11	Expanded I/O1 error monitor (I/O2)	0	0~5	
12	Expanded I/O2 error monitor (I/O3)	0	0~5	
13	Expanded I/O3 error monitor (I/O4)	0	0~5	
14	Number of ports using network I/F-card remote input	n	0~256	Specify the Modbus/TCP remote DI bits by a multiple of 8 ($8 \leq n \leq 256$).
15	Number of ports using network I/F-card remote output	m	0~256	Specify the Modbus/TCP remote DO bits by a multiple of 8 ($8 \leq n \leq 256$).

(Note) When word registers are to be used in Modbus/TCP, set the remote I/O head numbers (I/O port start numbers: I/O parameters 2 and 3) on a 16-bit boundary, and also set the remote I/O bits (numbers of ports using input/output: I/O parameters 14 and 15) as a multiple of 16.

4.2.2 Combined Use of Expansion I/O Board (Modbus/TCP + Expanded I/O)

The following settings are applicable when the standard I/O ports are mapped on Modbus/TCP (input-port start No. 0 and output-port start No. 300), while the expansion I/O boards are used with port assignments starting with input-port start No. 200 and output-port start No. 500.

[I/O parameters]

No.	Parameter name	Setting	Input range	Remarks
1	I/O port assignment type	0	0~20	0: Fixed assignment I/O numbers are specified by parameters. 1: Automatic assignment (priority sequence: slot 1~)
2	Standard I/O input-port start number (I/O1)	0	-1~599	0 + (Multiple of 8) (A negative value is invalid.) 0: Assign Modbus/TCP remote DIs from No. 0.
3	Standard I/O output-port start number (I/O1)	300	-1~599	300 + (Multiple of 8) (A negative value is invalid.) 300: Assign Modbus/TCP remote DOs from No. 300.
4	Expanded I/O1 input-port start number based on fixed assignment (I/O2)	200	-1~599	0 + (Multiple of 8) (A negative value is invalid.) Assign DIs of expanded I/O1 from No. 200.
5	Expanded I/O1 output-port start number based on fixed assignment (I/O2)	500	-1~599	0 + (Multiple of 8) (A negative value is invalid.) Assign DOs of expanded I/O1 from No. 500.
6	Expanded I/O2 input-port start number based on fixed assignment (I/O3)	-1	-1~599	0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DI
7	Expanded I/O2 output-port start number based on fixed assignment (I/O3)	-1	-1~599	300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DO
8	Expanded I/O3 input-port start number based on fixed assignment (I/O4)	-1	-1~599	0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DI
9	Expanded I/O3 output-port start number based on fixed assignment (I/O3)	-1	-1~599	300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DO
10	Standard I/O error monitor (I/O1)	1	0~5	0: Do not monitor 1: Monitor 2: Monitor (Do not monitor 24 V I/O power error) 3: Monitor (Monitor 24 V I/O power error only)
11	Expanded I/O1 error monitor (I/O2)	1	0~5	
12	Expanded I/O2 error monitor (I/O3)	0	0~5	
13	Expanded I/O3 error monitor (I/O4)	0	0~5	
14	Number of ports using network I/F-card remote input	n	0~256	Specify the Modbus/TCP remote DI bits by a multiple of 8 ($8 \leq n \leq 256$).
15	Number of ports using network I/F-card remote output	m	0~256	Specify the Modbus/TCP remote DO bits by a multiple of 8 ($8 \leq n \leq 256$).

- (Note) 1. Set the parameters so that the total number of DIs and that of DOs, respectively, will not exceed 300.
2. The last DI number should be 299 or below, while the last DO number should be 599 or below.
3. When word registers are to be used in Modbus/TCP, set the remote I/O head numbers (I/O port start numbers: I/O parameters 2 and 3) on a 16-bit boundary, and also set the remote I/O bits (numbers of ports using input/output: I/O parameters 14 and 15) as a multiple of 16.

4.3 Setup Procedure for Exception Status Support

The X-SEL Ethernet option supports the function that notifies the host of an error condition (the upper two digits of the error number) of the X-SEL controller using an exception code stored in Modbus/TCP.

By setting bits 0 to 3 of I/O parameter No. 129 to "2" (HEX), any error occurring in the X-SEL controller can be indicated to the host controller via Modbus/TCP.

The EXCEPTION status stores the upper two digits (one byte) of the system error number (consisting of three digits). When this EXCEPTION status is used, provide measures appropriate for the error level by referring to the descriptions in the "Error Level Control" section of the operation manual for the X-SEL controller.

(Note) The system error number cannot be specified from the EXCEPTION status (two digits). (This is because the error number consists of three digits.)

4.4 Correspondence of Modbus/TCP Address and X-SEL I/O

Modbus/TCP can address the same object using either bit addressing or word addressing.

The DI area (bit numbers from No. 0 up to No. 299 can be defined) of the X-SEL controller is mapped in the word address 0x400 (1024) (coil and holding register as viewed from the PC side) under Modbus/TCP.

The DO area (bit numbers from No. 300 up to No. 599 can be defined) of the X-SEL controller is mapped in the word address 0x000 (0) (input discrete and input register as viewed from the PC side) under Modbus/TCP.

Since the DI addressing in the X-SEL controller and the addressing via Modbus are different, it is important to note the following two points:

1. The number order of one byte in the byte boundary is reversed.

(Example)

X-SEL DI7 → Modbus bit address 1 (Modbus/TCP bit address 0)
 DI0 → Modbus bit address 8 (Modbus/TCP bit address 7)

2. When register access is executed from the X-SEL controller using an IN, INB, OUT or OUTB command, the upper and lower bytes will be reversed.

(Example)

Writing 0x1234 to 16 bits from X-SEL DO300
 → Modbus input register 0 (Modbus/TCP bit address 0)
 DI0 → Modbus bit address 8 (Modbus/TCP bit address 7)

Both the Motorola and Intel formats can be supported using an FMIO command. (Refer to Chapter 2, "Explanation of Commands," in the operation manual for the X-SEL controller.) The FMIO command changes the endian in IN/OUT commands. Executing input or output after an FMIO command execution with the format type set to "1" will align the byte order with Modbus/TCP. Each FMIO command is valid only with respect to the task for which the command is executed.

A table of correspondence is shown on the next page.

4.4.1 Little Endian Operation

The default endian mode of DI/DO operation commands of the X-SEL controller is the little endian. In the little endian mode, the remote I/O field accessed via word operation with an IN, INB, OUT or OUTB command of the X-SEL controller will have its upper and lower bytes reversed in relation to the X-SEL data if the same field is word-accessed via Modbus/TCP.

The following examples are based on 256-bit assignments from the head DO number (= 300) in X-SEL as Modbus/TCP remote I/Os.

(Note) Remote I/Os can be defined only as consecutive numbers.

The assignable head number must satisfy: $300 + 8n$ ($31 \geq n \geq 0$).

The total number of assignable bits must satisfy: $m + n < 32$ & $32 \geq m$, where m represents the number of assigned remote I/O bytes.

[Modbus/TCP input areas (assignment of X-SEL DO area 300 onward)]

Address	BIT7 (MSB)	6	5	4	3	2	1	0 (LSB)
X-SEL DO	307	306	305	304	303	302	301	300
Modbus/TCP bit address	0	1	2	3	4	5	6	7
Modbus/TCP word address	0 Lower byte							
Modbus input status	10001	10002	10003	10004	10005	10006	10007	10008
Modbus input register	30001 Lower byte							
X-SEL DO	315	314	313	312	311	310	309	308
Modbus/TCP bit address	8	9	10	11	12	13	14	15
Modbus/TCP word address	0 Upper byte							
Modbus input status	10009	10010	10011	10012	10013	10014	10015	10016
Modbus input register	30001 Upper byte							
:								
:								
X-SEL DO	547	546	545	544	543	542	541	540
Modbus/TCP bit address	240	241	242	243	244	245	246	247
Modbus/TCP word address	15 Lower byte							
Modbus input status	10248	10249	10250	10251	10252	10253	10254	10255
Modbus input register	30016 Lower byte							
X-SEL DO	555	554	553	552	551	550	549	548
Modbus/TCP bit address	15 Upper byte							
Modbus/TCP word address	248	249	250	251	252	253	254	255
Modbus input status	10249	10250	10251	10252	10253	10254	10255	10256
Modbus input register	30016 Upper byte							
	Cannot be used							

Input status:	input discretes	single bit, provided by an I/O system, read-only
Output coil:	output discretes	single bit, alterable by an application program, read-write
Input register:	input registers	16-bit quantity, provided by an I/O system, read-only
Output register:	output registers	16-bit quantity, alterable by an application program, read-write

The output areas are described on the next page.

[Modbus/TCP output areas (assignment of X-SEL DI area 300 onward), FMIO = 0]

Address	BIT7 (MSB)	6	5	4	3	2	1	0 (LSB)
X-SEL DI	7	6	5	4	3	2	1	0
Modbus/TCP bit address	16384	16385	16386	16387	16388	16389	16390	16391
Modbus/TCP word address	1024 Lower byte							
Modbus output coil	1	2	3	4	5	6	7	8
Modbus hold register	40001 Lower byte							
X-SEL DI	15	14	13	12	11	10	9	8
Modbus/TCP bit address	16392	16393	16394	16395	16396	16397	16398	16399
Modbus/TCP word address	1024 Upper byte							
Modbus output coil	9	10	11	12	13	14	15	16
Modbus hold register	40001 Upper byte							
:								
:								
X-SEL DI	247	246	245	244	243	242	241	240
Modbus/TCP bit address	16624	16625	16626	16627	16628	16629	16630	16631
Modbus/TCP word address	1039 Lower byte							
Modbus output coil	241	242	243	244	245	246	247	248
Modbus hold register	40016 Lower byte							
X-SEL DI	255	254	253	252	251	250	249	248
Modbus/TCP bit address	16632	16633	16634	16635	16636	16637	16638	16639
Modbus/TCP word address	1039 Upper byte							
Modbus output coil	249	250	251	252	253	254	255	256
Modbus hold register	40016 Upper byte							
	Cannot be used							

4.4.2 Big Endian Operation

To align the word handling between Modbus/TCP and the X-SEL controller, the I/O operation mode must be set to the big endian with an FMIO command before executing a DI/DO operation command in any X-SEL task.

With this setting the remote I/O field accessed via word operation with an IN, INB, OUT or OUTB command of the X-SEL controller can be handled as the same data when the same field is word-accessed via Modbus/TCP.

The following examples are based on 256-bit assignments from the head DO number (= 300) in X-SEL as Modbus/TCP remote I/Os.

The only difference from the examples shown in 4.4.1, "Little Endian Operation," is the byte order of the word registers.

(Note) Remote I/Os can be defined only as consecutive numbers.

The assignable head number must satisfy: $300 + 8n$ ($31 \geq n \geq 0$).

The total number of assignable bits must satisfy: $m + n < 32$ & $32 \geq m$, where m represents the number of assigned remote I/O bytes.

[Modbus/TCP input areas (assignment of X-SEL DO area 300 onward)]

Address	BIT7 (MSB)	6	5	4	3	2	1	0 (LSB)
X-SEL DO	307	306	305	304	303	302	301	300
Modbus/TCP bit address	0	1	2	3	4	5	6	7
Modbus/TCP word address	0 Upper byte							
Modbus input status	10001	10002	10003	10004	10005	10006	10007	10008
Modbus input register	30001 Upper byte							
X-SEL DO	315	314	313	312	311	310	309	308
Modbus/TCP bit address	8	9	10	11	12	13	14	15
Modbus/TCP word address	0 Lower byte							
Modbus input status	10009	10010	10011	10012	10013	10014	10015	10016
Modbus input register	30001 Lower byte							
:								
:								
X-SEL DO	547	546	545	544	543	542	541	540
Modbus/TCP bit address	240	241	242	243	244	245	246	247
Modbus/TCP word address	15 Upper byte							
Modbus input status	10248	10249	10250	10251	10252	10253	10254	10255
Modbus input register	30016 Upper byte							
X-SEL DO	555	554	553	552	551	550	549	548
Modbus/TCP bit address	15 Lower byte							
Modbus/TCP word address	248	249	250	251	252	253	254	255
Modbus input status	10249	10250	10251	10252	10253	10254	10255	10256
Modbus input register	30016 Lower byte							
	Cannot be used							

Input status:	input discretes	single bit, provided by an I/O system, read-only
Output coil:	output discretes	single bit, alterable by an application program, read-write
Input register:	input registers	16-bit quantity, provided by an I/O system, read-only
Output register:	output registers	16-bit quantity, alterable by an application program, read-write

The output areas are described on the next page.

[Modbus/TCP output areas (assignment of X-SEL DI area 300 onward), FMIO = 0]

Address	BIT7 (MSB)	6	5	4	3	2	1	0 (LSB)
X-SEL DI	7	6	5	4	3	2	1	0
Modbus/TCP bit address	16384	16385	16386	16387	16388	16389	16390	16391
Modbus/TCP word address	1024 Upper byte							
Modbus output coil	1	2	3	4	5	6	7	8
Modbus hold register	40001 Upper byte							
X-SEL DI	15	14	13	12	11	10	9	8
Modbus/TCP bit address	16392	16393	16394	16395	16396	16397	16398	16399
Modbus/TCP word address	1024 Lower byte							
Modbus output coil	9	10	11	12	13	14	15	16
Modbus hold register	40001 Lower byte							
:								
:								
X-SEL DI	247	246	245	244	243	242	241	240
Modbus/TCP bit address	16624	16625	16626	16627	16628	16629	16630	16631
Modbus/TCP word address	1039 Upper byte							
Modbus output coil	241	242	243	244	245	246	247	248
Modbus hold register	40016 Upper byte							
X-SEL DI	255	254	253	252	251	250	249	248
Modbus/TCP bit address	16632	16633	16634	16635	16636	16637	16638	16639
Modbus/TCP word address	1039 Lower byte							
Modbus output coil	249	250	251	252	253	254	255	256
Modbus hold register	40016 Lower byte							
	Cannot be used							

4.5 Installation to a Modbus/TCP System

No special tools are required for operation of the X-SEL controller via Modbus/TCP on Ethernet. Simply set the controller parameters, connect the Ethernet cable and turn on the power. The Modbus/TCP server in the controller will be started, enabling remote I/O control.

The Ethernet port number of Modbus/TCP is fixed at "502."

Modbus/TCP connection is established by specifying IP address port 502 for the X-SEL controller via an OPC (OLE for process control) server or other Modbus/TCP software.

To check whether the network setup of the controller is correct, use a "ping" command (the command for checking the status of communication on the IP level of TCP/IP using an MS-DOS prompt (or command prompt in Windows NT/2000)) or similar command.

5. IAI Protocol B/TCP

This protocol uses TCP packets embedded with the message format of IAI protocol B for serial communication. The controller supports the slaves under this protocol, regardless of the connection method (client or server). (The connected device always becomes the protocol master.)

5.1 Setup of Ethernet Environment

The X-SEL controller provides IP addresses and other network-definition areas in its I/O parameters for control of the IAI protocol B/TCP operation.

To select the IAI protocol B/TCP function:

Set "I/O parameter No. 129: Network attribute 10, bits 4 to 7" to "1: Use TCP/IP message communication."

Then, set "I/O parameter No. 124: Network attribute 5, bits 0 to 3 (MANU mode) or bits 4 to 7 (AUTO mode)" to "1: Client (Assign own port number automatically)" or "3: Server (Specify own port number)."

Set the necessary parameters according to the network environment before connecting to the network. Establishing a connection without setting the parameters may disable normal communication to and from other devices on the network.

[I/O parameters]

No.	Parameter name	Setting	Input range	Remarks
124	Network attribute 5	(MANU mode) 1H or 3H (AUTO mode) 10H or 30H	0H~FFFFFFFH	<p>Ethernet TCP/IP message communication attribute</p> <p>Ethernet client/server type</p> <p>(0: Do not use 1: Client (Assign own port number automatically) 2: Client (Specify own port number) → This setting is not recommended in view of the associated device restrictions, such as a forced-error detection if the port is opened for approximately 10 minutes in a condition where a close response cannot be confirmed due to a power failure in the connected device, etc.) 3: Server (Specify own port number) * Note: Number of clients that can be connected to one server-port channel simultaneously = 1</p> <p>Bits 0 to 3: IAI protocol B/TCP (MANU mode) * PC software connection is enabled in the client mode only.</p> <p>Bits 4 to 7: IAI protocol B/TCP (AUTO mode) * PC software connection is enabled in the client mode only.</p> <p>Bits 8 to 11: User-open channel 31 Bits 12 to 15: User-open channel 32 Bits 16 to 19: User-open channel 33 Bits 20 to 23: User-open channel 34</p> <p>* IAI protocol B/TCP MANU/AUTO The connection will be cut off briefly during switching between the MANU and AUTO modes, if the parameter settings of "own port number," "client/server type," "IP address of connection destination" and "port number of connection destination" do not fully correspond between the two modes.</p>
⋮	⋮	⋮	⋮	⋮
129	Network attribute 10	10H	0H~FFFFFFFH	<p>Ethernet operation requirement</p> <p>Bits 0 to 3: Modbus/TCP (remote I/O) 0: Do not use 1: Use (EXCEPTION status invalid) 2: Use (EXCEPTION status valid)</p> <p>Bits 4 to 7: TCP/IP message communication 0: Do not use 1: Use</p> <p>Bits 8 to 31: Not used</p>
130	Own MAC address (H)	0030H	Reference value (HEX)	Only the lower two bytes are valid. (This parameter is not settable.)
131	Own MAC address (L)	11H	Reference value (HEX)	(This parameter is not settable.)
132	Own IP address (H)	192	1~255	* Setting of "0" and "127" is prohibited.
133	Own IP address (MH)	168	0~255	
134	Own IP address (ML)	0	0~255	
135	Own IP address (L)	1	1~254	* Setting of "0" and "255" is prohibited.
136	Subnet mask (H)	255	0~255	
137	Subnet mask (MH)	255	0~255	
138	Subnet mask (ML)	255	0~255	
139	Subnet mask (L)	0	0~255	

140	Default gateway (H)	0	0~255	
141	Default gateway (MH)	0	0~255	
142	Default gateway (ML)	0	0~255	
143	Default gateway (L)	0	0~255	
⋮	⋮	⋮	⋮	⋮
149	IAI protocol B/TCP: IP address of connection destination (MANU mode) (H)	192	1~255	* Setting of "0" and "127" is prohibited.
150	IAI protocol B/TCP: IP address of connection destination (MANU mode) (MH)	168	0~255	
151	IAI protocol B/TCP: IP address of connection destination (MANU mode) (ML)	0	0~255	
152	IAI protocol B/TCP: IP address of connection destination (MANU mode) (L)	100	1~254	* Setting of "0" and "255" is prohibited.
153	IAI protocol B/TCP: Port number of connection destination (MANU mode)	64611	0~65535	Mode setting in parameter No. 124: * In the server mode "0" can be set. 0 = Ignore port number of connection destination (Only the IP address is checked.) * In the client mode "0" cannot be set.
154	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (H)	192	1~255	* Setting of "0" and "127" is prohibited.
155	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (MH)	168	0~255	
156	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (ML)	0	0~255	
157	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (L)	100	1~254	* Setting of "0" and "255" is prohibited.
158	IAI protocol B/TCP: Port number of connection destination (AUTO mode)	64611	0~65535	Mode setting in parameter No. 124: * In the server mode "0" can be set. 0 = Ignore port number of connection destination (Only the IP address is checked.) * In the client mode "0" cannot be set.

- (Note) 1. To connect the controller to IAI's PC software, set the parameter to "1: Client (Assign own port number automatically)."
2. IAI's PC software will detect "Error No. ECF: Socket error (PC)" if the controller-side port is disabled due to a mode change on the controller side, reception of an IAI protocol serial-communication message or other reason while the controller is connected to the PC software. This does not indicate abnormal status.
3. The connection will be cut off briefly during switching between the MANU and AUTO modes under IAI protocol B/TCP, if the parameter settings of "own port number," "client/server type," "IP address of connection destination" and "port number of connection destination" do not fully correspond between the two modes.
4. One of the two ports will be used for connection, depending on the MANU/AUTO mode.

5. The port will be enabled at the following intervals:
 - When the initialization after power ON reset is complete
 - When no IAI protocol serial-communication message has been received for approximately five seconds after the completion of controller initialization
6. The port will be disabled at the following intervals:
 - Upon reception of an IAI protocol serial-communication message (serial communication having priority)
 - Upon mode change
 - Upon software reset
7. If the controller is used as a client, a connection retry will be initiated within approximately two seconds after the recognition of a connection failure (refused, timed out, failed, etc.).
8. For details on the message format, refer to the attached "X-SEL (Cartesian/IX SCARA) Serial Communication Specification (Format B)."

[Example of operation check procedure when the controller is used as a server]

Set the port number for the host computer and utilize the telnet tool included with your windows operating system to communicate to the host controller. Also, set the port on the X-SEL controller side to match by setting I/O parameter #144 (MANU mode) or No. 159 (AUTO mode). Then perform data transfer in accordance with the format defined in the Serial Communication in order to test communication.

The following is an example of a simple check using "telnet":

"!992001234567890@@" + Enter = Send a "test call" → Receive a response, "#99200123456789034"

CR/LF is appended at the end of the sending message by "telnet."

Using "telnet" with "Local echo enabled" will make the operation easier.

5.2 Ethernet Connection of X-SEL PC Software

5.2.1 Software Versions Supporting This Function

- (1) PC software V2.1.0.0 or later (Japanese version)
V2.1.0.0E or later (English version)

5.2.2 Function

- (1) Connection confirmation
 - a. Selecting the communication port
Select "Ethernet" in the port name list on the Connection Confirmation screen.
* Refer to (3) of 5.2.3, "Items to Note," for details.

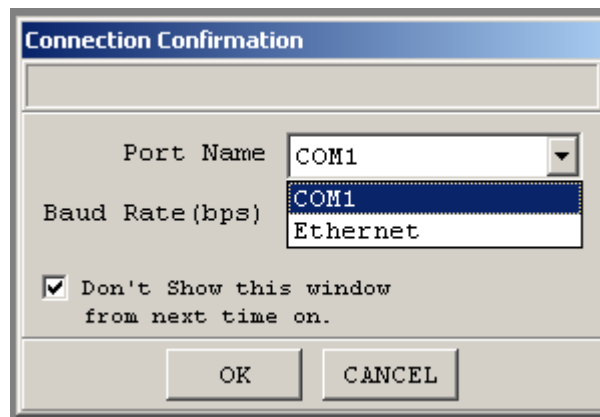


Figure 1

- b. Entering the own port number
Selecting "Ethernet" will change the field label "Baud Rate (bps)" to "Port No."

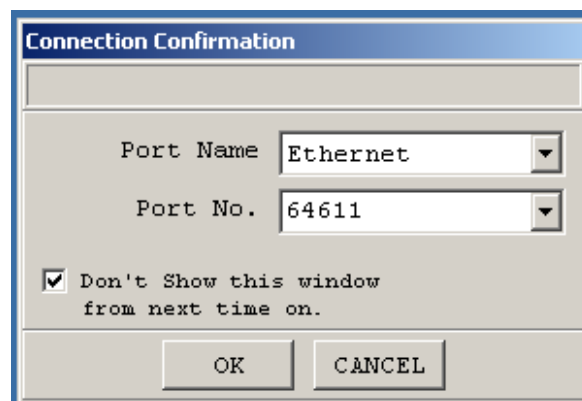


Figure 2

Enter the waiting port number of the PC software in this field.
The number should match the port number specified in I/O parameter No. 153 (MANU mode) or No. 158 (AUTO mode).

* Enter a number between 1025 and 65535 not already used in another application.

- c. Selecting the controller
Entering the port number and clicking the [OK] button switches the display to the Select Controller screen.

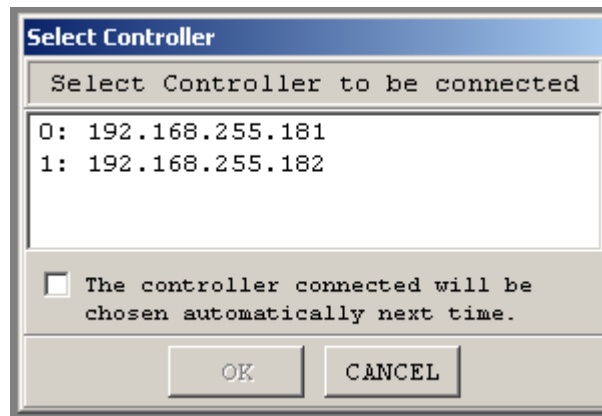


Figure 3

Each time a connection is established from a controller, the IP address of the connecting controller is added to the list. Select the IP address of the controller with which you want to communicate, and then click the [OK] button. Communication will be established with the selected controller and the application will start in the online mode. Clicking the [CANCEL] button will activate the offline mode. (Even after the application is started in the offline mode, you can still switch to the online mode through “reconnection.”) If the checkbox “The controller connected will be chosen automatically next time” is selected, the application will automatically establish connection with the controller that was connected first.

* Check this option only when you are communicating with a single controller or using peer-to-peer connection.

- d. Changing the connection destination
If you want to switch between multiple controllers, the connecting controller can be changed via the following procedure.

(2) Connection destination change

Select "Controller (C)" → "Request Release Pause (L)" from the menu.

* This menu item will be added only when connections have been established from two or more controllers.

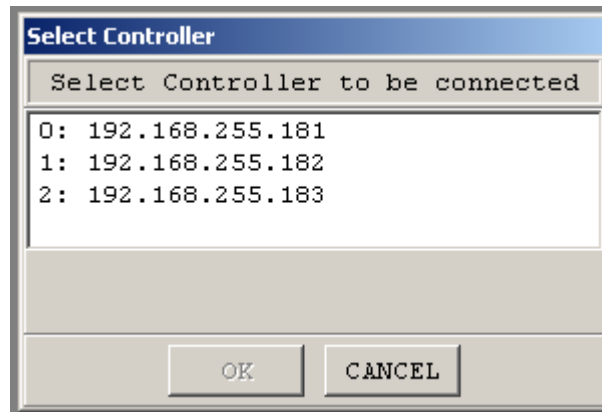


Figure 4

Select the IP address of the controller with which you want to communicate, and then click the [OK] button. Communication will be established with the selected controller.

5.2.3 Items to Note

- (1) When connecting via Ethernet, the IP address parameter must be set via serial connection beforehand in accordance with the applicable environment.
- (2) If a firewall (including the firewall function of virus protection software) is installed in the PC, etc., the port block must be canceled or the firewall function disabled before a connection can be made.
(This is because the very purpose of firewall software is to block external connection to the protecting device.)
- (3) Ethernet connection is enabled only when the checkbox “The connection to the CTL by Ethernet is supported (for expansion)” (see Fig. 5), as provided on the “Setting” tab accessed by selecting “Tools” → “Environment Setup” from the menu, is selected (PC software V2.1.0.4 or later).

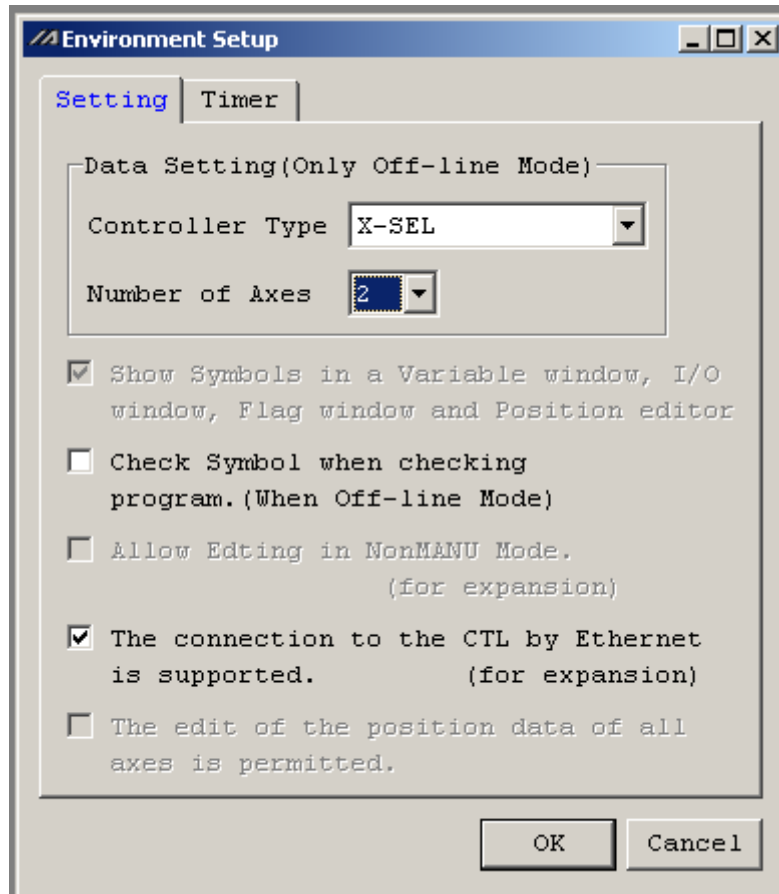


Figure 5

6. Transmission by SEL Program

Four channels of ASCII-based, delimiter-controlled communication (CH31 through CH34) are supported, using a set of transmission commands in a system roughly equivalent to that used in the X-SEL controller's serial communication.

(The specification of each SEL command may vary slightly from the corresponding command specification in serial communication, so exercise due caution.)

6.1 Setup of Ethernet Environment

To select the transmission function by SEL program:

Set "I/O parameter No. 129: Network attribute 10, bits 4 to 7" to "1: Use TCP/IP message communication."

Then, set "I/O parameter No. 124: Network attribute 5, bits 8 to 11 (CH31), bits 12 to 15 (CH32), bits 16 to 19 (CH33) or bits 20 to 23 (CH34)" to "1: Client (Assign own port number automatically)" or "3: Server (Specify own port number)."

* Data transmission is performed by SEL program based on the specifications of the following items:

- CH (channel) selection
- IP address of connection destination
- Port number

For programming details, refer to 6.2, "Ethernet Option SEL Commands."

[I/O parameters]

No.	Parameter name	Setting	Input range	Remarks
124	Network attribute 5	00***100H (Channel 31) 00**1*00H (Channel 32) 00*1**00H (Channel 33) 001***00H (Channel 34) Or, 00***300H (Channel 31) 00**3*00H (Channel 32) 00*3**00H (Channel 33) 003***00H (Channel 34)	0H~FFFFFFFH	Ethernet TCP/IP message communication attribute Ethernet client/server type (0: Do not use 1: Client (Assign own port number automatically) 2: Client (Specify own port number) → This setting is not recommended in view of the associated device restrictions, such as a forced-error detection if the port is opened for approximately 10 minutes in a condition where a close response cannot be confirmed due to a power failure in the connected device, etc.) 3: Server (Specify own port number) * Note: Number of clients that can be connected to one server-port channel simultaneously = 1 Bits 0 to 3: IAI protocol B/TCP (MANU mode) * PC software connection is enabled in the client mode only. Bits 4 to 7: IAI protocol B/TCP (AUTO mode) * PC software connection is enabled in the client mode only. Bits 8 to 11: User-open channel 31 Bits 12 to 15: User-open channel 32 Bits 16 to 19: User-open channel 33 Bits 20 to 23: User-open channel 34 * IAI protocol B/TCP MANU/AUTO The connection will be cut off briefly during switching between the MANU and AUTO modes, if the parameter settings of “own port number,” “client/server type,” “IP address of connection destination” and “port number of connection destination” do not fully correspond between the two modes.
⋮	⋮	⋮	⋮	⋮
129	Network attribute 10	10H	0H~FFFFFFFH	Ethernet operation requirement Bits 0 to 3: Modbus/TCP (remote I/O) 0: Do not use 1: Use (EXCEPTION status invalid) 2: Use (EXCEPTION status valid) Bits 4 to 7: TCP/IP message communication 0: Do not use 1: Use Bits 8 to 31: Not used
130	Own MAC address (H)	0030H	Reference value (HEX)	Only the lower two bytes are valid. (This parameter is not settable.)
131	Own MAC address (L)	11H	Reference value (HEX)	(This parameter is not settable.)
132	Own IP address (H)	192	1~255	* Setting of “0” and “127” is prohibited.
133	Own IP address (MH)	168	0~255	
134	Own IP address (ML)	0	0~255	
135	Own IP address (L)	1	1~254	* Setting of “0” and “255” is prohibited.

136	Subnet mask (H)	255	0~255	
137	Subnet mask (MH)	255	0~255	
138	Subnet mask (ML)	255	0~255	
139	Subnet mask (L)	0	0~255	
140	Default gateway (H)	0	0~255	
141	Default gateway (MH)	0	0~255	
142	Default gateway (ML)	0	0~255	
143	Default gateway (L)	0	0~255	

6.2 Ethernet Option SEL Commands

* The “Ethernet Option SEL Commands” are supported in the following versions:
 X-SEL (Cartesian) Main Application V0.79 or later
 X-SEL (IX SCARA) Main Application V0.29 or later
 X-SEL PC Software Ver. 2.1.1.0 or later

- OPEN (Channel open) [* When the Ethernet option is used]

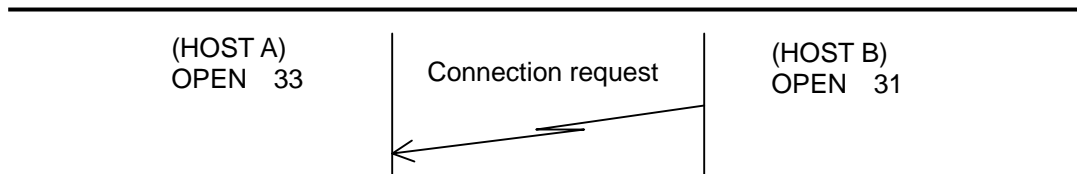
Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output (Output, flag)
		Command, declaration	Operand 1	Operand 2	
Optional	Optional	OPEN	Channel number	Prohibited	CC

[Function] Open the channel specified in operand 1.
 Transmission via the specified channel will hereafter be enabled.
 Before executing this command, the end character must be set with an SCHA command and the IP address/port address of connection destination with an IPCN command.

- (Note 1) Channel Nos. 31 through 34 can be specified in operand 1 with the Ethernet option.
 Up to four channels can be opened simultaneously.
- (Note 2) Be sure to design the program in such a way that the normal completion or abnormal completion of the return code will always be confirmed before moving on to the next process.
- (Note 3) To change the connection destination, the channel must be closed once using a CLOS command. It may take approximately four seconds to reopen the closed channel.
 Executing an OPEN command for a given channel while the channel is already open will generate a “B1B: Ethernet socket open-without-close error.”
- (Note 4) To avoid occurrence of system trouble, it is recommended that the system be built by ensuring a sufficient period so that the port opening order of the connected device and controller will satisfy “server port open → client port open.”

(1) Server open
 Opens the port and waits for a connection request from the client (specified with an IPCN command).

(2) Client open
 Opens the port and issues a connection request to the server (specified with an IPCN command).



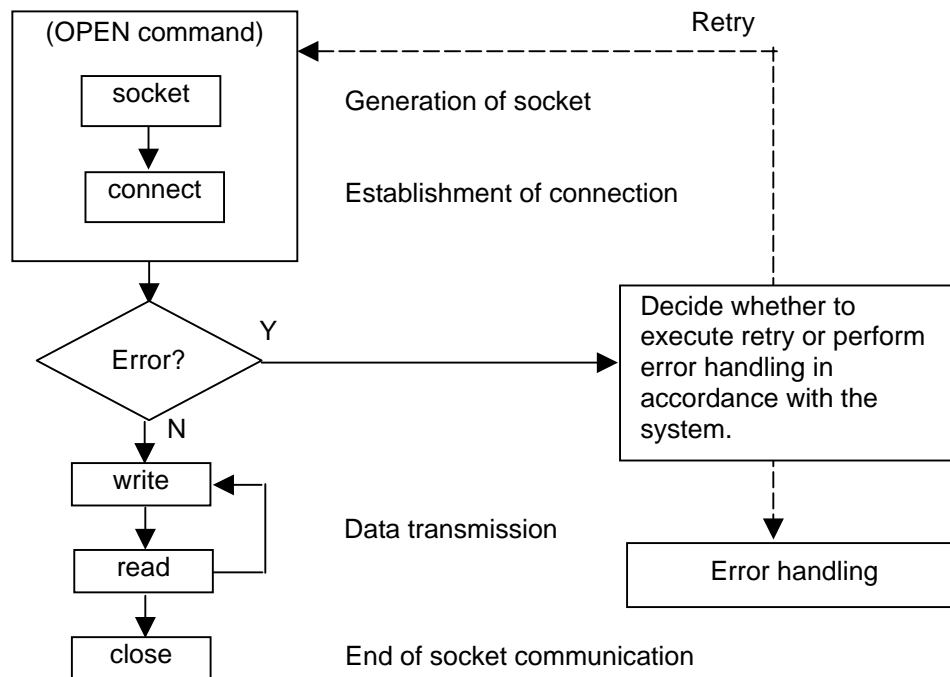
- (Note 5) When the controller is used as a server, the number of clients that can be connected to one server-port channel simultaneously is 1.
- (Note 6) If a firewall (including the firewall function of virus protection software) is installed in the PC, etc., the port block must be canceled or the firewall function disabled before a connection can be made.
 (This is because the very purpose of firewall software is to block external connection to the protecting device.)
- (Note 7) The client/server mode is determined upon reset via “I/O parameter No. 124: Network attribute 5, bits 8 to 11 (CH31), bits 12 to 15 (CH32), bits 16 to 19 (CH33) or bits 20 to 23 (CH34).” The controller cannot be used during dynamic switching between the client and server modes.

(Note 8)

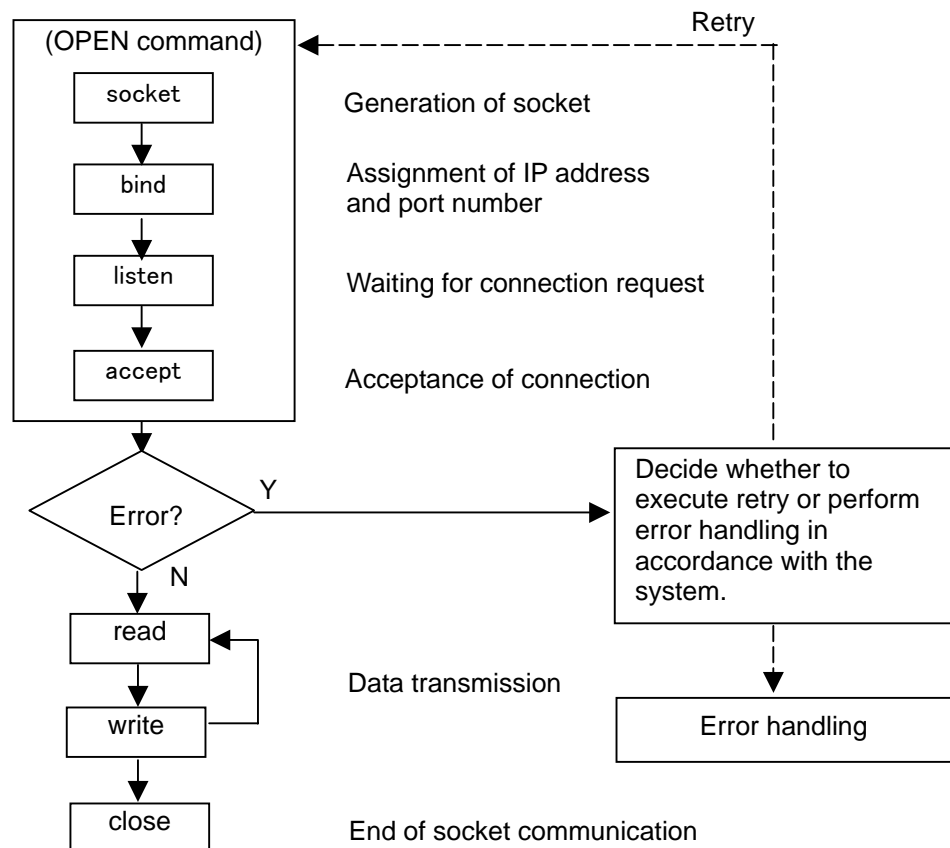
The diagram below explains the mechanism of “socket interface.”

* Bear in mind that “socket,” “connect,” “write,” “read,” “close,” “bind,” “listen” and “accept” are not SEL language commands (SEL commands).

(1) Client open



(2) Server open



[Example]

LET	90	192		IP address of connection destination (H) = 192
LET	91	168		IP address of connection destination (MH) = 168
LET	92	72		IP address of connection destination (ML) = 72
LET	93	101		IP address of connection destination (L) = 101
LET	94	64514		Port number of connection destination = 64514
IPCN	31	90		Declare the IP address/port number storage area for the connection destination of channel 31 = Local integer variable between 90 and 94.
SCHA	10			Specify 10 (= LF) as the end character.
OPEN	31		990	Open channel 31.
TRAN	1	99		Store the return code in variable 1.
N 990 GOTO	15			OPEN failed → Proceed to error handling or retry process after closing.

• Common return codes of OPEN, READ and WRIT commands [* When the Ethernet option is used]

The return code is stored in the local variable specified in "Other parameter No. 24." The default setting is variable 99.

0: Normal completion

1: Timeout

[Specification procedure of timeout value]

OPEN:

Client mode

I/O parameter No. 127: Network attribute 8, bits 0 to 7
(Use the default setting if it poses no particular problem.)

Server mode

I/O parameter No. 128: Network attribute 9, bits 0 to 15
(Use the default setting if it poses no particular problem.)

READ: TMRD command specification

WRIT: I/O parameter No. 127: Network attribute 8, bits 16 to 23
(Use the default setting if it poses no particular problem.)

2: Cancel timer (The wait status is canceled with a TIMC command.)

3, 4: (Undefined)

5: WAIT factor error (program aborting error)

(This error cannot be recognized through SEL commands.)

6: End task (program-end request, etc.)

(This error cannot be recognized through SEL commands.)

7~12: (Undefined)

50~: Device error information

50	Invalid Message ID
51	Invalid Message Type
52	Invalid Command
53	Invalid Data Size
54	Invalid Frame Count
55	Invalid Frame Number
56	Invalid Offset
57	Invalid Address
58	Invalid Response
59	Flash Config Error
60~64	Invalid To Be Defined 1-7
101	Invalid IP-address or Subnet mask
102	Invalid socket type
103	No free socket
104	Invalid socket
105	Not connected
106	Command failed
107	Invalid data size
108	Invalid fragment type
109	Fragment error
110	Invalid timeout time
111	Can't send more
112~115	(reserved)
116	Command aborted
117	Too many registered objects
118	Object already registered
119	Deregistering invalid object
121	Unsupported Command
122	(reserved)
123	No timeout
124	Invalid port number
125	Duplicate port number
126	(reserved)
127	Mapping Failed
128	Reset notification unsupported

- CLOS (Channel close) [* When the Ethernet option is used]

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output (Output, flag)
		Command, declaration	Operand 1	Operand 2	
Optional	Optional	CLOS	Channel number	Prohibited	CC

[Function] Close the channel specified in operand 1.
Transmission via the specified channel will hereafter be disabled.

(Note 1) Channel Nos. 31 through 34 can be specified in operand 1 with the Ethernet option.

[Example]

CLOS	31		Close channel 31.
LET	1	32	Assign 32 to variable 1.
CLOS	*1		Close the content of variable 1 (channel 32).

● READ (Read) [* When the Ethernet option is used]

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output (Output, flag)
		Command, declaration	Operand 1	Operand 2	
Optional	Optional	READ	Channel number	Column number	CC

[Function] Read a character string from the channel specified in operand 1 to the column specified in operand 2.

The reading will end upon reaching the character specified with an SCHA command.
Either a local or global column may be specified.

(Note 1) Channel Nos. 31 through 34 can be specified in operand 1 with the Ethernet option.

(Note 2) Be sure to design the program in such a way that the normal completion or abnormal completion of the return code will always be confirmed before moving on to the next process.

[Example]

```

    . . .
    . . .
    SCHA    10                               Specify 10 (= LF) as the end character.
    . . .
    . . .
    . . .
    READ    31      5      991               Read a character string from channel 31 to column 5
                                                until LF is reached.
    TRAN    2        99                      Store the return code in variable 2.

N 991  GOTO    16                               READ failed → Proceed to error handling or retry
                                                process after closing.

```

● Common return codes of OPEN, READ and WRIT commands [* When the Ethernet option is used]

The return code is stored in the local variable specified in "Other parameter No. 24." The default setting is variable 99. For details on the return code, refer to the page describing the "OPEN" command.

- WRIT (Write) [* When the Ethernet option is used]

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output (Output, flag)
		Command, declaration	Operand 1	Operand 2	
Optional	Optional	WRIT	Channel number	Column number	CC

[Function] Write a character string from the column specified in operand 2 to the channel specified in operand 1.

The writing will end when the character specified with an SCHA command is written.
Either a local or global column may be specified.

(Note 1) Channel Nos. 31 through 34 can be specified in operand 1 with the Ethernet option.

(Note 2) Be sure to design the program in such a way that the normal completion or abnormal completion of the return code will always be confirmed before moving on to the next process.

[Example]

```

    . . .
    . . .
    SCHA    10                               Specify 10 (= LF) as the end character.
    . . .
    . . .
    . . .
    WRIT    31      5      992               Write a character string from column 5 to channel 31 until
                                           LF is written.
    TRAN    3      99                        Store the return code in variable 3.

N 992 GOTO  17                               WRIT failed → Proceed to error handling or retry
                                           process after closing.

```

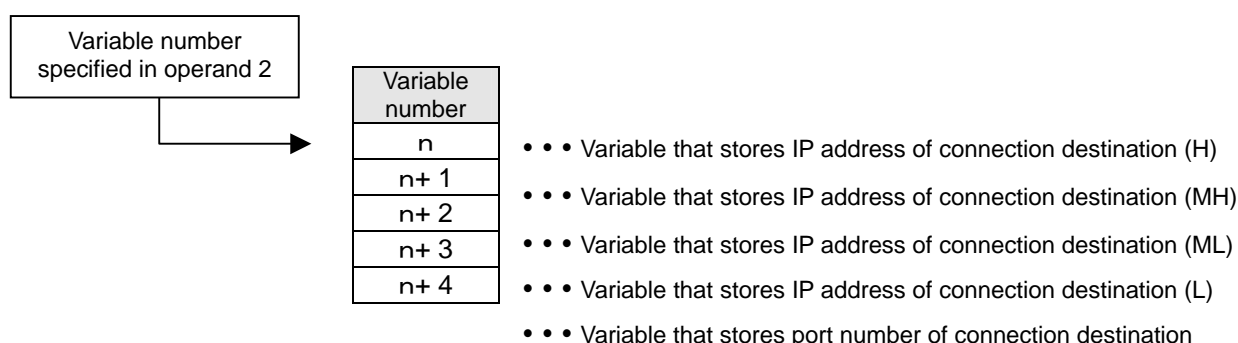
- Common return codes of OPEN, READ and WRIT commands [* When the Ethernet option is used]

The return code is stored in the local variable specified in "Other parameter No. 24." The default setting is variable 99. For details on the return code, refer to the page describing the "OPEN" command.

- IPCN (IP address/port number settings of connection destination) [* When the Ethernet option is used]

Extension condition (LD, A, O, AB, OB)	Input condition (I/O, flag)	Command, declaration			Output (Output, flag)
		Command, declaration	Operand 1	Operand 2	
Optional	Optional	IPCN	Channel number	Integer variable number	CP

[Function] Set the storage areas of IP address/port number for the connection destination of the user-open TCP/IP channel. The connection destination information stored in the five consecutive integer variables, beginning with the integer variable number specified in operand 2, is defined as the connection destination of the user-open TCP/IP channel specified in operand 1. This command must always be executed before an OPEN command.



(Note 1) Channel Nos. 31 through 34 can be specified in operand 1 with the Ethernet option.

(Note 2) Executing this command while a channel or channels are already open will specify settings for the next OPEN command.

[Example]

LET	90	192	IP address of connection destination (H) = 192
LET	91	168	IP address of connection destination (MH) = 168
LET	92	72	IP address of connection destination (ML) = 72
LET	93	101	IP address of connection destination (L) = 101
LET	94	64514	Port number of connection destination = 64514
IPCN	31	90	Declare the IP address/port number storage area for the connection destination of channel 31 = Local integer variable between 90 and 94.

In the above example, IP address 192.168.72.101 and port number 64514 are set as the connection destination of user-open TCP/IP channel No. 31.

7. Common Items to Note (Be sure to read this section.)

- (1) The Ethernet option will be enabled when a reset is executed on the controller equipped with an Ethernet interface board, following a parameter setup (Ethernet option function-selection parameter and network environment parameters) by transferring the parameters to the controller and writing them to the flash ROM, and an Ethernet cable connection.
Check the connection to the network using a “ping” command (the command for checking the status of communication on the IP level of TCP/IP using an MS-DOS prompt (or command prompt in Windows NT/2000)) or similar command.
* For details on the parameters, refer to “Appendix: “X-SEL (Cartesian/IX SCARA) Ethernet Option Parameters.”
- (2) Build the system by ensuring a sufficient period so that the port opening order of the connected device and controller will satisfy “server port open → client port open.”
- (3) When the controller is used as a server, the number of clients that can be connected to one server-port channel simultaneously is 1.
- (4) When the controller is used as a server, if the IP address and port number of the connected device do not match, the network status will become “connected” and then the connection will close.
When the controller is used as a server, the port number on the client side is not already known in a system where the client’s port number is not bound (the own port number on the client side is assigned automatically). Therefore, set the port number of connection destination to “0” (= Ignore port number of connected device).
With this setting, the first connection from the specified IP address will be considered a valid connection. All connections from other ports of the same IP address will be considered invalid and rejected until the first connection is disconnected.
- (5) When the controller is used as a server, no other port may not be opened (socket cannot be generated) in the event of insufficient socket space caused by continuous external connection to the server port.
- (6) Build the system in such a way that the power will be shut off only after a disconnection process (socket closure) is performed on the connected-device side whenever the power is to be shut off only to the connected device while maintaining power to the controller.
- (7) The system to be connected to the controller should constantly perform a connection check via polling, etc., and return a close response upon receipt of a closing command from the controller. Given the lack of a close response, in some cases the controller may not be able to open the port (generate a socket).
- (8) Select a straight or crossed Ethernet cable as deemed appropriate for the connection environment.
[Normal]

Controller ⇔ HUB connection	Straight
Connection between controllers	Crossed
Controller ⇔ PC connection	Crossed

- (9) If a firewall (including the firewall function of virus protection software) is installed in the PC, etc., the port block must be canceled or the firewall function disabled before a connection can be made. (This is because the very purpose of firewall software is to block external connection to the protecting device.)
- (10) When the Ethernet option is enabled, the system will detect a “link error” if the connection is not made using the correct Ethernet cable. Set “I/O parameter No. 10: Standard I/O error monitor” to “0: Do not monitor” during debugging, teaching or other operation using an SEL program where the Ethernet cable is not connected.
With this setting, in the online mode errors will not be detected even when the Ethernet cable is abnormal. If the system will be used in the online mode, set the above parameter to “1: Monitor” or “2: Monitor (Do not monitor 24 V I/O power error).”
- (11) The IP address of the controller itself cannot be specified as the controller’s connection destination. (Accordingly, a communication test or other operation involving different channels of the same controller cannot be performed.)
- (12) Due to the associated device restrictions, do not set “I/O parameter No. 124: Network attribute 5” to “2: Client (Specify own port number).”
- (13) When a parameter has been changed, always transfer the setting to the controller, write it to the flash ROM and then reset the software.
- (14) If you are contacting IAI to inquire about the encountered problem, please have the following information ready so that we can better assist in a quick recovery and prevent any recurrence of the problem. That information is an essential part of the troubleshooting process.
- a. Error list file
 - b. Parameter file
 - c. Lighting conditions of the monitor LEDs on the front panel of the Ethernet interface board
* Refer to 3.2, “Monitor LED Indications,” for details on the monitor LEDs.
 - d. SEL program file
 - e. Symbol file
 - f. Position data file
- (15) The descriptions provided in this manual are based on the standard parameter settings. The content of this manual is subject to change without notice for the purpose of product improvement.
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Appendix: X-SEL (Cartesian/IX SCARA) Ethernet Option Parameters

[I/O parameters]

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/ TCP	IAI protocol B/TCP	Transmission by SEL program						
A	C	C	1	I/O port assignment type	1	0~20		0: Fixed assignment I/O numbers are specified by parameters. 1: Automatic assignment (priority sequence: slot 1~)
A	C	C	2	Standard I/O input-port start number (I/O1)	0	-1~599		0 + (Multiple of 8) (A negative value is invalid.) 0: Assign Modbus/TCP remote DIs from No. 0.
A	C	C	3	Standard I/O output-port start number (I/O1)	300	-1~599		300 + (Multiple of 8) (A negative value is invalid.) 300: Assign Modbus/TCP remote DOs from No. 300.
A	C	C	4	Expanded I/O1 input-port start number based on fixed assignment (I/O2)	-1	-1~599		0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O1 DI
A	C	C	5	Expanded I/O1 output-port start number based on fixed assignment (I/O2)	-1	-1~599		300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O1 DO
A	C	C	6	Expanded I/O2 input-port start number based on fixed assignment (I/O3)	-1	-1~599		0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DI
A	C	C	7	Expanded I/O2 output-port start number based on fixed assignment (I/O3)	-1	-1~599		300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O2 DO

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
A	C	C	8	Expanded I/O3 input-port start number based on fixed assignment (I/O4)	-1	-1~599		0 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DI
A	C	C	9	Expanded I/O3 output-port start number based on fixed assignment (I/O3)	-1	-1~599		300 + (Multiple of 8) (A negative value is invalid.) -1: No expanded I/O3 DO
A	C	C	10	Standard I/O error monitor (I/O1)	1	0~5		0: Do not monitor 1: Monitor 2: Monitor (Do not monitor 24 V I/O power error) 3: Monitor (Monitor 24 V I/O power error only)
A	C	C	11	Expanded I/O1 error monitor (I/O2)	1	0~5		
A	C	C	12	Expanded I/O2 error monitor (I/O3)	1	0~5		
A	C	C	13	Expanded I/O3 error monitor (I/O4)	1	0~5		
A			14	Number of ports using network I/F-card remote input	0	0~256		Specify the Modbus/TCP remote DI bits by a multiple of 8 ($8 \leq n \leq 256$).
A			15	Number of ports using network I/F-card remote output	0	0~256		Specify the Modbus/TCP remote DO bits by a multiple of 8 ($8 \leq n \leq 256$).

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
	C	C	123	Network attribute 4	0H	0H~FFFFFFFFH		Bits 0 to 3: Ethernet TCP/IP message communication Selection of whether or not to permit IP address 0.0.0.0 (a specification to ignore the IP address of the connected device) as the connection destination when the controller is used as a server 0: Do not permit 1: Permit (<u>This setting is not recommended.</u>) * Note: Number of clients that can be connected to one server-port channel simultaneously = 1
	A	A	124	Network attribute 5	0H	0H~FFFFFFFFH		Ethernet TCP/IP message communication attribute Ethernet client/server type (0: Do not use 1: Client (Assign own port number automatically) (2: Client (Specify own port number) → <u>This setting is not recommended</u> in view of the associated device restrictions, such as a forced-error detection if the port is opened for approximately 10 minutes in a condition where a close response cannot be confirmed due to a power failure in the connected device, etc.) 3: Server (Specify own port number) * Note: Number of clients that can be connected to one server-port channel simultaneously = 1 Bits 0 to 3: IAI protocol B/TCP (MANU mode) * PC software connection is enabled in the client mode only. Bits 4 to 7: IAI protocol B/TCP (AUTO mode) * PC software connection is enabled in the client mode only. Bits 8 to 11: User-open channel 31 Bits 12 to 15: User-open channel 32 Bits 16 to 19: User-open channel 33 Bits 20 to 23: User-open channel 34 * IAI protocol B/TCP MANU/AUTO The connection will be cut off briefly during switching between the MANU and AUTO modes, if the parameter settings of "own port number," "client/server type," "IP address of connection destination" and "port number of connection destination" do not fully correspond between the two modes.

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
C	C	C	125	Network attribute 6	1E32H	0H~FFFFFFFFH		Bits 0 to 7: Module initialization check timer value when Ethernet is used (100 msec) Bits 8 to 15: Module initialization check timer value when Ethernet is not used (100 msec) Bits 16 to 23: Increment of "PC/TP reconnection delay time upon software reset" when Ethernet is used (sec)
C	C	C	126	Network attribute 7	7D007D0H	0H~FFFFFFFFH		Ethernet TCP/IP message communication attribute Bits 0 to 15: Min timeout value (msec) Bits 16 to 31: Mout timeout value (msec)
C	C	C	127	Network attribute 8	5050214H	0H~FFFFFFFFH		Ethernet TCP/IP message communication attribute Bits 0 to 7: CONNECT_TIMEOUT (sec) * Changes to this setting are prohibited. Bits 8 to 15: Connection retry interval (sec) (IAI protocol B/TCP) Bits 16 to 23: Send timeout value (sec) Bits 24 to 31: IAI protocol B-SIO non-communication check timer value (sec) (IAI protocol B/TCP connection trigger)
		C	128	Network attribute 9	0H	0H~FFFFFFFFH		Ethernet TCP/IP message communication attribute Bits 0 to 15: SEL server open timeout value (sec) (No timeout check when "0" is set)
A	A	A	129	Network attribute 10	0H	0H~FFFFFFFFH		Ethernet operation requirement Bits 0 to 3: Modbus/TCP (remote I/O) 0: Do not use 1: Use (EXCEPTION status invalid) 2: Use (EXCEPTION status (upper two digits of error number) valid) *Handle each error according to the error level by referring to the explanation of error level in the operation manual. Bits 4 to 7: TCP/IP message communication 0: Do not use 1: Use Bits 8 to 31: Not used
			130	Own MAC address (H)	0H	Reference only (HEX)		Only the lower two bytes are valid.
			131	Own MAC address (L)	0H	Reference only (HEX)		
B	B	B	132	Own IP address (H)	192	1~255		* Setting of "0" and "127" is prohibited.

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
B	B	B	133	Own IP address (MH)	168	0~255		
B	B	B	134	Own IP address (ML)	0	0~255		
B	B	B	135	Own IP address (L)	1	1~254		* Setting of "0" and "255" is prohibited.
B	B	B	136	Subnet mask (H)	255	0~255		
B	B	B	137	Subnet mask (MH)	255	0~255		
B	B	B	138	Subnet mask (ML)	255	0~255		
B	B	B	139	Subnet mask (L)	0	0~255		
B	B	B	140	Default gateway (H)	0	0~255		
B	B	B	141	Default gateway (MH)	0	0~255		
B	B	B	142	Default gateway (ML)	0	0~255		
B	B	B	143	Default gateway (L)	0	0~255		
	C		144	IAI protocol B/TCP: Own port number (MANU mode)	64511	1025~65535		* Important note: Be sure to set a unique number for each own port number. (The duplication of own port numbers is permitted only in the IAI protocol B/TCP MANU/AUTO modes.)
		C	145	User-open channel 31 (TCP/IP): Own port number	64512	1025~65535		
		C	146	User-open channel 32 (TCP/IP): Own port number	64513	1025~65535		
		C	147	User-open channel 33 (TCP/IP): Own port number	64514	1025~65535		
		C	148	User-open channel 34 (TCP/IP): Own port number	64515	1025~65535		

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
	B		149	IAI protocol B/TCP: IP address of connection destination (MANU mode) (H)	192	0~255		* Setting of "0" and "127" is prohibited.
	B		150	IAI protocol B/TCP: IP address of connection destination (MANU mode) (MH)	168	0~255		
	B		151	IAI protocol B/TCP: IP address of connection destination (MANU mode) (ML)	0	0~255		
	B		152	IAI protocol B/TCP: IP address of connection destination (MANU mode) (L)	100	0~254		* Setting of "0" and "255" is prohibited.
	B		153	IAI protocol B/TCP: Port number of connection destination (MANU mode)	64611	0~65535		* In the server mode "0" can be set. 0 = Ignore port number of connection destination (Only the IP address is checked.) * In the client mode "0" cannot be set.
	B		154	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (H)	192	0~255		* Setting of "0" and "127" is prohibited.
	B		155	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (MH)	168	0~255		
	B		156	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (ML)	0	0~255		
	B		157	IAI protocol B/TCP: IP address of connection destination (AUTO mode) (L)	100	0~254		* Setting of "0" and "255" is prohibited.

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
	B		158	IAI protocol B/TCP: Port number of connection destination (AUTO mode)	64611	0~65535		* In the server mode "0" can be set. 0 = Ignore port number of connection destination (Only the IP address is checked.) * In the client mode "0" cannot be set.
	C		159	IAI protocol B/TCP: Own port number (AUTO mode)	64516	1025~65535		* Important note: Be sure to set a unique number for each own port number. (The duplication of own port numbers is permitted only in the IAI protocol B/TCP MANU/AUTO modes.)

[Other parameters]

Setting requirement A: Required (function selection) B: Required (network environment, etc.) C: Checked (As a rule, the default value on the parameter list must be used.)			No.	Parameter name	Default value (reference)	Input range	Unit	Remarks
Modbus/TCP	IAI protocol B/TCP	Transmission by SEL program						
C	C	C	6	PC/TP reconnection delay time upon software reset	11000	1~99999	msec	* Valid after the PC software/TP is closed and then restarted.



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