CKD

SCARA Robot

KSL3000 Field Bus Slave Function Manual

INSTRUCTION MANUAL

SM-A20057-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

Preface

This manual describes the field bus slave function, the KSL3000 robot controller extension function. It is intended for users with general knowledge of field bus. The slave module for the filed bus can use PROFIBUS, DeviceNet, CC-Link, EtherNet/IP, EtherCAT, or PROFINET which should be determined at order entry.

The field bus input signals are assigned to **DIN301 to DIN364** and **DIN401 to DIN464**, and the output signals are assigned to **DOUT301 to DOUT364** and **DOUT401 to DOUT464**. (For DeviceNet only, input sgnals can be assigned to DIN301 to DIN364, DIN401 to DIN464, DIN501 to DIN564, DIN601 to DIN664, DIN701 to DIN764, DIN801 to DIN864, DIN901 to DIN964, and DIN1001 to DIN1064, and output signals can be assigned to DOUT301 to DOUT364, DOUT401 to DOUT464, DOUT501 to DOUT564, DOUT601 to DOUT664, DOUT701 to DOUT764, DOUT801 to DOUT864, DOUT901 to DOUT964, and DOUT1001 to DOUT1064.) Also, the Simple PLC Function (option) can be used to enable changing of the I/O signal and routing of the system signal input/output through the field bus.

Instruction manuals which are referred to from this manual

- Robot language manual
- Operation manual
- User parameter manual
- Maintenance manual
- Instruction manual of master station you wish to use

! **CAUTION**	• This manual does not contain any detailed descriptions on power and robot connection. For the connection of the power and robot, see the Installation & Transport Manual.

Cautions on Safety

This manual contains the important information on the robot and controller to prevent injury to the operators and persons nearby, to prevent damages to assets and to assure correct use.
Make sure that you well understand the following details (indications and symbols) before reading this manual. Always observe the information that is noted.

[Explanation of indications]

Indication	Meaning of indication
! **DANGER**	This means that "incorrect handling will lead to fatalities or serious injuries."
! **WARNING**	This means that "incorrect handling will lead to fatalities or serious injuries."
! **CAUTION**	This means that "incorrect handling may lead to personal injuries 1) or physical damage 2)."

1): Injuries refer to injuries, burns and electric shocks, etc., which do not require hospitalization or long-term medical treatment.

2): Physical damage refers to damages due to destruction of assets or resources.

[Explanation of symbols]

Symbol	Meaning of symbol
	This means that the action is prohibited (must not be done). Details of the actions actually prohibited are indicated with pictures or words in or near the symbol.
	This means that the action is mandatory (must be done). Details of the actions that must be done are indicated with pictures or words in or near the symbol.
	This indicates danger and cautions. Details of the actual caution are indicated with pictures or words in or near the symbol.

 **CAUTION**	To perform the work ranging from robot installation to operation with safety, read through and through the Safety Manual provided separately before actually starting the work.

Maintenance and Inspection

To use the robot safety, strictly observe the following matters.

! DANGER	
 Prohibited	• NEVER burn, disassemble or charge the battery. Otherwise, it may explode.
 Mandatory	• Before performing the maintenance and inspection, be sure to disconnect the controller power plug from the power supply. • When disposing of batteries, be sure to follow the user's regulations.

! CAUTION	
 Disassembly prohibited	• The user should NEVER replace or change parts other than those stipulated in the instruction manual. Otherwise, performance degradation, malfunction, or accidents may result.
 Mandatory	• To replace parts, use the spare parts designated by CKD. • Carry out the maintenance and inspection on a regular basis. Otherwise, the equipment may go wrong or accidents will be caused.

! CAUTION	
	To perform the maintenance and inspection of the robot with safety, read through and through the Maintenance Manual provided separately before actually starting the work.

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1. Operation Flow

The operation flow to enable the field bus interface is given below.

* When specifying the Field Bus during the purchase of the robot controller, read the step **(2) Connecting with the master station** and skip to step **(4) Setting the master station** and go to later steps.

(1) Mounting the field bus ⋯ See Section 2 of this manual.

Mount the field bus you procured on the controller.
Uncover the controller and perform the manual work.
Before starting this work, be sure to turn the power off.
When you already specified the field bus at order entry of the robot, the bus is factory-set. Make sure of it.
To proceed with the next process, the controller should remain uncovered.

⇩

(2) Connecting with the master station ⋯ See Section 2 of this manual.

Connect the field bus terminal on the controller side with the field bus cable connecting to the master station.

⇩

(3) Setting the controller parameters ⋯See Section 3 of this manual, the operation manual and user parameter manual.

Turn on the controller power, edit the [U16 FIELD BUS] parameter contained in the user parameter (USER.PAR) file. When EtherNet/IP, EtherCAT, PROFINET and DeviceNet (512 points) communication is to be used, edit the parameter by using the field bus parameter (FIELDBUS.PAR) as well.
The user parameter becomes operative after the power is turned off once, then on again.

⇩

(4) Setting the master station ⋯ See Section 3 of this manual and the master station instruction manual.

Perform setting of the master station. The setting procedures differ with the master station to be used. Refer to the master station instruction manual you procured.

⇩

⇩

(5) Confirming the operation ⋯ See Section 7 of this manual and the master station instruction manual.

The power is turned on in order of "First Field Bus master" and "Robot controller".
To make sure that the I/Os assigned to the robot controller can be operated properly, set ON the switch assigned from the master station and monitor the I/O status from the robot controller. Also, set ON the switch on the robot controller side and monitor the I/O state from the master station to make sure that the information can be transmitted legally.
If an error has generated, investigate the error information from the master station.

⇩

(6) Creating the robot program and verifying the control ⋯ See Section 8 of this manual and the master language instruction manual.

Create the robot program, referring to the example of robot program creation and make sure that the I/Os on the field bus can be controlled, using the SCOL language.

⇩

(7) Finish of the work

Now the work has finished.

2. Hardware Structure

2.1. Field Bus Printed Board Assembling Procedures to the KSL3000 Controller

Use the procedure below to install the field bus printed board into the robot controller.

(1) Turn off the 200 VAC power supplied to the robot controller from the primary side. To ensure safety, disconnect the power connector (ACIN).

(2) Remove the top cover of the robot controller.
The top cover is secured using a total of eight (8) countersunk screws (M3×10 black) with four screws on the side panel and four screws on the top panel of the robot controller. Use a screwdriver to remove the screws, and pull the cover towards the front to remove.

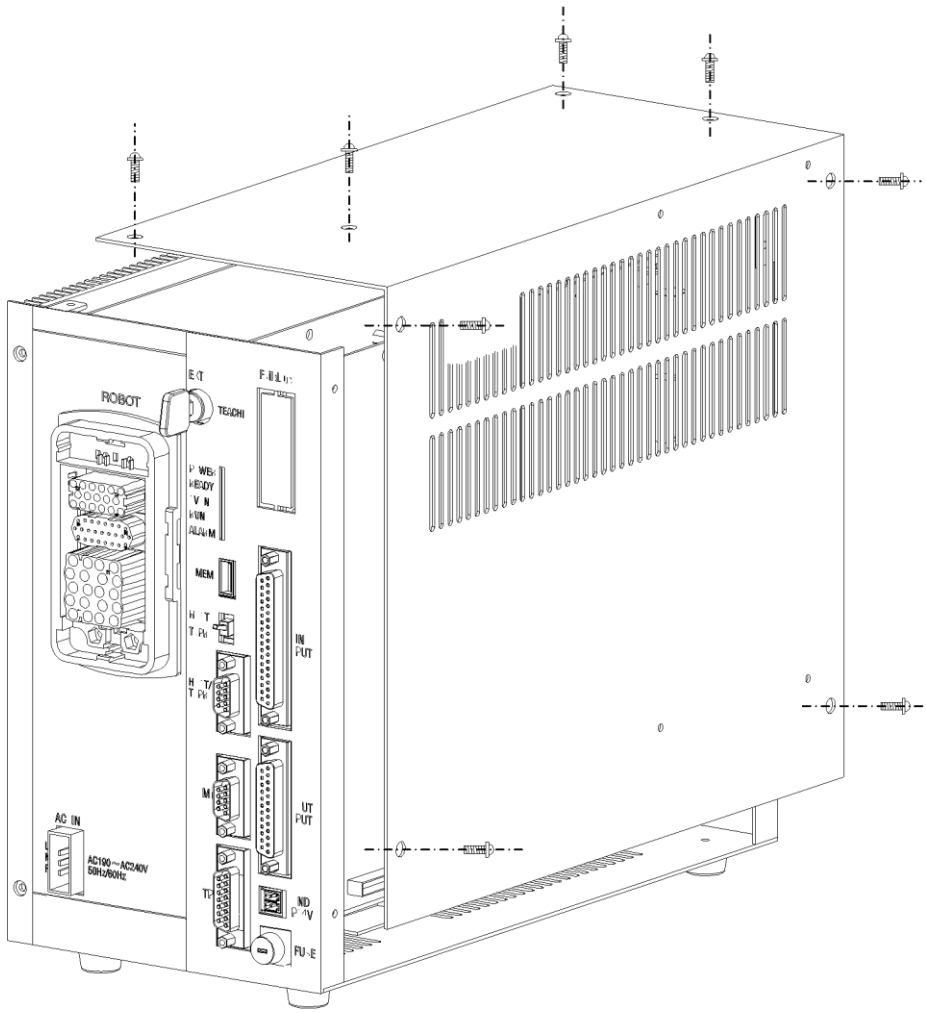


Fig. 5 Removing the KSL3000 Cover

(3) Remove the dummy connector plate (shown as the cross-hatched section in Fig. 6) on the rear panel of the robot controller.

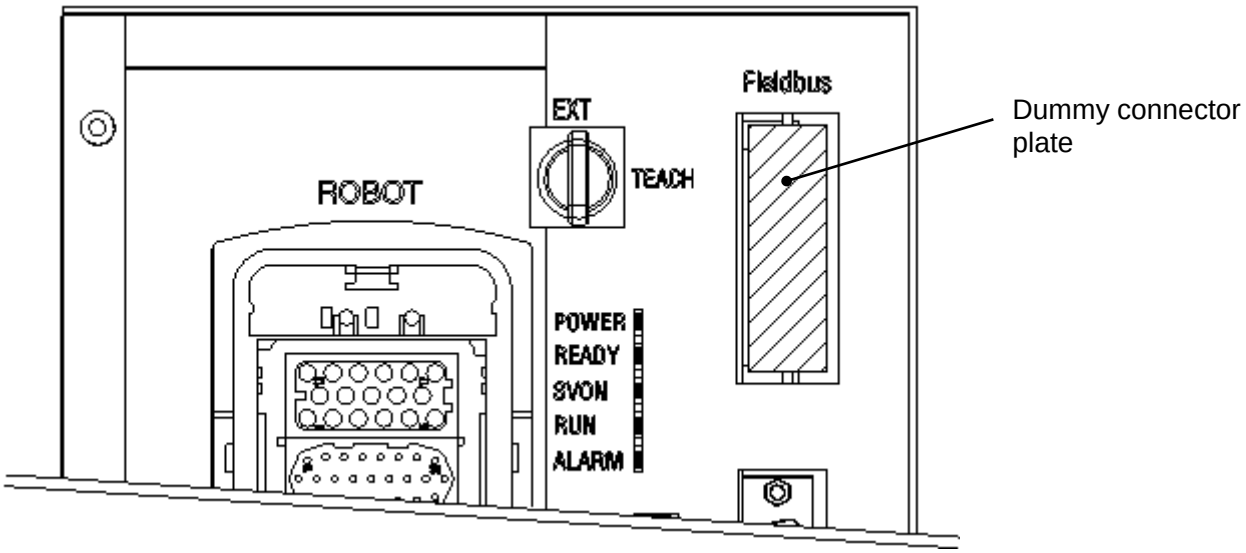


Fig. 6 KSL3000 Robot Controller Front Panel Top

(4) Remove the mounting screws on the X8YX printed board.

(5) Insert the field bus printed board into CN6 of the X8YX printed board.

(6) Use the screws to secure the printed board in place.

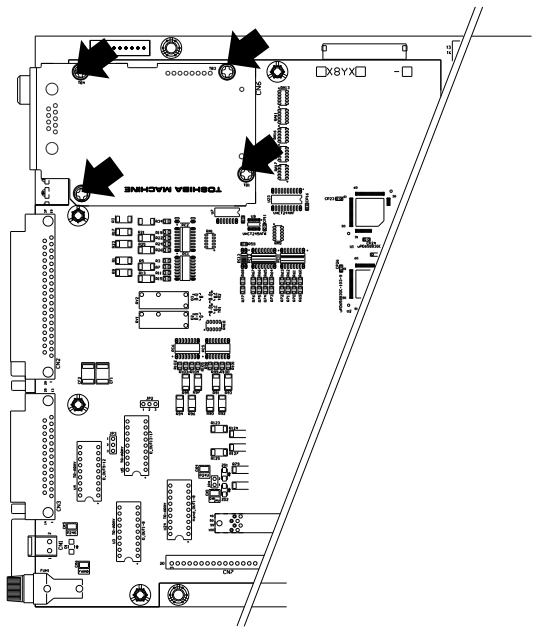
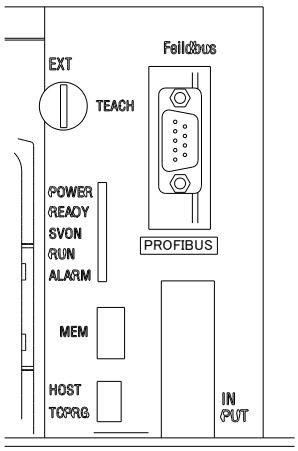


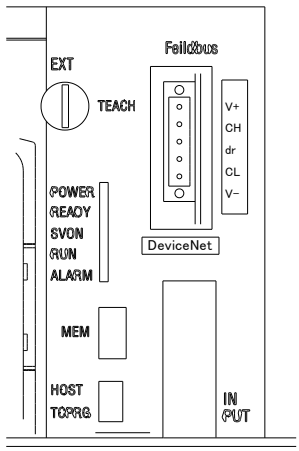
Fig. 7 KSL3000 Robot Controller Side Panel
(After Installation of Field Bus Printed Board)

(7) Remount the cover onto the robot controller, and secure in place using the screws.

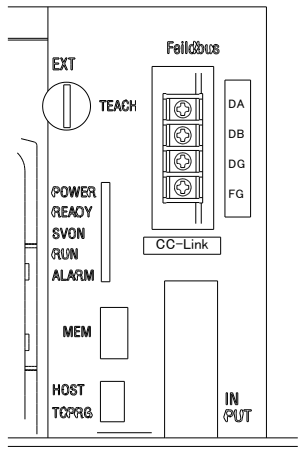
Reference: Fig. 8 shows the appearance after each type of field bus printed board is installed.



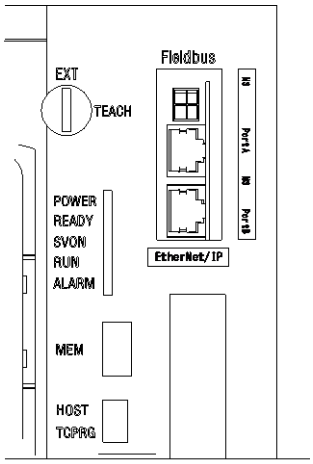
PROFIBUS



DeviceNet



CC-Link



EtherNet/IP, EtherCAT, PROFINET

Fig. 8 KSL3000 Controller Front Panel
(After Installation of Field Bus Printed Board)

2.2. Connection

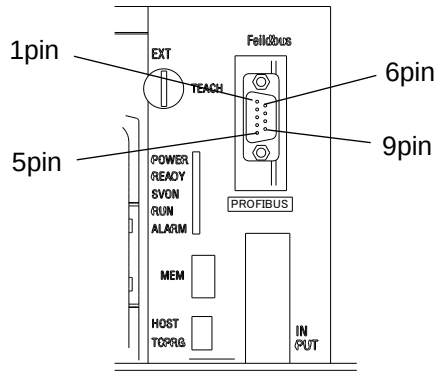
2.2.1. Pin Array of Connector for Connecting External Equipment

The pin array of the Field bus connector in the controller panel is as shown below.

(a) PROFIBUS

Pin No.	Signal name	Application
Housing	SHIELD	Connected to PE.
1	—	Not connected.
2	—	Not connected.
3	RXD (B-Line)	Positive RxD/TxD according to RS485 specifications.
4	RST	Request to send
5	GND (V–)	Isolated GND from RS485 side.
6	P5V (V+)	Isolated P5V from RS485 side.
7	—	Not connected.
8	TXD (A-Line)	Negative RxD/TxD according to RS485 specifications.
9	—	Not connected.

Field bus connector: 9pin D_SUB (female)



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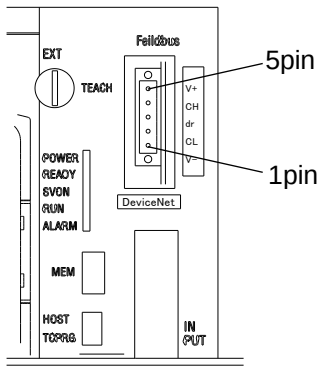
(b) DeviceNet

Pin No.	Signal name	Application
1	24G (V–)	Negative supply voltage
2	CAN_L	CAN_L bus line
3	SHIELD	Cable shield
4	CAN_H	CAN_H bus line
5	P24V (V+)	Positive supply voltage

Field bus connector: 5.08 pluggable screw



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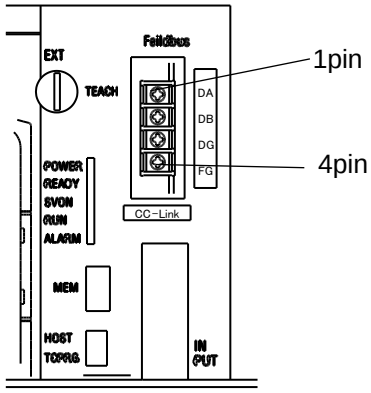
(c) CC-LINK

Pin No.	Signal name	Application
1	DA	Communication line (DA)
2	DB	Communication line (DB)
3	DG	Digital GND (DG)
4	SHIELD	Cable shield

Field bus connector: Terminal block



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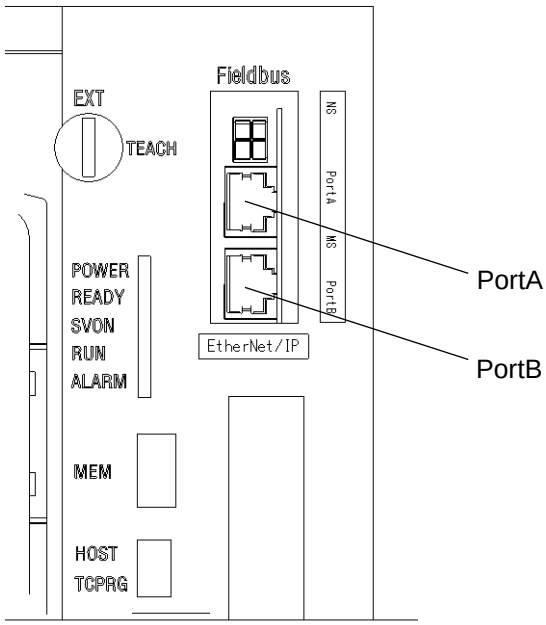
(d) EtherNet/IP

Common to Port1 and Port2

Pin No.	Signal name	Application
1	TXD+	Positive TxD
2	TXD-	Negative TxD
3	RXD+	Positive RxD
4	―	Not connected
5	―	Not connected
6	RXD-	Negative RxD
7	―	Not connected
8	―	Not connected

Field bus connector: RJ45 connector



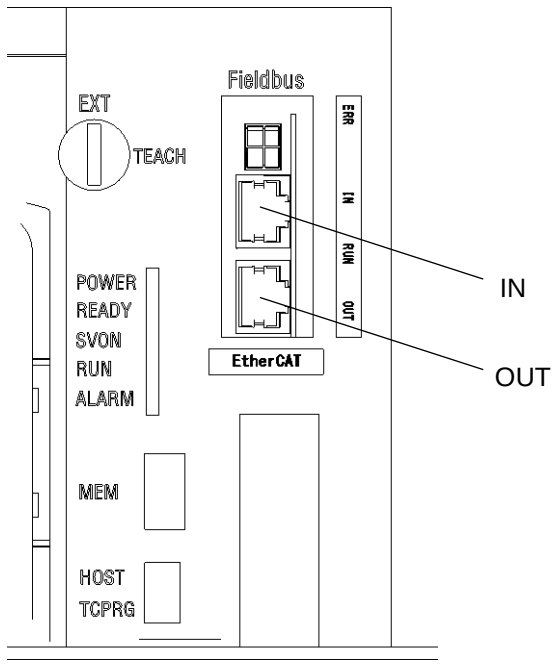
KSL3000 (Front)

(e) EtherCAT

Common to IN and OUT

Pin No.	Signal name	Application
1	TXD+	Positive TxD
2	TXD-	Negative TxD
3	RXD+	Positive RxD
4	─	Not connected
5	─	Not connected
6	RXD-	Negative RxD
7	─	Not connected
8	─	Not connected

Field bus connector: RJ45 connector



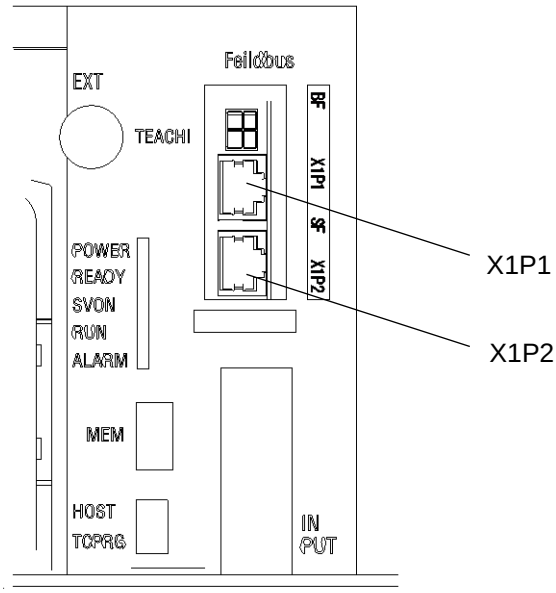
KSL3000 (Front)

(f) PROFINET

Common to IN and OUT

Pin No.	Signal name	Application
1	TXD+	Positive TxD
2	TXD-	Negative TxD
3	RXD+	Positive RxD
4	—	Not connected
5	—	Not connected
6	RXD-	Negative RxD
7	—	Not connected
8	—	Not connected

Field bus connector: RJ45 connector



KSL3000 (Front)

2.2.2. Connection

For the cable connecting the external equipment, use the recommended cable of the master sequencer (PLC) you use.

Use the following cable for the connector on the cable side.

(a) PROFIBUS : XM2D–0901 made by OMRON
(b) DeviceNet : MSTB2.5/5–STF-5.08 made by Phoenix
(c) CC-Link : V1.25-M3
(d) EtherNet/IP : RJ45 connector Cat5
shield cable (straight cable)
(e) EtherCAT : RJ45 connector Cat5
shield cable (straight cable)
(f) PROFINET : RJ45 connector Cat5
shield cable (straight cable)

3. Field Bus Slave Module

3.1. PROFIBUS Slave Module Specifications

3.1.1. PROFIBUS Specifications

Field bus specifications	PROFIBUS
Module name	W8XOA
Module type	Slave
Master device	16-bit little endian device (e.g., Siemens S7 315DP2) 16-bit big endian device
Node address	The node address is specified by user parameter (1 to 125).
Baudrate	Automatic detection (9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps, 3 Mbps, 6 Mbps, 12 Mbps)
GSD file	Each device on the PROFIBUS network relates to the GSD file containing all required information on the devices. The GSD file is used to establish the network. The basic settings can be made by loading this file. **The GSD file is contained in the Instruction Manual CD.**
Number of inputs	128 numbers (DIN301 to 364, DIN401 to 464)
Number of outputs	128 numbers (DOUT301 to 364, DOUT401 to 464)

3.1.2. Setting of PROFIBUS User Parameter

The PROFIBUS user parameter should be specified, using [U16] of the USER.PAR file. The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
[U16] FIELD BUS
= 1   3   –1   0
```

(Type of field bus) : Specify the type of the field bus.
Specify "1" for the PROFIBUS.
–1 : Without any field bus option (initial value)
1 : PROFIBUS

(Node) : Specify the node address of the field bus.
Take careful precautions not to share the same address with any other device in the same network.
The range of the set value differs with the type of the field bus.
–1 : Without any field bus option (initial value)
0 to 127 : Effective range of PROFIBUS node address

(Baudrate) : Specify the baudrate.
PROFIBUS baudrate is set from the master side. As the robot controller automatically detects it, the baudrate need not be specified on the robot controller side.

(Type of master) : Specify the type of the field bus master.
As the byte order (endian) differs with the master, specify the type according to the master. Set this parameter when connecting to a master where the order of the upper or lower bytes of the IO data that was input/output is different.
0 : 16-bit big endian
(DRM21 by Omron, A1SJH by MELSEC)
(Example: 0x1234→0x1234: No conversion)
1 : 16-bit little endian (S7 315DP2 made by Siemens)
(Example: 0x1234→0x2143)
2 : 32-bit big endian
(Example: 0x1234→0x3412)

3 : 32-bit little endian
(Example: 0x1234→0x4321)

Example setting : When the PROFIBUS is selected, the node address is 2 and Siemens's S7 315DP2 is used as the master module:
[U16] FIELD BUS
{Type / Node Addr / Speed / Byte Order}
= 1 2 –1 1

Example setting : When the field bus slave module is neglected:
[U16] FIELD BUS
{Type / Node Addr / Speed / Byte Order}
= –1 –1 –1 –1

3.2. DeviceNet Slave Module Specifications

3.2.1. DeviceNet Specifications

Field bus specifications		DeviceNet
Module name		W2XOA
Module type		Slave
Master/scanner operation		Not supported.
Master device		16-bit little endian device 16-bit big endian device (e.g., OMRON DRM21)
Node address		An exclusive node address is assigned to the DeviceNet on the network. The node address consists of 1 to 63, which is used to identify each node. The node address is specified by user parameter.
Baudrate		The baudrate is specified by user parameter. 0: 125 kbps 1: 250 kbps 2: 500 kbps
EDS file		Each device on the DeviceNet network relates to the EDS file containing all required information on the devices. The EDS file is used during network configuration. The basic settings can be made by loading this file. The EDS file is contained in the Instruction Manual **CD.** **The EDS files are contained in the Instruction Manual CD.** **The EDS file for 128 points (TS3KDEV.EDS) and the EDS file for 512 points (TS3KSDEV512.EDS) are available. Use the appropriate one in accordance with the controller setting.**
Explicit message		Not supported.
I/O message		Not supported.
Predefined Master/SlaveConnectionSet		
	Polling	Supported.
	Bit strobe	Supported.
	Cyclic	Supported.
	Change of state	Supported.

	Number of inputs	128 numbers (DIN301 to 364, DIN401 to 464) 512 numbers* (DIN301 to DIN364,DIN401 to DIN464, DIN501 to DIN564,DIN601 to DIN664, DIN701 to DIN764,DIN801 to DIN864, DIN901 to DIN964,DIN1001 to DIN1064)
	Number of outputs	128 numbers (DOUT301 to 364, DOUT401 to 464) 512 numbers* (DOUT301 to DOUT364, DOUT401 to DOUT464, DOUT501 to DOUT564, DOUT601 to DOUT664, DOUT701 to DOUT764, DOUT801 to DOUT864, DOUT901 to DOUT964, DOUT1001 to DOUT1064)
Supported software versions		128 points Main part: All versions PLC part: All versions 512 points* Main part: X8GCAS-15A or later PLC part: X8YCC-09A or later

* FIELDBUS.PAR needs to be changed to set the number of I/O points to 512. For details, refer to "3.2.2 Setting of DeviceNet User Parameter".

3.2.2. Setting of DeviceNet User Parameter

The DeviceNet user parameter should be specified, using [U16] of the USER.PAR file. The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
[U16] FIELD BUS
=  37  1  2  1
```

(Type of field bus) : Specify the type of the field bus.
Specify "37" for the DeviceNet.
–1 : Without any field bus option (initial value)
37 : DeviceNet

(Node) : Specify the node address of the field bus.

Take careful precautions not to share the same address with any other device in the same network. The range of the set value differs with the type of the field bus.

–1 : Without any field bus option (initial value)

0 to 63 : DeviceNet

(Baudrate) : Specify the baudrate according to the master baudrate.

0 : 125 kbps

1 : 250 kbps

2 : 500 kbps

(Type of master) : Specify the type of the field bus master.

As the byte order (endian) differs with the master, specify the type according to the master.

0 : 16-bit big endian (DRM21 made by OMRON)

1 : 16-bit little endian

2 : 32-bit big endian

3 : 32-bit little endian

Example setting 1: When the DeviceNet is selected, the node address is 2, the baudrate is 125 kbps and OMRON DRM21 is used as the master module:

[U16] FIELD BUS

{Type / Node Addr / Speed / Byte Order}

= 37 2 0 0

Example setting 2: When the field bus slave module is neglected:

[U16] FIELD BUS

{Type / Node Addr / Speed / Byte Order}

= –1 –1 –1 –1

3.2.3. Setting of DeviceNet Field Bus Parameter

To set the number of I/O points used for DeviceNet, use item [F04] in the FIELDBUS.PAR file.
The syntax for [F04] is as follows.

= **(Number of I/O points)**

```
[F04] DEVICENET I/O SIZE
{0:16byte 1:64byte}
= 0
```

(Number of I/O points): Set the number of I/O points used for DeviceNet.
0: 128 points each for input and output (16 bytes)
1: 512 points each for input and output (64 bytes)

Setting example 1: Using DeviceNet with 512 I/O points

```
[F04] DEVICENET I/O SIZE
{0:16byte 1:64byte}
= 1
```

3.3. CC-Link Slave Module Specifications

3.3.1. CC-Link Specifications

Field bus specifications	CC-Link Version 1.10
Module name	W1XOA
Module type	Remote device
Master device	16-bit little endian device 16-bit big endian device (e.g., MELSEC A1SJH)
Node address	The node address is specified by user parameter (1 to 64).
Baudrate	The baudrate is specified by user parameter. 0: 156 kbps 1: 625 bps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps
No. of occupied stations	Four (4) stations
Number of inputs	128 numbers (DIN301 to 364, DIN401 to 464) *
Number of outputs	128 numbers (DOUT301 to 364, DOUT401 to 464) *

* Due to the CC-Link specifications, the last two I/O terminals of 128 numbers are designed to be used for the system; and are not applicable to users.

For setting of CC-Link, select "four occupied stations" and "remote device".

3.3.2. Setting of CC-Link User Parameter

The CC-Link user parameter should be specified, using [U16] of the USER.PAR file. The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
[U16] FIELD BUS
=   -1   -1   0   0
```

(Type of field bus) :Specify the type of the field bus.
–1 : Without any field bus option (initial value)
144 : CC-Link

(Node) : Specify the node address of the field bus.
Take careful precautions not to share the same address with any other device in the same network.
The range of the set value differs with the type of the field bus.
–1 : Without any field bus option (initial value)
1 to 64 : CC-Link

(Baudrate) : Specify the baudrate according to the master baudrate.
Specify the CC-Link baudrate
0 : 156 kbps
1 : 625 kbps
2 : 2.5 Mbps
3 : 5 Mbps
4 : 10 Mbps

(Type of master) : Specify the type of the field bus master.
As the byte order (endian) differs with the master, specify the type according to the master.
0 : 16-bit big endian (A1SJH made by MELSEC)
1 : 16-bit little endian
2 : 32-bit big endian
3 : 32-bit little endian

Example setting : When the CC-Link is selected, the node address is 2, the baudrate is 156 kbps and MELSEC's A1SJH is used as the master module:
[U16] FIELD BUS
{Type / Node Addr / Speed / Byte Order}
= 144 2 0 0

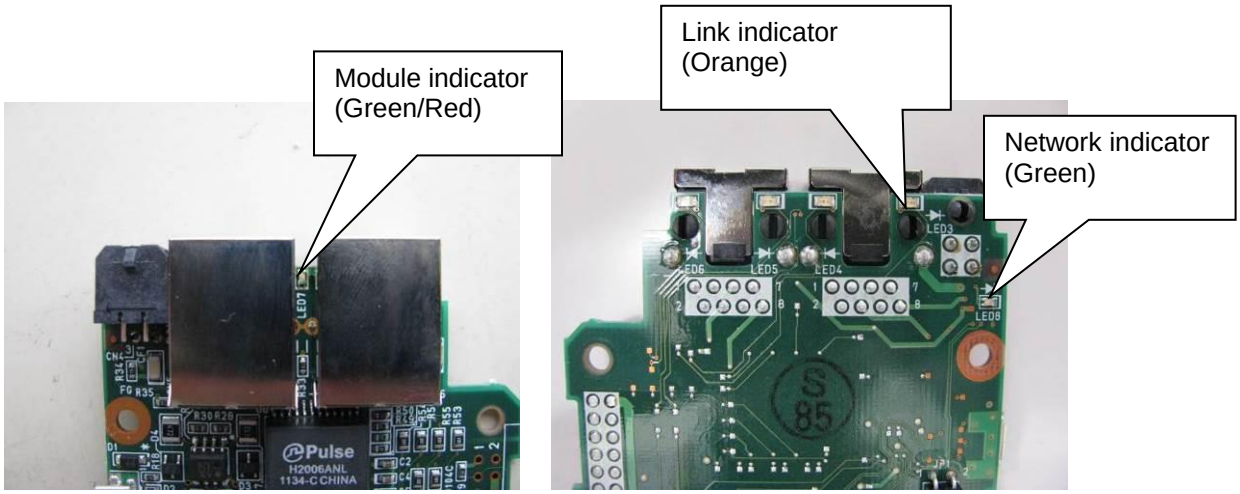
Example setting : When the field bus slave module is neglected:
[U16] FIELD BUS
{Type / Node Addr / Speed / Byte Order}
= –1 –1 –1 –1

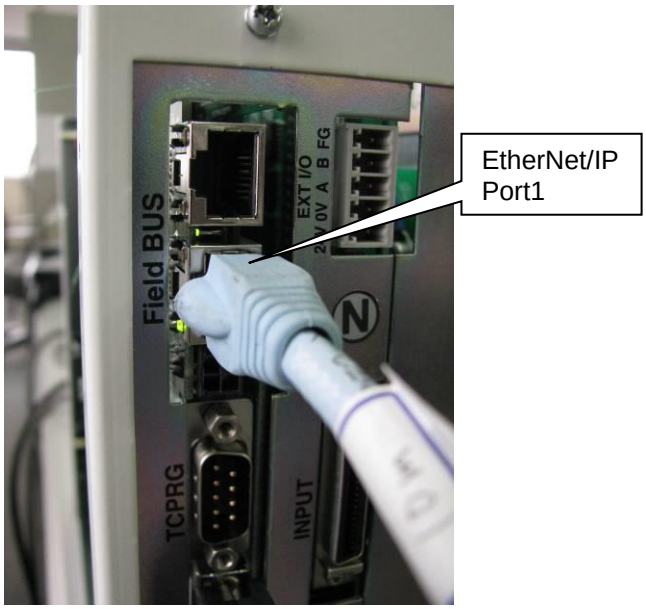
3.4. EtherNet/IP Slave Module

3.4.1. EtherNet/IP Specifications

Field bus specifications	EtherNet/IP
Module name	W9XO
Module type	Scanner
Master device	16-bit little endian device 16-bit big endian device (e.g., KV-5500 made by Keyence)
Node address	Not used. Specify 0 as the node address of user parameter.
EDS file	Each device on the EtherNet/IP network relates to the EDS file containing all required information on the devices. The EDS file is used during network configuration. The basic settings can be made by loading this file. **The EDS file is contained in the Instruction Manual CD.**
Number of inputs	128 numbers (DIN301 to DIN364, DIN401 to DIN464)
Number of outputs	128 numbers (DOUT301 to DOUT364, DOUT401 to DOUT464)
Software version	Main part: X8GCAS-12A or later PLC part: X8YCC-06B (I/O function only) X8YCC-07A or later

3.4.2. EtherNet/IP LED indication





Module status indicator

- OFF power off
- Green lighting device operation
- Green blinking standby
- Red lighting major fault
- Red blinking minor fault
- Red/Green alternate blinking self-test

Network status indicator

- OFF power off
- Green lighting connect
- Green blinking No connect

Link status

- Orange blinking Link

3.4.3. Setting of EtherNet/IP User Parameter

The EtherNet/IP user parameter should be specified, using [U16] of USER.PAR file. The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
 [U16]FIELDBUS
= 3   0   0   1
```

(Type of field bus) : Specify the type of the field bus.
Specify "3" for EtherNet/IP.
-1 : Without any field bus option (initial value)
3 : EtherNet/IP

(Node) : Not used for EtherNet/IP. Specify "0".
-1 : Without any field bus option (initial value)
0 : EtherNet/IP

(Baudrate) : Not used for EtherNet/IP. Specify "0".
0 : EtherNet/IP

(Type of master) : Specify the type of the field bus master.
As the byte order (endian) differs with the master, specify the type according to the master.
0 : 16-bit big endian
1 : 16-bit little endian (KV-5500 made by Keyence)
2 : 32-bit big endian
3 : 32-bit little endian

Example setting 1: When the EtherNet/IP is selected and KV-5500 made by Keyence is used as the master module:
[U16] FIELDBUS
{Type / Node Addr / Speed / Byte Order}
= 3 0 0 1

Example setting 4 : When the field bus slave module is neglected:
[U16] FIELDBUS
{Type / Node Addr / Speed / Byte Order}
= -1 -1 -1 -1

3.4.4. Setting of EtherNet/IP Field Bus Parameter

The EtherNet/IP field bus parameter should be specified, using [F01] of the FIELDBUS.PAR file. The contents of [F01] are shown below.

= (IP address)
= (Subnet mask)
= (Gateway)

```
[F01] ETHERNET/IP SETTING
{IPAdress}
= 192.168.0.0
{Net Mask}
= 255.255.255.0
{GateWay}
= 0.0.0.0
```

(IP address) : Specify the IP address of EtherNet/IP itself.

(Subnet mask) : Specify the subnet mask to be connected.

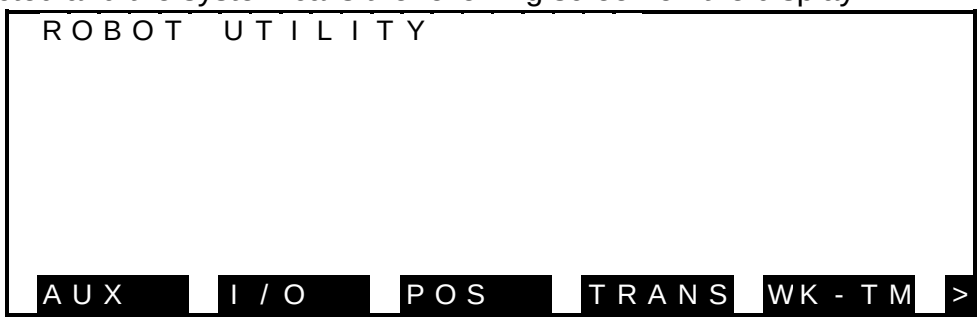
(Gateway) : Specify the default gateway address.

Example setting 1: When the EtherNet/IP is selected and KV-5500 is set as the followings:
IP address: 192.168.10.1
Subnet mask: 255.255.255.0
Gateway: 0.0.0.0
:
[F01] ETHERNET/IP SETTING
{IPAdress}
= 192.168.10.2
{Net Mask}
= 255.255.255.0
{GateWay}
= 0.0.0.0

3.4.5. Verifying EtherNet/IP Setting

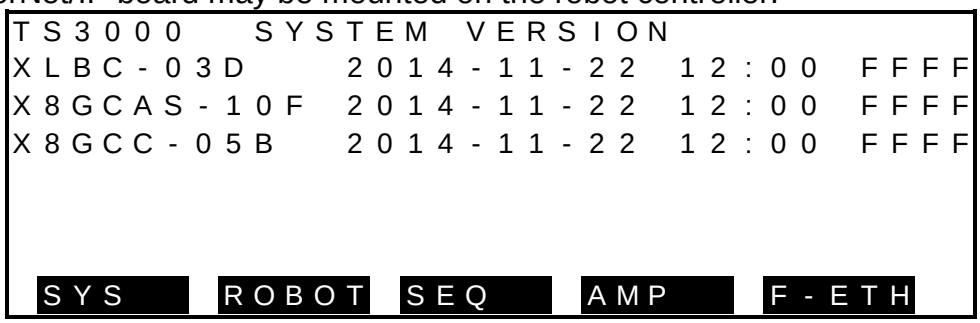
When the EtherNet/IP board is mounted, the board setting information can be confirmed in the utility mode. For detailed operation of the utility mode, see the operation manual provided separately. Follow the procedures shown below. (Confirm the field bus parameter setting and the board setting.)

Press the UTILITY key provided on the teach pendant, and the utility mode is selected and the system calls the following screen on the display.

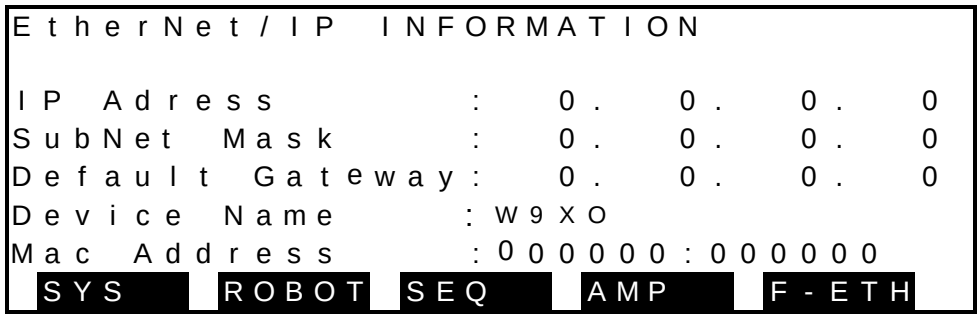


Press the NEXT key on the teach pendant twice. The system calls the following screen on the display.

Press the F4 key (VER) on the teach pendant, and the version information display appears. If the F-ETH is not shown, an optional board other than the EtherNet/IP board may be mounted on the robot controller.



Press the [F5] key ([F-ETH]) on the teach pendant, and the EtherNet/IP information display appears.



IP Address : IP address of the EtherNet/IP board itself described in "FIELDBUS.PAR" [F01].

SubNet Mask : Network subnet mask described in "FIELDBUS.PAR" [F01]

Default Getway : Default gateway address described in "FIELDBUS.PAR" [F01]

Device Name : Device name specified for the EtherNet/IP board itself
* "W9XO" is specified.

Mac Address : MAC address of the EtherNet/IP board itself

3.5. EtherCAT slave module

3.5.1. EtherCAT specifications

Field bus specifications	EtherCAT
Module name	W9XO
Module type	Slave
Master device	16-bit little endian device 16-bit big endian device (e.g., NJ-301 made by OMRON)
Node address	The value is changed by an upper sequencer. When a sequencer made by OMRON (NJ series) is used, specify 1 as the node address of user parameter.
xml file	Each device on the EtherCAT network relates to the xml file containing all required information on the devices. The xml file is used during network configuration. The basic settings can be made by loading this file. **The xml file is contained in the Instruction Manual CD.**
Number of inputs	128 numbers (DIN301 to DIN364, DIN401 to DIN464)
Number of outputs	128 numbers (DOUT301 to DOUT364, DOUT401 to DOUT464)
Support function	Conformance Test Tool 1.20.80.0 / EtherCAT State Machine / Indicator and Labeling / CoE Mailbox Protocol CiA402 Profile(Not support) / Distributed Clocks(Not support) / Semi Device Profile(Not support) / Explicit Device ID(Not support)
Software version	Main part: X8GCAS-13A or later PLC part: X8YCC-07A or later

*This series is compatible with EtherCAT®.

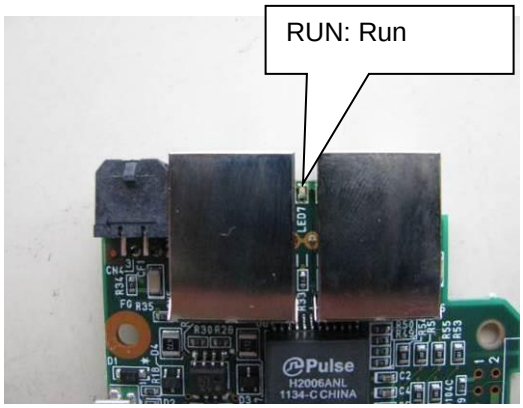
Registered trademark

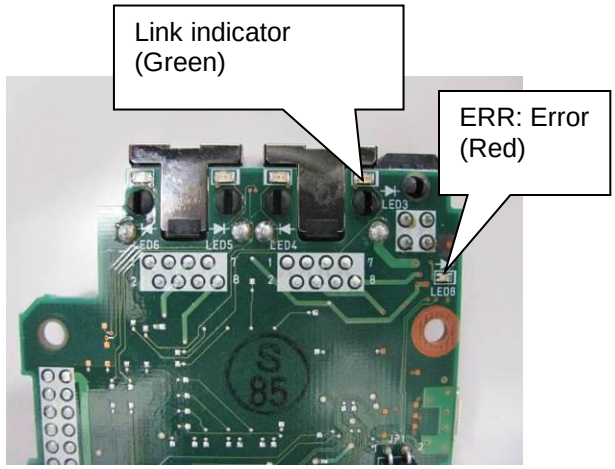
EtherCAT®, licensed by Beckhoff Automation GmbH based in Germany, is a patented technology and a registered trademark.

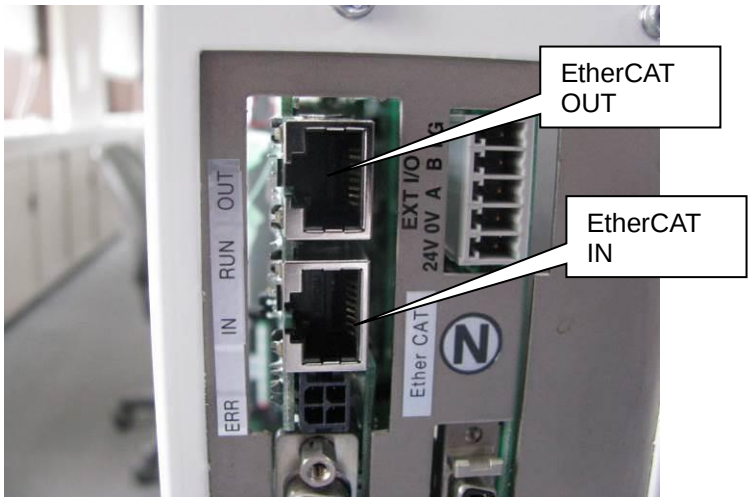
Reference

- ETG.1000.5 EtherCAT Specifications Part5 Application Layer Service Definition
- ETG.1000.6 EtherCAT Specifications Part6 Application Layer Protocol Specifications
- ETG.1300 Indicator and Labeling Specification
- ETG.6010 Implementation Directive for CiA402
- ETG.9001 EtherCAT Marking Rules

3.5.2. EtherCAT LED indication







Link indicator (Green)

- ON Port open
- Green blinking Port open

RUN status indicator (Green)

- OFF Initialization
- Green blinking Pre-operational
- Green lighting once Safe-operational
- ON Operational
- Green quick blinking Initialization

ERROR status indicator (Red)

- ON Application controller failure
- Red blinking twice Watchdog timeout
- Red blinking once Local Error
- Red blinking Invalid configuration
- Red quick blinking Booting Error
- OFF No Error

3.5.3. Setting of EtherCAT User Parameter

The EtherCAT user parameter should be specified, using [U16] of the USER.PAR file. The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
 [U16]FIELDBUS
= 4   0   0   1
```

(Type of field bus) : Specify the type of the field bus.
Specify "4" for EtherCAT/IP.
-1 : Without any field bus option (initial value)
4 : EtherCAT

(Node) : Not used for EtherCAT. Specify "0".
-1 : Without any field bus option (initial value)
0 : EtherCAT

(Baudrate) : Not used for EtherCAT. Specify "0".
0 : EtherCAT

(Type of master) : Specify the type of the field bus master.
As the byte order (endian) differs with the master, specify the type according to the master
0 : 16-bit big endian
1 : 16-bit little endian (NJ series made by OMRON)
2 : 32-bit big endian
3 : 32-bit little endian

Example setting 1: When the EtherCAT is selected and NJ series made by OMRON is used as the master module:

```
[U16]   FIELDBUS
{Type / Node Addr / Speed / Byte Order}
= 4   0   0   1
```

Example setting 4: When the field bus slave module is neglected:

```
[U16]   FIELDBUS
{Type / Node Addr / Speed / Byte Order}
= -1   -1   -1   -1
```

3.5.4. Setting of EtherCAT Field Bus Parameter

The EtherCAT field bus parameter should be specified, using [F02] of the FIELDBUS.PAR file.

The contents of [F02] are shown below.

= (Node address)

```
[F02] EtherCAT SETTING
{0: DISABLE, 1-255: ENABLE}
= 0
```

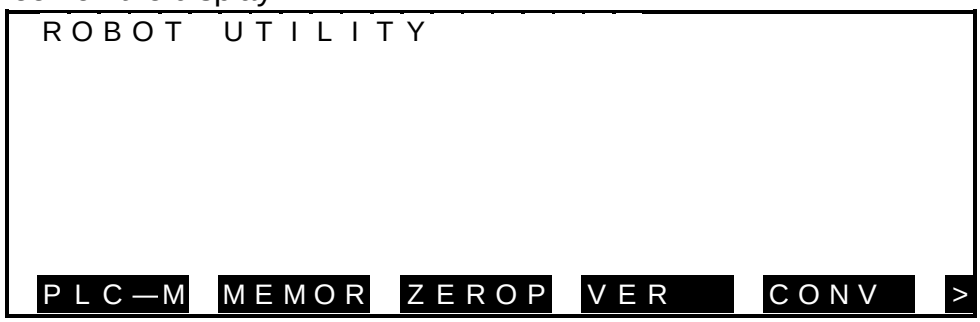
(Node address) : Specify the node address of the EtherCAT itself.

3.5.5. Verifying EtherCAT Setting

When the EtherCAT board is mounted, the board setting information can be confirmed in the utility mode. For detailed operation of the utility mode, see the operation manual provided separately. Follow the procedures shown below. (Confirm the field bus parameter setting and the board setting.)

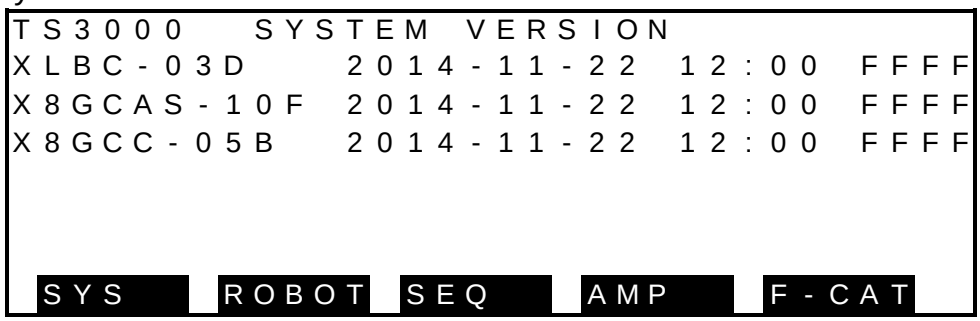
Press the UTILITY key provided on the teach pendant, and the utility mode is selected and the system calls the following screen on the display.

Press the NEXT key on the teach pendant twice. The system calls the following screen on the display.

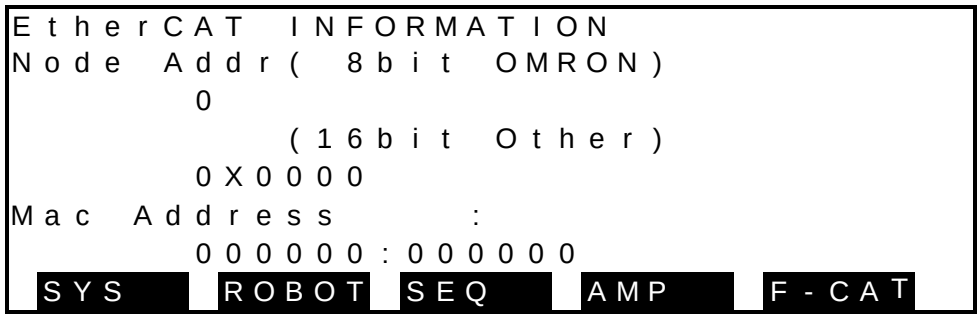


Press the F4 key (VER) on the teach pendant, and the version information display appears.

If the F-CAT is not shown, an optional board other than the EtherCAT board may be mounted on the robot controller.



Press the F5 key (F-CAT) on the teach pendant, and the EtherCAT information display appears.



Node Addr : Node address of the EtherCAT board itself described in "FIELDBUS.PAR" [F02]

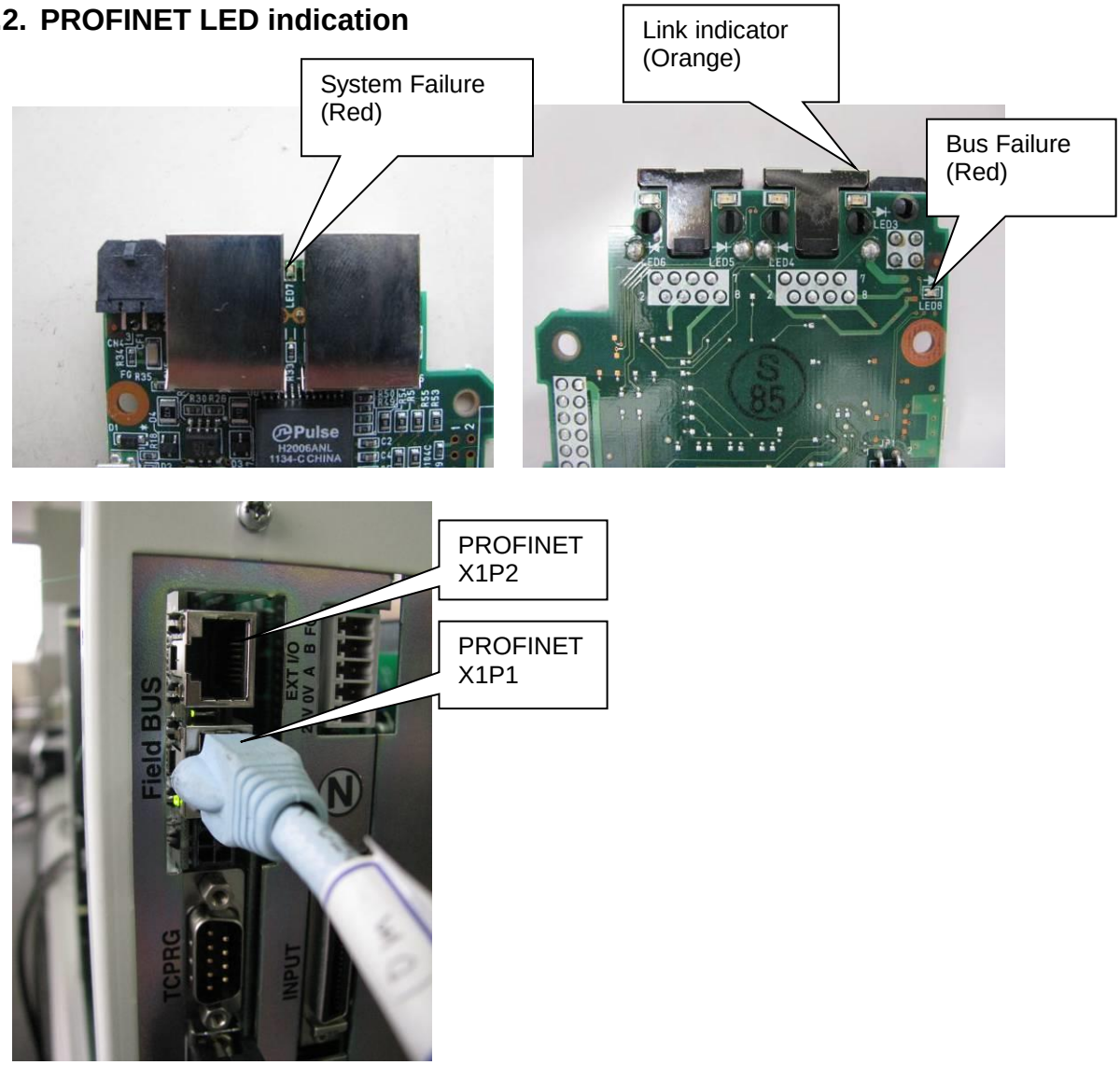
Mac Address : MAC address of the EtherCAT board itself

3.6. PROFINET slave module

3.6.1. PROFINET specifications

Field bus specifications	PROFINET
Module name	W9XO
Module type	IO-device
Master device	16-bit little endian device 16-bit big endian device (e.g., SIMATIC S7-1200 made by Siemens K.K.)
Node address	Not used. Specify 0 as the node address of user parameter.
GSDML file	Each device on the PROFINET network relates to the GSDML file containing all required information on the devices. The GSDML file is used during network configuration. The basic settings can be made by loading this file. **The GSDML file is contained in the Instruction Manual CD.**
Number of inputs	128 numbers (DIN301 to DIN364, DIN401 to DIN464)
Number of outputs	128 numbers (DOUT301 to DOUT364, DOUT401 to DOUT464)
Software version	Main part: X8GCAS-14A or later PLC part: X8YCC-08A or later

3.6.2. PROFINET LED indication



System failure indicator

- Red lighting system failure

Bus failure indicator

- Red lighting bus failure

Link status

- Orange blinking Link

3.6.3. Setting of PROFINET User Parameter

The PROFINET user parameter should be specified, using [U16] of the USER.PAR file.
The contents of [U16] are shown below.

= (Type of field bus) (Node) (Baudrate) (Type of master)

```
[U16] FIELDBUS
= 5   0   0   1
```

(Type of field bus) : Specify the type of the field bus.
Specify "5" for PROFINET.
-1 : Without any field bus option (initial value)
5 : PROFINET

(Node) : Not used for PROFINET. Specify "0."
-1 : Without any field bus option (initial value)
0 : PROFINET

(Baudrate) : Not used for PROFINET. Specify "0."
0 : PROFINET

(Type of master) : Specify the type of the field bus master.
As the bit order (endian) differs with the master, specify the type according to the master.
0 : 16-bit big endian
1 : 16-bit little endian (SIMATIC S7-1200 made by Siemens K.K.)
2 : 32-bit big endian
3 : 32-bit little endian

Example setting 1: When PROFINET is selected and SIMATIC S7-1200 made by Siemens K.K. is used as the master module:

```
[U16]   FIELDBUS
{type / Node Addr / Speed / Byte Order}
= 5   0   0   1
```

Example setting 2: When the field bus slave module is neglected:

```
[U16]   FIELDBUS
{type / Node Addr / Speed / Byte Order}
= -1   -1   -1   -1
```

3.6.4. Setting of PROFINET field bus parameter

The PROFINET field bus parameter should be specified, using [F01] of the FIELDBUS.PAR file.
The contents of [F03] are shown below.

= (Device name)
= (IP address)
= (Subnet mask)
= (Gateway)

```
[F03] PROFINET SETTING
{Device Name}
= "??????"
{IPAdress}
= 192.168.0.0
{Net Mask}
= 255.255.255.0
{GateWay}
= 0.0.0.0
```

(Device name) : Specify the device name using up to 15 characters.
(IP address) : Specify the IP address of EtherNet/IP itself.
(Subnet mask) : Specify the subnet mask of the network to be connected.
(Gateway) : Specify the default gateway address.

Example setting 1 : When PROFINET is selected and SIMATIC S7-1200 made by Siemens K.K. is set as follows:
IP address: 192.168.10.1
Subnet mask: 255.255.255.0
Gateway: 0.0.0.0

```
[F03] PROFINET SETTING
{Device Name}
= "W9XO"
{IPAdress}
= 192.168.10.2
{Net Mask}
= 255.255.255.0
{GateWay}
= 0.0.0.0
```

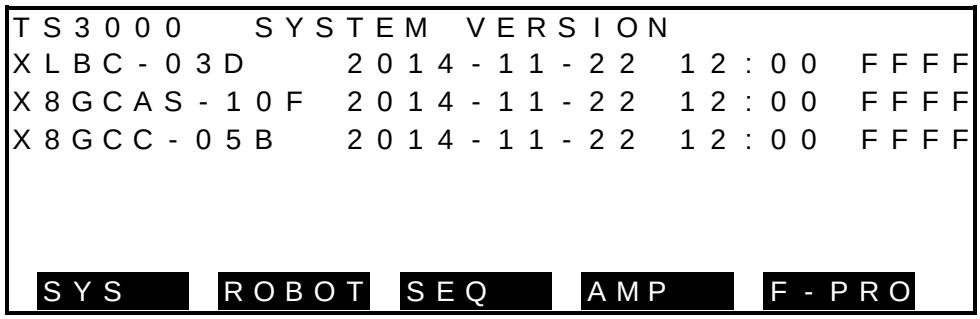
3.6.5. Verifying PROFINET setting

When the PROFINET board is mounted, the board setting information can be confirmed in the utility mode. For detailed operation of the utility mode, see the Operation Manual provided separately. The procedures are shown below. (Confirm the field bus parameter setting and the board setting.)

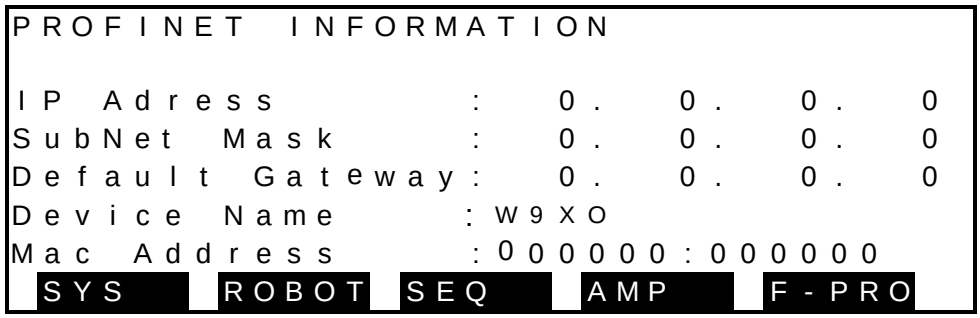
Press the UTILITY key provided on the teach pendant, and the utility mode is selected and the system calls the following screen on the display.

Press the NEXT on the teach pendant twice. The system calls the following screen on the display.

Press the F4 key (VER) on the teach pendant, and the version information display appears.
If F-PRO is not shown, an optional board other than the PROFINET board may be mounted on the robot controller.



Press the [F5] key ([F-PRO]) on the teach pendant, and the PROFINET information display appears.



IP Address : IP address of the PROFINET board itself described in "FIELDBUS.PAR" [F03]

SubNet Mask : Subnet mask of the network described in "FIELDBUS.PAR" [F03]

Default Gateway : Default gateway address described in "FIELDBUS.PAR" [F03]

Device Name : Device name (Name of station) described in "FIELDBUS.PAR" [F03]

Mac Address : MAC address of the PROFINET board itself

4. Field Bus Parameter (FIELDBUS.PAR)

The following parameters are used for field bus functions. Specify the detailed setting of EtherNet/IP, EtherCAT, and PROFINET communication in this parameter. This parameter is not used for PROFIBUS, and CC-Link specification. Use the default setting as is.

No.	Data Name	Application	Initial Value
1	[F00] FIELDBUS {type / Node Addr / Speed / Byte Order}	(Not used)	-1 -1 -1 -1
2	[F01] ETHERNET/IP SETTING		
	IPAdress	Specify the IP address of EtherNet/IP itself.	192.168.0.0
	Net Mask	Specify the subnet mask of the network to be connected.	255.255.255.0
	GateWay	Default gateway address	0.0.0.0
3	[F02] ETHERCAT SETTING {Node Addr} {0: THA1-255 ENABLE}	Specify the node address of the EtherCAT.	0
4	[F03] PROFINET SETTING		
	Print Device Name	Specify the device name (Name of station) using up to 15 characters.	?????
	IPAdress	Specify the IP address of PROFINET itself	192.168.0.0
	Net Mask	Specify the subnet mask of the network to be connected	255.255.255.0
	GateWay	Default gateway address	0.0.0.0
5	[F04] DEVICENET I/O SIZE {0:16byte 1:64byte}	Specify the number of I/O points used for DeviceNet.	0

4.1. Field Bus

[F00] FIELDBUS

* This parameter is not used.
  Set to the user parameter (USER.PAR) [U16].

4.2. Setting of EtherNet/IP

[F01] ETHERNET/IP SETTING

EtherNet/IP, IP address
{IPAdress}

Specify the IP address of the EtherNet/IP itself.

Data type : Integer
Data unit : None
Data range : 0 to 255
Example value : =192.168.10.2

- An IP address is like an address for identification of an EtherNet connection device.
- An IP address consists of four numbers ranging 0 to 255 and "." (periods) between them. When the EtherNet/IP is directly connected to the computer that is connected directly to a network one-on-one, an initial IP address (arbitrary) can be used. When connected to the existing LAN, however, specify the IP address according to an instruction of your LAN system administrator. If the IP address is duplicated, the functions cannot work correctly.
- The computer or PLC to be communicated with EtherNet/IP needs to be connected on the same network.

EtherNet/IP, net mask
{Net Mask}

Specify the subnet mask of the network to be connected.

Data type : Integer
Data unit : None
Data range : 0 to 255
Example value : = 255.255.255.0

For connecting to the existing LAN. Specify the subnet mask according to an instruction of your LAN system administrator.

EtherNet/IP, gateway
{GateWay}

Specify the default gateway address.

Data type : Integer
Data unit : None
Data unit : 0 to 255
Example value : = 192.168.10.1

For connecting to the existing LAN. Specify the default gateway address according to an instruction of your LAN system administrator.

4.3. Setting of EtherCAT

[F02] ETHERCAT SETTING

EtherCAT, node address
{Node Addr}

Specify the node address of the EtherCAT itself.
Setting : (Example) = 1 (Node address)
Data type : Integer
Data unit : None
Data range : 0 to 255
Description : Address for identification of EtherCAT connection device
0 : Ineffective
1 to 255 : Effective

4.4 Setting of PROFINET

[F03] PROFINET SETTING

PROFINET, device name (Name Of station)
{Device Name}

Specify the device name of PROFINET itself.
Setting : = (Specify the device name.)
Data type :
Data unit : None
Data range : Up to 15 alphanumeric characters, '-' or '.'
Example value : = "XXXXX"

- Character string in which up to 15 alphanumeric characters and '-' and '.' Are used to specify the device name
- This character string is used for initial setting of PROFINET.
- When the device name is specified externally, up to 240 characters can be used. However, up to 15 characters can only be displayed on the teach pendant.

PROFINET, IP address
{IPAdress}

Specify the IP address of the PROFINET itself.

Data type : Integer
Data unit : None
Data range : 0 to 255
Example value : = 192.168.10.2

- An IP address is like an address for identification of an EtherNet connection device.
- An IP address consists of four numbers ranging 0 to 255 and "." (periods) among them.
  When the PROFINET is to be directly one-to-one connected to the personal computer that is connected to a network, an initial IP address (arbitrary) can be used. For connecting to the existing LAN, however, specify the IP address according to an instruction of your LAN system administrator.
  If the IP address is duplicated, the functions cannot work correctly.
- The personal computer or PLC to be communicated with PROFINET needs to be connected on the same network.

PROFINET, net mask
{Net Mask}

Specify the subnet mask of the network to be connected.

Data type : Integer
Data unit : None
Data range : 0 to 255
Example value : = 255.255.255.0

For connecting to the existing LAN, specify the subnet mask according to an instruction of your LAN system administrator.

PROFINET, gateway
{GateWay}

Specify the default gateway address.

Data type : Integer
Data unit : None
Data range : 0 to 255
Example value : = 192.168.10.1

For connecting to the existing LAN, specify the default gateway address according to an instruction of your LAN system administrator.

4.5. Setting of DeviceNet

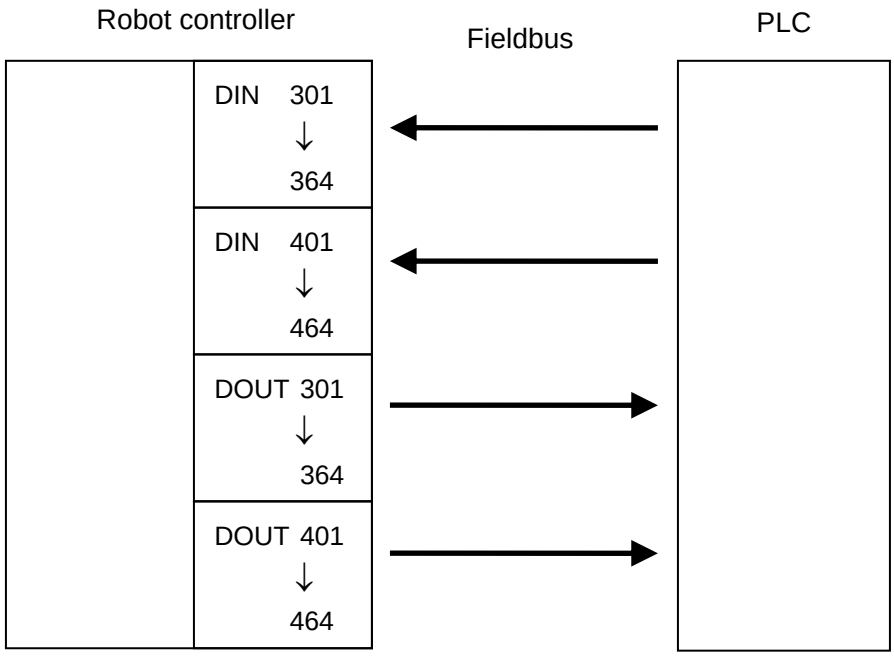
[F04] DEVICENET I/O SIZE

Setting of the number of I/O points used for DeviceNet

Specify the number of I/O points used for DeviceNet.

Data type : Integer
Data unit : None
Data range : 0 or 1
Example value : 1
Description : Specify the number of I/O points used for DeviceNet.
0: 128 points each for input and output
1: 512 points each for input and output

5. Input/Output Addresses



6. Error Detection

Field bus slave function detects the following alarms.

- 8-353 Field bus Parameter error
  The field bus parameter set value is wrong. Reset the parameter and then turn the power supply off, then on again.

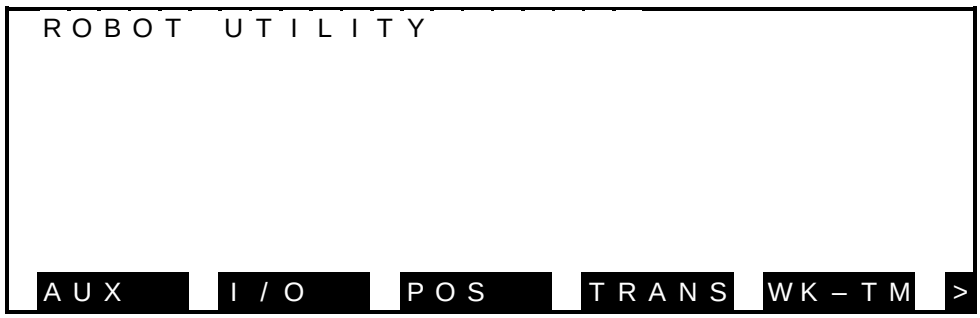
- 8-354 Field bus Offline
  The controller and master device side are offline status. This error will be retained until changed to an online status. This error brings the moving robot to an emergency stop. Check to find out the detailed causes for the offline status on the field bus master device side.

- 8-355 Field bus Board error
  There has been a discrepancy between the set parameter and the installed printed board. Alternatively, the printed board has not been installed. Reset the parameter and then turn the power supply off, then on again.

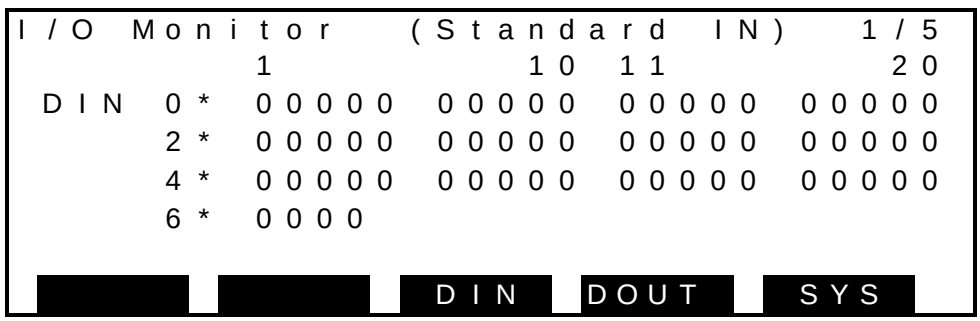
7. Verifying Motion

The field bus input signals are assigned to **DIN301 to DIN364** and **DIN401 to DIN464**. The field bus output signals are assigned to **DOUT301 to DOUT364** and **DOUT401 to DOUT464**.
Respective motions of the above signal cables can be confirmed in the utility mode. For detailed operation of the utility mode, see the operation manual provided separately.
Follow the procedures shown below.
(Make sure that the setting of the user parameter and field bus master have finished, and that no error is generated in the field bus or controller.)

Press the UTILITY key provided on the teach pendant, and the utility mode is selected and the system calls the following screen on the display.



Press the F2 key (I/O) on the teach pendant, and the external input/output signal display appears. The following standard input signal status display is shown.



Press the NEXT key or the "ALT + ⇩" keys three (3) times to call the page where the inputs from the field bus are displayed.
Now, you can make sure that the one-hundred-twenty-eight (128) field bus input signals assigned from the master side can be turned on and off.
The input or output signal status is "1" when the contact is closed. It is "0" when the contact is open. A total of twenty (20) signals, separated by every five (5) signals, are displayed on the same line with the leading signal number shown on the left end.

Page 1 (Field bus input)

```
I/O Monitor  (Fieldbus1 IN)  4/5
             1          10 11          20
 DIN30*  00000  00000  00000  00000
     32*  00000  00000  00000  00000
     34*  00000  00000  00000  00000
     36*  0000

                  DIN   DOUT   SYS
```

Page 2 (Field bus input)

```
I/O Monitor  (Fieldbus2 IN)  5/5
             1          10 11          20
 DIN40*  00000  00000  00000  00000
     42*  00000  00000  00000  00000
     44*  00000  00000  00000  00000
     46*  0000

                  DIN   DOUT   SYS
```

Press DOUT to call the output screen.
Press the NEXT key or the "ALT + ⇩" keys three (3) times to call the page where the outputs from the field bus are displayed.
Now, you can make sure that the one-hundred-twenty-eight (128) field bus output signals can be turned on and off.

The operative keys and contents of operation are listed below.

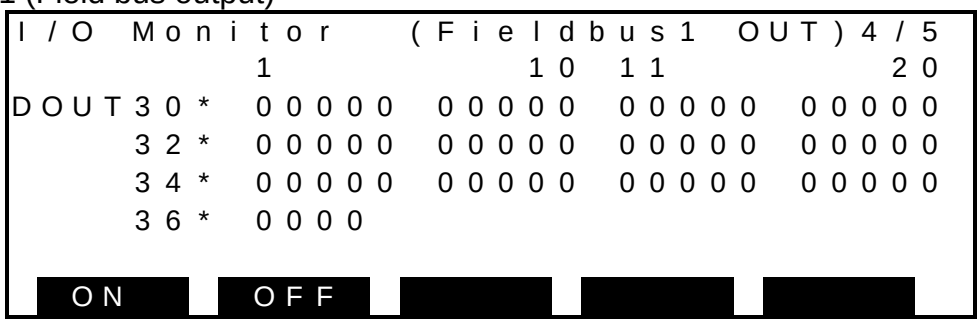
Key	Descriptions
←	Used to move the cursor to the left. When the cursor is located at the left end, it will not move any further.
→	Used to move the cursor to the right. When the cursor is located at the right end, it will not move any further.
↑	Used to move up the cursor. When the cursor is located at the top, it will not move any further.
↓	Used to move down the cursor. When the cursor is located at the bottom, it will not move any further.
ALT + ↓	Used to call the next page. When the final page is displayed, the page will not change over.
ALT + ↑	Used to call the previous page. When the first page is displayed, the page will not change over.
ESC	Used to return the system to the utility screen.

The operative soft keys and contents of operation are listed below.

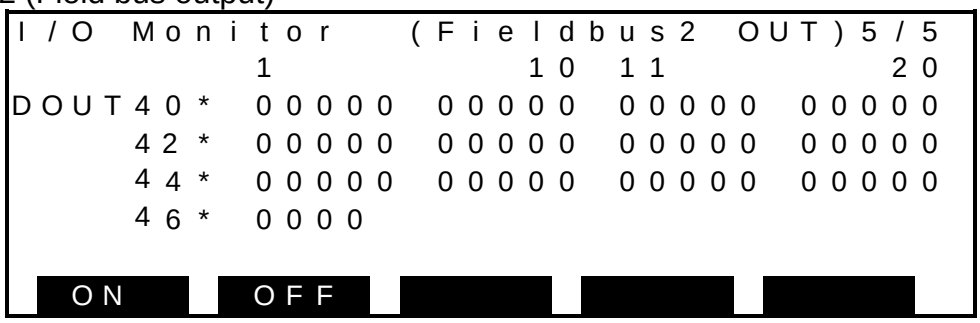
Key	Descriptions
[ON]	Turns on the bit indicated by the cursor.
[OFF]	Turns off the bit indicated by the cursor.

You can make sure that the signals assigned from the master side can be turned on and off.

Page 1 (Field bus output)



Page 2 (Field bus output)



8. How to Use SCOL Language Instruction

The field bus signals can be operated by the SCOL language instructions.
For details on how to use each instruction of the SCOL language, see the robot language instruction manual.

DIN	:	Reads the specified input signal status.
DOUT	:	Outputs the specified output signal.
RESET DOUT	:	Turns off the user's output signal.
PULOUT	:	Outputs the specified output signal in 0.2 second-interval pulse. The output time by the PULOUT instruction to this output area may be longer than 0.2 second, the normal DOUT output time.
BCDIN	:	Reads in BCD code the input signals whose length is four (4) times the specified signal length, starting from the specified signal.
BCDOUT	:	Converts the value of the expression into the BCD code and outputs the value equivalent to the number of digits as specified by the signal length to the output signals whose length is four (4) times the specified signal length, starting from the specified signal.
HEXIN	:	Reads in HEX code the input signals whose length is equivalent to the specified signal length, starting from the specified signal.
HEXOUT	:	Converts the value of the expression into the HEX code and outputs the value equivalent to the number of digits as specified by the signal length to the output signals whose length is equivalent to the specified signal length, starting from the specified signal.

8.1. Sample Program

This is the program in which the robot waits until input signal 301 turns on, then moves to taught points A1, A2 and A3.

```
PROGRAM    DINSAMPLE
WAIT DIN(301)
MOVE A1
MOVE A2
MOVE A3
END
DATA
POINT A3      =  1500.000,    0.000,    0.000,    0.000,    0.000 / RIGHTY
POINT A2      =  1500.000,    0.000,    0.000,    0.000,    0.000 / RIGHTY
POINT A1      =  1500.000,    0.000,    0.000,    0.000,    0.000 / RIGHTY
END
```

This program turns on and off output signals 301 through 316 in turn.

```
PROGRAM    DOUTSAMPLE
FOR K=301 TO 316
DOUT(K)
TIMER=0.5
WAIT TIMER==0
DOUT(-K)
NEXT K
END
```

9. Fieldbus System Signal Input/Output Function

This function assigns system signal input/output to the fieldbus.
The fieldbus assignment is switched on/off by setting the value of the row 1 column 1 (FUNCTION 1) of the user parameter [U35] SEQUENCE FUNCTION SELECT SWITCH as shown below.

0: Function off (This performs input/output of the system signal to the external operation input/output signal line (SYSTEM).)

1: Function on (The system signal input/output is assigned to the fieldbus. Input/output to the external operation input/output signal line (SYSTEM) is disabled.)

* This function is performed by the standard sequences of the Simple PLC built into the KSL3000. To change to a user-selected input/output, see 10. Simple PLC Function (TCmini) on the next section and the Simple PLC Function Operation Manual.

User parameter [U35] settings

Function Off setting

[U35] SEQUENCE FUNCTION SELECT SWITCH
= **0** 0 0 0 0 0 0 0

Function On setting

[U35] SEQUENCE FUNCTION SELECT SWITCH
= **1** 0 0 0 0 0 0 0

When set to 1, the system signal input/output is assigned to the fieldbus.

Fieldbus signal assignment

Input signals

Fieldbus input	When Function Off	When Function On
FIELDBUS_IN-113	DIN(449)	STROBE (Strobe)
FIELDBUS_IN-114	DIN(450)	PRG_RST (Program reset)
FIELDBUS_IN-115	DIN(451)	STEP_RST (Step reset)
FIELDBUS_IN-116	DIN(452)	CYC_RST (Cycle reset)
FIELDBUS_IN-117	DIN(453)	DO_RST (Output signal reset)
FIELDBUS_IN-118	DIN(454)	ALM_RST (Alarm reset)
FIELDBUS_IN-119	DIN(455)	RUN (Run)
FIELDBUS_IN-120	DIN(456)	EX_SVON (External input servo on)
FIELDBUS_IN-121	DIN(457)	STOP (Stop)
FIELDBUS_IN-122	DIN(458)	CYCLE (Cycle operation mode)
FIELDBUS_IN-123	DIN(459)	LOW_SPD (Low speed)
FIELDBUS_IN-124	DIN(460)	BREAK (Decelerate and stop)
FIELDBUS_IN-125	DIN(461)	SV_OFF (Servo off)
FIELDBUS_IN-126	DIN(462)	BZ_RST (Buzzer reset)

* For details on the system signals, see the Interface Operation Manual.

Output signals

Fieldbus output	When Function Off	When Function On
FIELDBUS_OUT-113	DOUT(449)	EMG_ST (Emergency stop state)
FIELDBUS_OUT-114	DOUT(450)	SV_RDY (Servo operation ready)
FIELDBUS_OUT-115	DOUT(451)	ACK (Acknowledge)
FIELDBUS_OUT-116	DOUT(452)	TEACH (Manual mode on)
FIELDBUS_OUT-117	DOUT(453)	INT (Internal mode on)
FIELDBUS_OUT-118	DOUT(454)	EXT_SIG (External mode on)
FIELDBUS_OUT-119	DOUT(455)	EXT_232C (External mode on)
FIELDBUS_OUT-120	DOUT(456)	SYS_RDY (Operation ready)
FIELDBUS_OUT-121	DOUT(457)	AUTO_RUN (Automatic operation on)
FIELDBUS_OUT-122	DOUT(458)	CYC_END (Cycle end)
FIELDBUS_OUT-123	DOUT(459)	LOW_ST (Low speed mode on)
FIELDBUS_OUT-124	DOUT(460)	BT_ALM (Battery alarm)
FIELDBUS_OUT-125	DOUT(461)	ALARM (Fault)
FIELDBUS_OUT-126	DOUT(462)	EXT_ETHER (External mode on)

* For details on the system signals, see the Interface Operation Manual.

10. Simple PLC Function (TCmini)

The KSL3000 robot controllers include a built-in Simple PLC (TCmini) function. The Simple PLC can be used to perform any input/output to the fieldbus.
The Simple PLC function is an option. This page provides only the tables of TCmini addresses that are input and output to and from the fieldbus. For details on the Simple PLC Function, see the Simple PLC Function Operation Manual.

10.1. Bit Input (FieldBUS→TCmini)

Address Table

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
X20W	FI16	FI15	FI14	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1
X21W	FI32	FI31	FI30	FI29	FI28	FI27	FI26	FI25	FI24	FI23	FI22	FI21	FI20	FI19	FI18	FI17
X22W	FI48	FI47	FI46	FI45	FI44	FI43	FI42	FI41	FI40	FI39	FI38	FI37	FI36	FI35	FI34	FI33
X23W	FI64	FI63	FI62	FI61	FI60	FI59	FI58	EI57	FI56	FI55	FI54	FI53	FI52	FI51	FI50	FI49
X24W	FI80	FI79	FI78	FI77	FI76	FI75	FI74	FI73	FI72	FI71	FI70	FI69	FI68	FI67	FI66	FI65
X25W	FI96	FI95	FI94	FI93	FI92	FI91	FI90	FI89	FI88	FI87	FI86	FI85	FI84	FI83	FI82	FI81
X26W	FI112	FI111	FI110	FI109	FI108	FI107	FI106	FI105	FI104	FI103	FI102	FI101	FI100	FI99	FI98	FI97
X27W	FI128	FI127	FI126	FI125	FI124	FI123	FI122	FI121	FI120	FI119	FI118	FI117	FI116	FI115	FI114	FI113

10.2. Bit Output (TCmimi→FieldBUS)

Address Table

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Y30W	FO16	FO15	FO14	FO13	FO12	FO11	FO10	FO9	FO8	FO7	FO6	FO5	FO4	FO3	FO2	FO1
Y31W	FO32	FO31	FO30	FO29	FO28	FO27	FO26	FO25	FO24	FO23	FO22	FO21	FO20	FO19	FO18	FO17
Y32W	FO48	FO47	FO46	FO45	FO44	FO43	FO42	FO41	FO40	FO39	FO38	FO37	FO36	FO35	FO34	FO33
Y33W	FO64	FO63	FO62	FO61	FO60	FO59	FO58	FO57	FO56	FO55	FO54	FO53	FO52	FO51	FO50	FO49
Y34W	FO80	FO79	FO78	FO77	FO76	FO75	FO74	FO73	FO72	FO71	FO70	FO69	FO68	FO67	FO66	FO65
Y35W	FO96	FO95	FO94	FO93	FO92	FO91	FO90	FO89	FO88	FO87	FO86	FO85	FO84	FO83	FO82	FO81
Y36W	FO11	FO11	FO11	FO10	FO10	FO10	FO10	FO10	FO10	FO10	FO10	FO10	FO10	FO99	FO98	FO97
Y37W	FO12	FO12	FO12	FO12	FO12	FO12	FO12	FO12	FO12	FO11	FO11	FO11	FO11	FO11	FO11	FO11

10.3. Data Input (FieldBUS→TCmini) * CCLink, EtherNet/IP, EtherCAT only

This function can only be used for CC-Link, EtherNET/IP, EtherCAT, and PROFINET.

Address Table

Register	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
D70*	FB RWr 16	FB RWr 15	FB RWr 14	FB RWr 13	FB RWr 12	FB RWr 11	FB RWr 10	FB RWr 9	FB RWr 8	FB RWr 7	FB RWr 6	FB RWr 5	FB RWr 4	FB RWr 3	FB RWr 2	FB RWr 1

10.4. Data Output (TCmini→FieldBUS) * CCLink, EtherNet/IP, EtherCAT only

This function can only be used for CC-Link, EtherNET/IP, EtherCAT, and PROFINET.

Address Table

Register	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
D74*	FB RWw 16	FB RWw 15	FB RWw 14	FB RWw 13	FB RWw 12	FB RWw 11	FB RWw 10	FB RWw 9	FB RWw 8	FB RWw 7	FB RWw 6	FB RWw 5	FB RWw 4	FB RWw 3	FB RWw 2	FB RWw 1

11. Simple PLC Function (Sample Connection Example)

This section explains the setting method for using an user PLC (e.g., KV-5500 made by Keyence) to control the robot controller with the EtherNet/IP specification. It is assumed that the program is set as follows.

[***] Description of simple PLC (TCmini) address in robot controller
[X20W~X27W] : Fieldbus input address
[Y30W~Y37W] : Fieldbus output address
[D700~D70F] : Data input address
[D740~D74F] : Data output address
[D460~D46F] : Data command address
[D660~D66F] : Data response address

[W00~W02F] : General-purpose input/output address in KV-5500 made by Keyence

■Example of user PLC assignment setting
<Fieldbus general-purpose I/O part>
Assign output of robot controller fieldbus to input of KV-5500 made by Keyence.
[Y30W~Y37W] → [W00~W07] 128 numbers

Assign output of KV-5500 made by Keyence to input of robot controller fieldbus.
[X20W~X27W] → [W018~W01F] 128 numbers

<Field bus PLC data part>
Assign output of robot controller fieldbus to input of KV-5500 made by Keyence.
[D740~D74F] → [W08~W017]

Assign output of KV-5500 made by Keyence to input of robot controller fieldbus.
[D700~D70F] → [W020~W02F]

The address [W00 to W02F] to be assigned varies depending on the maker of user PLC to be connected.

11.1. Operating the robot from user PLC

(1) Use the function in Section 9.

The value of the row 1 column 1 (FUNCTION 1) of the user parameter [U35] SEQUENCE FUNCTION SELECT SWITCH is set to 1 to assign input/output of system signal to fieldbus.

Input address table

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
[X20W]	FI16	FI15	FI14	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1
·																·
·																·
[X27W]	FI128	FI127	FI126	FI125	FI124	FI123	FI122	FI121	FI120	FI119	FI118	FI117	FI116	FI115	FI114	FI113

↓

[X27W]			BZ_ RST	SV OFF	BREA K	LOW_ SPD	CYCL E	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STRO BE

Output address table

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
[Y30W]	FO16	FO15	FO14	FO13	FO12	FO11	FO10	FO9	FO8	FO7	FO6	FO5	FO4	FO3	FO2	FO1
·																·
·																·
[Y37W]	FO128	FO127	FO126	FO125	FO124	FO123	FO122	FO121	FO120	FO119	FO118	FO117	FO116	FO115	FO114	FO113

↓

[Y37W]		EXT ETHER	ALARM	BT_ ALM	CYC _ST	LOW _ST	CYC _END	AUTO RUN	SYS_ RDY	EXT 232C	EXT SIG	INT	TEACH	ACK	SV_ RDY	EMG_ ST

Fieldbus input address [X27W] part and fieldbus output address [Y37W] part are switched from general-purpose input/output to system input/output signal.

(2) Since the value of [U35] has been changed, turn OFF and then ON the power to the robot controller to enable the parameter.

- Confirm whether robot controller information has been recognized by the user PLC. Conversely, write a value from the user PLC to confirm whether the signal perates.

<Example> Confirm that the program stop signal of the robot controller can be controlled by the user PLC.

- Set 1 to the 8th bit of user PLC [W01F] address and press UTILITY-[I/O]-[SYS]-NEXT buttons on the teach pendant. The following screen is displayed.
- Confirm that 1 is set in the item STOP on the teach pendant screen.

user PLC output address

[W01F]	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0

↓

Input address

[X27W]			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCL E	**STOP**	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STRO BE

Teach pendant screen

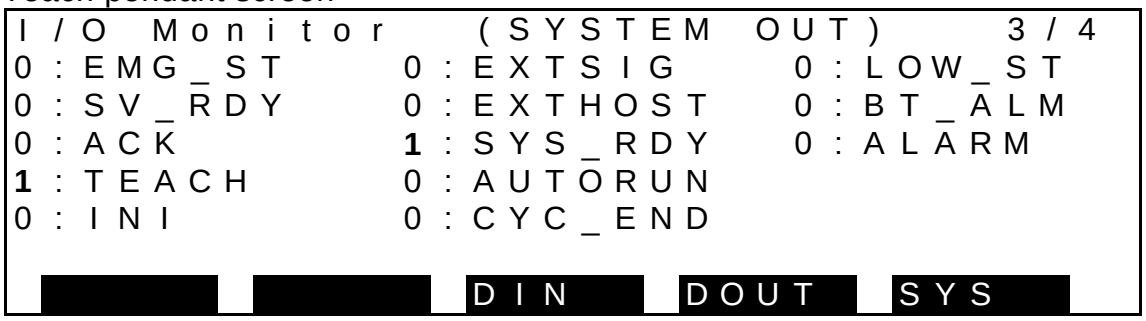
```
I/O Monitor    (SYSTEM IN)          2/4
0:STORBE       0:ALM_RST      1:STOP
0:PRG_RST      0:RUN          0:CYCLE
0:STEP_RST     0:EXT_SVON     0:LOW_SPD
0:CYC_RST                     0:BREAK
0:DO_RST                      0:SVOFF

          DIN      DOUT     SYS
```

- Then, confirm that the value of robot controller state changes in the user PLC. At this time, assume that the operation mode of robot controller is TEACH mode.

- Press the UTILITY-[I/O]-[SYS]-NEXT button on the teach pendant twice. The following screen is displayed

Teach pendant screen



Output address

[Y37W]	/	EXT ETHER	ALARM	BT_ ALM	CYC _ST	LOW _ST	CYC _END	AUTO RUN	**SYS_ RDY**	EXT 232C	EXT SIG	INT	**TEACH**	ACK	SV_ RDY	EMG_ ST

↓

user PLC input address

[W07]	0	0	0	0	0	0	0	0	**1**	0	0	0	**1**	0	0	0

- Confirm that 1 is set in 3rd and 7th bits of user PLC [W07] address.

(3) Input the servo ON signal from the user PLC.

- Press the ESC button until the screen [EDIT] that defaults to the teach pendant screen is displayed.
- Set the operation mode key of the robot controller to EXT.SIG mode.
- Press the ERR button on the teach pendant to confirm that there is no error. (The emergency stop switch is in released state.)
- Ensure safety around the robot.
- First, set 1 in the SVOFF signal, and then input a command to the EX_SVON signal from the user PLC so that it becomes a pulse signal (100 msec wide).

user PLC output address

[W01F]	0	0	0	**1**	0	0	0	0	**0→1 →0**	0	0	0	0	0	0	0

↓

Input address

[X27W]			BZ_ RST	**SV OFF**	BREAK	LOW_ SPD	CYCLE	STOP	**EX_ SVON**	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STRO BE

- Confirm that the SVON button on the teach pendant lights green. Also, confirm that 1 is set in the 1st bit SV_RDY of user PLC address [W07].

Output address

[Y37W]		EXT ETHER	ALARM	BT_ ALM	CYC _ST	LOW _ST	CYC _END	AUTO RUN	SYS_ RDY	EXT 232C	EXT SIG	INT	TEACH	ACK	**SV_ RDY**	EMG_ ST

↓

user PLC input address

[W07]	0	0	0	0	0	0	0	0	1	0	1	0	0	0	**1**	1

- Set 0 in the SVOFF signal to confirm that the SVON button on the teach pendant goes off. Also, confirm that 0 is set in the 1st bit SV_RDY of user PLC address [W07].

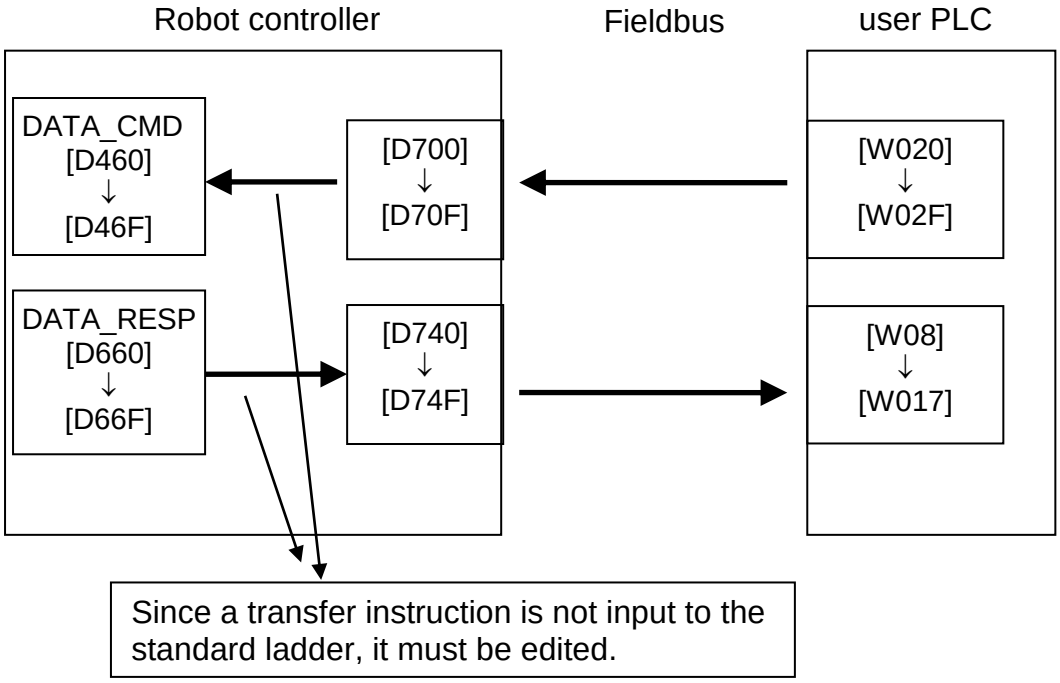
CAUTION

- After the servo is turned OFF, the servo cannot be turned ON for about 4.5 seconds to prevent internal breakage. After the servo is turned OFF, about 5 seconds or more elapse, then execute servo ON signal again. When the servo is turned ON for the third time, the interval time is 7 seconds.

11.2. Transmitting Robot Position Information to user PLC

The simple PLC data communication described in Chapter 12 of Simple PLC Function Manual is used. The joint coordinate position of the robot, the current position of world coordinate and the current position of work coordinate can be obtained by transmitting a command from the user PLC. These data items can be transmitted to the user PLC.

<Schematic diagram>



* If the software version of the PLC part of the robot controller is X8YCC-07B or later, the fieldbus data communication function can be enabled by changing the user parameter without needing to edit the standard ladder. In this case, the following steps (1) to (5) are not necessary.

<Fieldbus data communication function>

Set the value (FUNCTION 2) at row 1 column 2 of the user parameter [U35] SEQUENCE FUNCTION SELECT SWITCH to 1, and power off and on the robot controller to enable the function.

[U35] SEQUENCE FUNCTION SELECT SWITCH

= 0 **1** 0 0 0 0 0 0

The following is applied when the function is enabled.

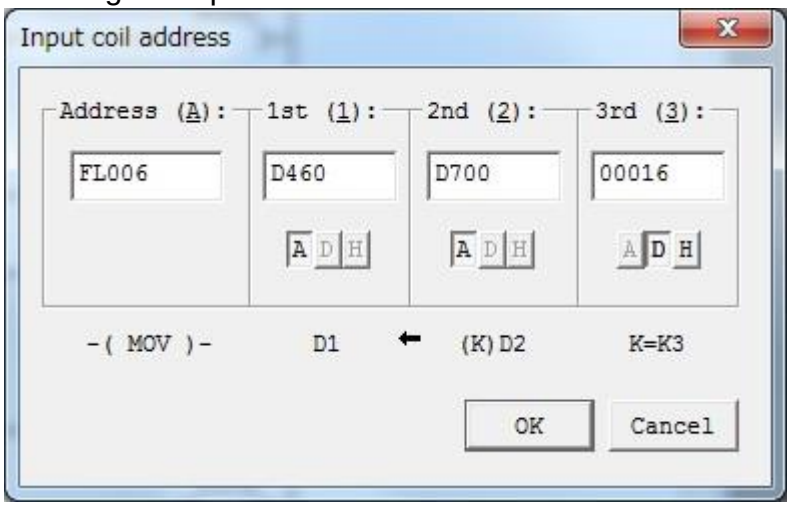
H10E: Command error signal → Assigned to fieldbus output (FO111)

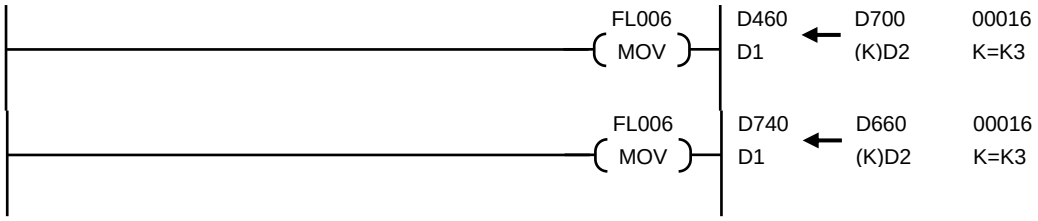
H10F: Response complete signal → Assigned to fieldbus output (FO112)
G10F: Request trigger signal → Assigned to robot program "DIN(448)"
D70*: Fieldbus data input register → Data is transferred to D46* (command set register)
D74*: Fieldbus data output register → Data is fetched from D66* (command response register)

(1) Use TCPRGOS software to edit the PLC ladder in the controller.

(2) Back up the standard ladder program to the personal computer.

(3) Add the coil to the last line of the ladder program and add two transfer instruction ladders as shown below.
Address : FL006, D1:D460, (K) D2:D700, K=K3:16
Address : FL006, D1:D740, (K) D2:D660, K=K3:16
<Setting example>





(4) Change the ladder program storage location in the robot controller. Change the user parameter [U15] from 0 to 3 and re-transmit the ladder program.

(5) Turn OFF and then ON the power to the robot controller and execute the re-transferred ladder program.

(6) Transmit a command from the user PLC.

Example: The current position command of the world coordinate in monitor mode.

Set user PLC address [W020]: 0xE311 and [W021]: 0x0000.

user PLC output address

[W02*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value															0	0x E311

↓

Data input address

[D70*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value															0	0x E311

↓

DATA_CMD input address

[D46*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value															0	0x E311

The current position of world coordinate can be obtained in [W08 to W017].

[D66*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Scara			Current position of world T coordinate		Current position of world C coordinate		Current position of world Z coordinate		Current position of world Y coordinate		Current position of world X coordinate		Posture		0	0x E311
6-axis	Current position of world C coordinate		Current position of world B coordinate		Current position of world A coordinate											

↓

Data output address

[D74*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	0x E311

↓

user PLC input address

[W0*]	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8
Value	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	0x E311

11.3. Transmitting a Teach Point from user PLC to Robot

The simple PLC data communication function described in Chapter 12 of Simple PLC Function Manual is used.

(1) In the same way as in the previous section, add a transfer instruction to the standard ladder. See Steps (1) to (5) in the previous section.

(2) Transmit teach point write command.

CAUTION

- The operation sequence in command mode is described in Chapter 12 of Simple PLC Function Manual.

Example: Transmit teach point data write command in command mode.

- Set user PLC address [W020]: 0xC2C1, [W021]: 0x0000, and any teach point data in each address [W022 to W02F].

user PLC output address

[W02*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	***	***	***	***	***	***	***	***	***	***	***	***	***	0	Table No.	0x C2C1

↓

Data input address

[D70*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	***	***	***	***	***	***	***	***	***	***	***	***	***	0	Table No.	0x C2C1

↓

DATA_CMD input address

[D46*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Scara			T coordinate value of teach point data		C coordinate value of teach point data		Z coordinate value of teach point data		Y coordinate value of teach point data		X coordinate value of teach point data		Posture	0	Table No.	0x C2C1
6-axis	C coordinate value of teach point data		B coordinate value of teach point data		A coordinate value of teach point data											

Status is input to [W08 to W017] to confirm whether the values have been set normally.

DATA_RESP output address

[D66*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value													0	Error code	Table No.	0x C2C1

↓

Data output address

[D74*]	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value													0	Error code	Table No.	0x C2C1

↓

user PLC input address

[W0*]	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8
Value													0	Error code	Table No.	0x C2C1

CAUTION

- Table No. represents the number of teach point data in the file selected as an execution file.
  Teach point data name must be created in the range from P001 to P999 in the file selected as the execution file and registered as teach point data.
- When you want to use the teach point data as the point data of array. Please change the number of the user parameter [U44] SIGNAL POINT DATA NAME CHANGE FUNCTION to "1". And then P(001)~P(999) and format are able to be changed.