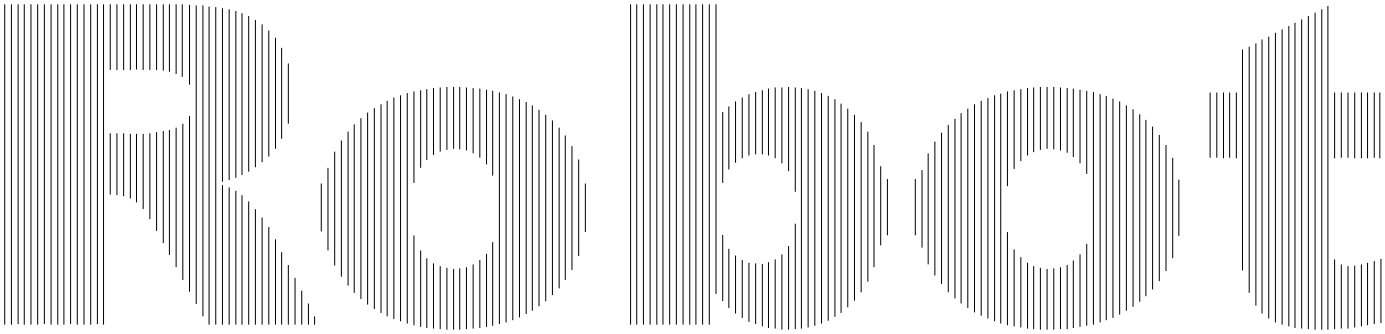
Simple and friendly

Kawasaki

Kawasaki Robot Controller
D/E Series

General Fieldbus I/O Usage Manual

(Option)



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PREFACE

This manual describes the General Fieldbus I/O Usage (Option) for Kawasaki Robot. This manual should be read with careful review of the separate basic manuals (including Safety Manual) delivered with the robot. Once the contents of all the manuals are thoroughly read and understood the robot can be used.

The manual provides as much detailed information as possible. However, not every possible operation, condition or situation that should be avoided can be described in full. Therefore, should any unexplained questions or problems arise during robot operation, please contact Kawasaki Machine Systems.

Most parts of this function are the same between D series controller and E series controller. Different parts are described with / (slash) in order of D series controller and E series controller.

1. This manual does not constitute a guarantee of the systems in which the robot is utilized. Accordingly, Kawasaki is not responsible for any accidents, damages, and/or problems relating to industrial property rights as a result of using the system.
2. It is recommended that all personnel assigned for activation of operation, teaching, maintenance or inspection of the robot attend the necessary education/training course(s) prepared by Kawasaki, before assuming their responsibilities.
3. Kawasaki reserves the right to change, revise, or update this manual without prior notice.
4. This manual may not, in whole or in part, be reprinted or copied without the prior written consent of Kawasaki.
5. Store this manual with care and keep it available for use at any time. If the robot is reinstalled or moved to a different site or sold off to a different user, attach this manual to the robot without fail. In the event the manual is lost or damaged severely, contact Kawasaki.

SYMBOLS

The items that require special attention in this manual are designated with the following symbols.

Ensure proper and safe operation of the robot and prevent physical injury or property damage by complying with the safety matters given in the boxes with these symbols.

⚠ DANGER

Failure to comply with indicated matters can result in imminent injury or death.

⚠ WARNING

Failure to comply with indicated matters may possibly lead to injury or death.

⚠ CAUTION

Failure to comply with indicated matters may lead to physical injury and/or mechanical damage.

[NOTE]

Denotes precautions regarding robot specification, handling, teaching, operation and maintenance.

⚠ WARNING

1. **The accuracy and effectiveness of the diagrams, procedures, and detail explanations given in this manual cannot be confirmed with absolute certainty. Should any unexplained questions or problems arise, please contact nearest Kawasaki.**
2. **Safety related contents described in this manual apply to each individual work and not to all robot work. In order to perform every work in safety, read and fully understand the safety manual, all pertinent laws, regulations and related materials as well as all the safety explanation described in each chapter, and prepare safety measures suitable for actual work.**

INTRODUCTORY NOTES

1. HARDWARE KEYS AND SWITCHES (BUTTONS)

The controller provides hardware keys and switches on the operation panel and the teach pendant for various kinds of operations. In this manual, the names of the hardware keys and switches are enclosed with a square as follows. The terms "key" or "switch" which should follow the relevant names are sometimes omitted for simpler expression. When pressing two or more keys at the same time, the keys are indicated by "+" as shown in the example below.

Examples

SELECT : expresses the hardware key "SELECT".

A + MENU : indicates pressing and holding down A then pressing MENU.

2. SOFTWARE KEYS AND SWITCHES

The controller provides software keys and switches which appear on the screen of the teach pendant for various kinds of operations depending on specifications and situations. In this manual, the names of software keys and switches are enclosed in parentheses "< >". The terms "key" or "switch" which should follow the relevant names are sometimes omitted for simpler expression.

Examples

<ENTER> : expresses an "ENTER" key that appears on the teach pendant screen.
<NEXT PAGE> : expresses a "NEXT PAGE" key on the teach pendant screen.

3. SELECTION ITEMS

Quite often an item must be selected from a menu or pull-down menu on the teach pendant screen. In this manual, the names of these menu items will be enclosed in brackets [XXX].

Examples

[BASIC SETTING] : expresses the item "BASIC SETTING" in a menu. To select it, press the "SELECT" key after moving the cursor to the relevant item by the arrow keys. For detailed description, this procedure should be described every time, but "select [XXX] item" will be used instead for simpler expression.

CONTENTS

1.0 OUTLINE

Kawasaki Robot Controller can build a field network in factory automation systems by connecting devices with various types of fieldbus. The motherboard (1JF (1QK)/1TJ board) / PCI adaptor board (1UQ board / 1YQ board) which is mounted with fieldbus interface cards, is inserted into the VME/PCI bus slot in the controller and is used to communicate with devices on the fieldbus system. Use fieldbus interface cards which comply with fieldbus standards.
Robot controller communicates with other controllers or peripheral equipment by transmitting ON/OFF information via I/O signals. The 1JF/1TJ motherboard and the external I/O board (1GW(1HW) /1TW board) installed into LOCAL bus slot can be used together at the same time.

An example of a system configuration using AnyBus-S-DeviceNet card is shown below.

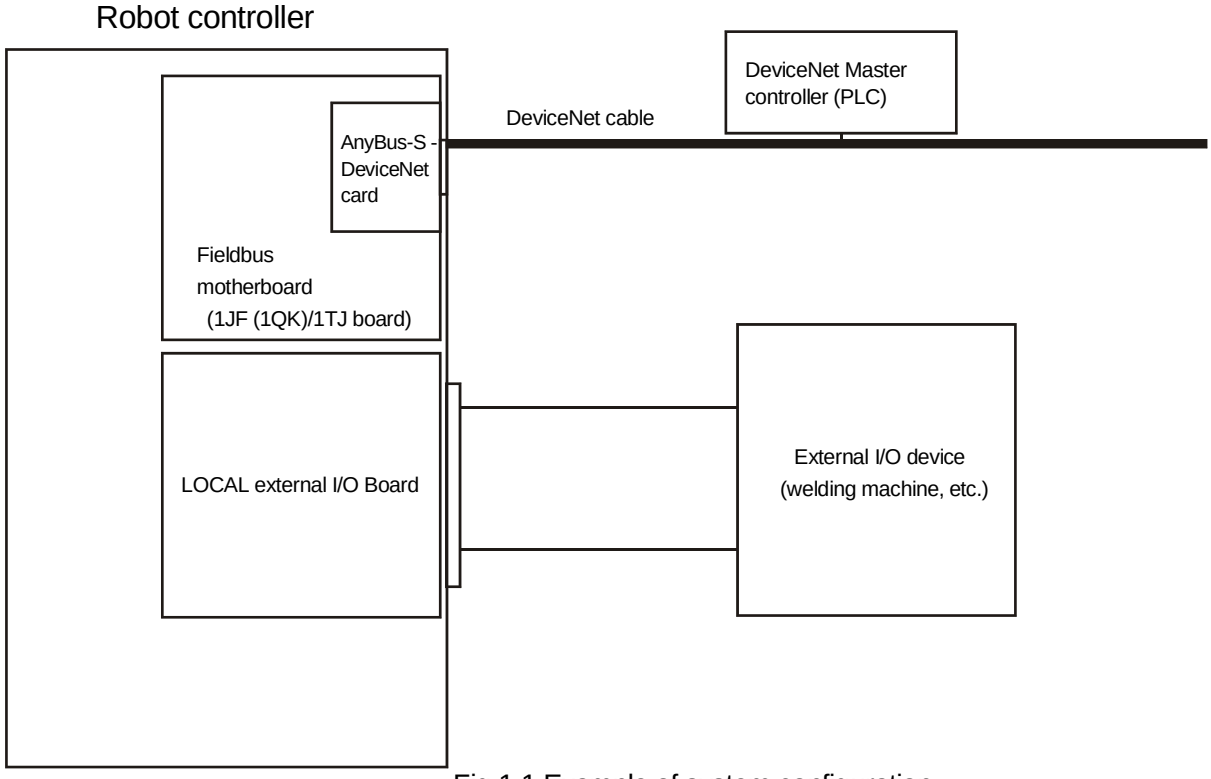


Fig.1.1 Example of system configuration

Five types of fieldbus are supported.

1. DeviceNet	Master/Slave
2. PROFIBUS-DP	Master/Slave
3. INTERBUS	Master/Slave
4. EtherNet/IP	Master/Slave
5. CC-Link	Master/Slave
6. Modbus-TCP	Slave
7. CANopen	Slave (Available only in E controller)
8. PROFInet	Master/Slave (Available only in E controller)
9. ControlNet	Slave (For D controller, available by using other option boards)

10. EtherCAT Slave (Available only in E controller)
11. CC-Link IE Slave (Available only in E controller)

For more details, see the Appendices and the Instruction manuals provided for each type of fieldbus.

1.1 COMPATIBLE FIELDBUS

The following sections describe a brief overview of the fieldbus supported by Kawasaki Controller. For details on each fieldbus refer to the Appendices or manuals provided the manufacturer.

1.1.1 DEVICENET

1.1.1.1 FEATURES OF DEVICENET

DeviceNet is a fieldbus system for connecting industrial devices, such as sensor, actuator, etc., to the controller and employs CAN (Controller Area Network) technology. CAN is based on broadcast oriented protocol. The features of Device Net are below:

1. Physical and transmission medium features:

(1) DeviceNet specific cable (twisted pair): Shielded cable composed of signal wire pairs and power wire pairs
(2) Master/Slave communication and Peer-to-Peer communication
(3) Trunkline/Dropline configuration
(4) Supports up to 64 nodes
(5) Node removal without shutting down severing the network.
(6) Supports both network powered (sensor) and self-powered devices (actuators)
(7) Use of open-style connectors
(8) Protection from wiring errors
(9) Baud rate can be selected from 125, 250 and 500 kbit/s.
(10) Adjustable power configuration to meet individual application needs
(11) High current capability (up to 16 A per power supply)
(12) Operation with off-the-shelf power supplies
(13) Power taps allow the connection of several power supplies from multiple vendors that comply with DeviceNet standards
(14) Built-in overcurrent protection
(15) Power available along the bus because signal and power lines are contained in the trunkline.

2. Communication characteristics

(1) Provisions for typical request/response oriented network communications
(2) Provisions for the efficient transfer of I/O data
(3) Data division for transferring larger volumes of information
(4) Network can be configured with up to 64 nodes. Each node on the network has a MAC_ID (node address) assigned 0 to 63.
(5) Duplicate MAC_ID detection

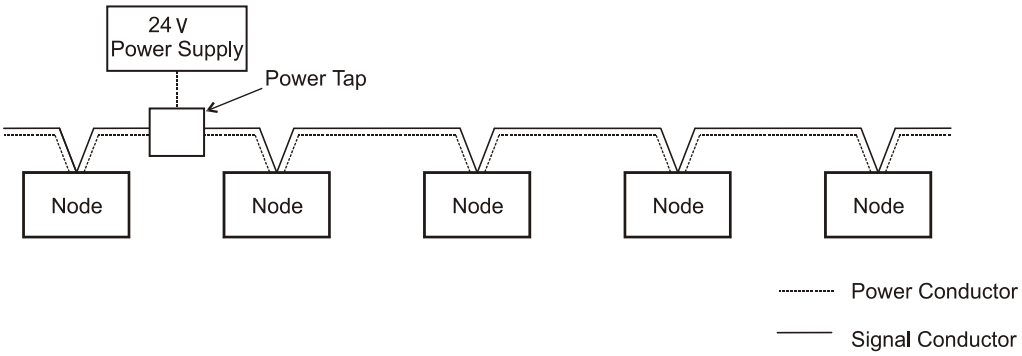


Fig. A1.1 Example outline of system configuration

1.1.1.2 SUPPORTING ORGANIZATIONS

Device Net is supported by a user organization, the Open DeviceNet Vendor Association (hereafter ODVA), made up of vendors who promote and manage the DeviceNet specifications. For more details on DeviceNet, refer to the web site below.

Web : http://www.odva.org

1.1.2 PROFIBUS

1.1.2.1 FEATURES OF PROFIBUS

PROFIBUS is a fieldbus system in compliance with EN50170 of European fieldbus standards. Three specifications in the PROFIBUS family are shown below.

1. PROFIBUS-FMS is object oriented model, effective for communications between intelligent stations, such as PLC, DCS and PC.
2. PROFIBUS-DP provides high speed data transmission between controller and remote I/O, drives etc., and is used for factory automation.
3. PROFIBUS-PA is used for process automation by supplying electric power via communication bus cable.

There are 3 device types for PROFIBUS-DP.
1. DP master class 1 (DPM1)
   Used for the central controller, such as PLC.
2. DP master class 2 (DPM2)
   Used for configuration diagnostics of DP system, and monitoring and evaluation of process data.
3. Slave
   Peripheral devices, such as binary, analog inputs/outputs, drives and valves, etc.

The controller supports DP master class 1 (DPM1) as PROFIBUS-DP interface.

Kawasaki Robot Controller uses PROFIBUS-DP, so hereafter PROFIBUS means PROFIBUS-DP, unless specified otherwise.

The features of PROFIBUS-DP are shown below.

1. Physical and transmission medium features:

(1) Transmission technique:PROFIBUS DIN 19245 Part1
   1) EIA RS 485 twisted pair or fiber optic cable
   2) Transmission speed: 9.6 kbit/s up to 12 Mbit/s, max. distance 200 m at 1.5 Mbit/s
   3) Extendible with repeaters

(2) Medium access:Hybrid medium access protocol based on DIN 19245 Part 1
   1) Mono-Master or Multi-Master systems supported

2) Master and Slave devices, max 126 stations possible per bus.

(3) Communications:Peer-to Peer (user data transfer) or Multicast (synchronization)
Cyclic Master-Slave transfer and acyclic Master-Master data transfer

(4) Bus access: Token passing

(5) Wiring and installation:Connecting or disconnecting of stations without affecting other stations

2. Communication characteristics

(1) Operation mode:

1) Operate: Cyclic transfer of input/output data
2) Clear: Input data are read and output data are cleared
3) Stop: Master-Master functions enabled

(2) Synchronization:Enables synchronization of I/O for DP-Slaves

1) Sync-Mode: Outputs are synchronized
2) Freeze-Mode: Inputs are synchronized

(3) Functions:

1) Cyclic data transfer between DP-Master and DP-Slave
2) Activation or deactivation of individual DP-Slave
3) Checking the configuration of the DP-Slave
4) Powerful diagnostic mechanisms, 3 levels of diagnostic messages
5) Synchronization of inputs/outputs
6) Address assignment of the DP-Slave over the bus
7) Configuration of the DP-Master (DPM1) over the bus
8) Max.244 bytes input and output data per DP-Slave, typical 32 bytes

(4) Security and protection mechanisms:

1) All messages are input and output data with Hamming Distance HD = 4
2) Watchdog timer at the DP-Slaves
3) Access protection for inputs/outputs at the DP-Slaves
4) Data transfer monitoring with configurable time interval at DP-Master (DPM1)

1.1.2.2 SUPPORTING ORGANIZATIONS

PROFIBUS is supported by an organization called PROFIBUS international (PI) and local profibus user organizations (PNO). For technical questions, contact your local profibus user organization. Refer to the web site: http://www.profibus.com

For general help on PROFIBUS, contact Profibus International via e-mail.

Profibus_international@compuserve.com

1.1.3 INTERBUS

1.1.3.1 FEATURES OF INTERBUS

INTERBUS is a fieldbus system used in various industries, e.g. automobile and food industry, plant construction, and process engineering, etc., to automate control of I/O units, sensors valves, etc.

The features are shown below.

1. Physical and transmission medium features:

(1) Transmission technique
   1) RS485 twisted pair cable (2 pair + GND)□
   2) Optical interface
   3) Transmission rate 500 kbit/s
   4) Total number of I/O signals: 4096

(2) Sub bus
   1) Local bus: Max. 8 nodes per local bus
   2) Installation remote bus (diverted from remote bus): Max. 256 nodes
   3) Remote bus (master dependent): Max. 256 nodes

(3) Max. bus cable length between
   1) Host and first remote bus module: 400 m
   2) Two remote bus modules: 400 m
   3) Host and last remote bus module: 12.8 km

(4) Medium access: Single-Master system supported

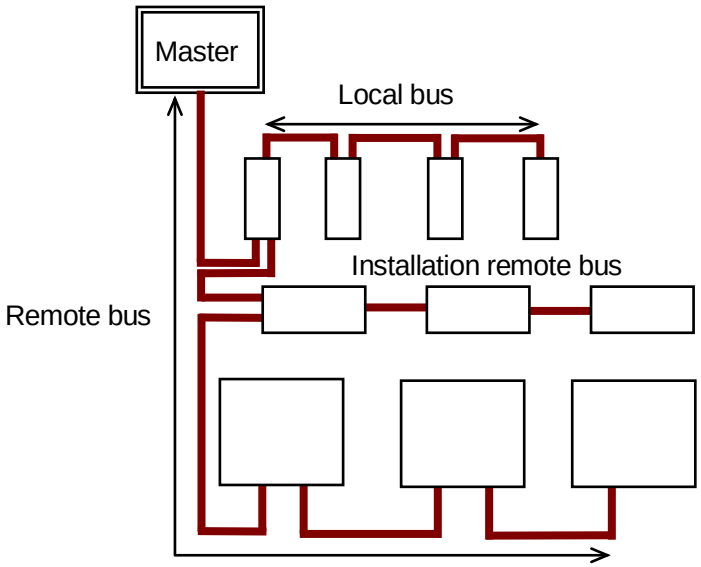
2. Communication characteristics

(1) Data types:1. Process data

1) Time deterministic
2) Shift register type
3) Total frame protocol
4) Cycle time dependent on number of I/O points

(2) Data types: 2. PCP object

1) Access protection of different levels in the PCP object area
2) Read and write protection



1.1.3.2 SUPPORTING ORGANIZATIONS

INTERBUS has a user organization called INTERBUS-Club, which supports INTERBUS. For more details on INTERBUS, refer to the web site below.

Web :http://www.interbusclub.com

1.1.4 ETHERNET/IP

1.1.4.1 FEATURES OF ETHERNET/IP

EtherNet/IP (Ethernet Industrial Protocol) has been standardized as a fieldbus system to answer to the demands from users to construct a single network system that controls both the production system and the information system for inventory management.

The features of EtherNet/IP card are shown below.

1. Physical and transmission medium features:

(1) An industrial network that takes advantage of commercial off-the-shelf Ethernet communication chips and physical media
(2) Shielded twist pair cable (twisted pair wire) or fiber optic cable
(3) Transmission speed: 10, 100 Mbit/s
(4) Connector RJ45, M12, fiber optic cable

2. Communication characteristics

(1) IEEE802.3 physical and open networking
(2) Ethernet TCP/IP protocols
(3) Open protocol for application layer (CIP: Control and Information Protocol)
CIP is a protocol standard proven for use in DeviceNet and in ControlNet. CIP data packet communicates data through TCP/UDP. Using a CIP router and connecting EtherNet/IP with DeviceNet or ControlNet enables data communication between different types of fieldbus network devices.

1.1.4.2 SUPPORTING ORGANIZATIONS

EtherNet/IP is a standard protocol supported by ControlNet International (CI), Industrial Ethernet Association (IEA) and Open DeviceNet Vendor Association (ODVA). For details on EtherNet/IP, refer to the web site below.

Web : http://www.odva.org

1.1.5 CC-LINK

1.1.5.1 FEATURES OF CC-LINK

CC-Link (Control & Communication Link) is a system that controls cable-connected units such as I/O units, intelligent function units, dedicated function units, etc., via sequencer CPU. There are the following station types:

Master Station:	Controls data link system
Remote I/O station:	Remote station that controls information only in bits.
Remote Device Station:	Remote station that controls information in bits and in words.
Local Station:	Station that communicates with the master station or other local stations via sequencer CPU.
Intelligent Device Station:	Station for transient transmission

Physical and transmission medium features and communication characteristics are as follows:

1. Physical and transmission medium features:

(1) Transmission path: Bus format
(2) Communication speed: 156 kbit/s to 10 Mbit/s
(3) Connection cable: CC-Link compatible cable (Shielded, 3-core twisted pair cable)
(4) Electric characteristics: EIA RS485 conformance

2. Communication characteristics:

(1) Communication system: Broadcast polling system
(2) Slave station number 1 to 64
(3) Maximum number of occupied station: 4 stations

(4) Maximum number of bit data (4 stations)

Version 1.0	Input 128 points Output 128 points
Version 2.0	Input 896 points Output 896 points

(5) Maximum number of word data (4 stations)

Version 1.0	Input 16 points Output 16 points
Version 2.0	Input 128 points Output 128 points

(6) Maximum number of link points

Version1.0	RX, RY: 2048 points
	RWw (Mater → Slave): 256 points
	RWr (Slave → Master station): 256 points
Version2.0	RX, RY: 8192 points

RWw (Master → Slave): 2048 points
RWr (Slave → Master station): 2048 points

(7) Maximum number of units connected
Remote I/O station Max. 64
Remote Device Station Max.42
Local station/ Intelligent station Max.26

(8) Condition for number of units connected
For version 1
Condition 1
$\{ (1\times a)+ (2\times b) + (3\times c) + (4\times d)\} \leq 64$
a: Number of units that occupies 1 station
b: Number of units that occupies 2 stations
c: Number of units that occupies 3 stations
d: Number of units that occupies 4 stations

Condition 2
$\{ (16\times A) + (54\times B) + (88\times C)\} \leq 2304$
A: Number of remote I/O station ≤ 64
B: Number of remote device station ≤ 42
C: Number of local station, stand by master station, intelligent device station ≤ 26

For version 2
Condition 1
$\{ (a+a2+a4+a8)+ (b+b2+b4+b8) \times 2+ (c+c2+c4+c8)\times 3+ (d+d2+d4+d8)\times 4\} \leq 64$

Condition 2
$[(a\times 32) + (a2\times 32) + (a4\times 64) + (a8\times 128)\}$
$+ \{ (b\times 64) + (b2\times 96) + (b4\times 192) + (b8\times 384)\}$
$+ \{ (c\times 96) + (c2\times 160) + (c4\times 320) + (c8\times 640)\}$
$+ \{ (d\times 128) + (d2\times 224) + (d4\times 448) + (d8\times 896)\}] \leq 8192$

Condition 3
$[\{ (a\times 4) + (a2\times 8) + (a4\times 16) + (a8\times 32)\}$
$+ \{ (b\times 8) + (b2\times 16) + (b4\times 32) + (b8\times 64)\}$
$+\{ (c\times 12) + (c2\times 24) + (c4\times 48) + (c8\times 96)\}$
$+ \{ (d\times 16) + (d2\times 32) + (d4\times 64) + (d8\times 128)\}] \leq 2048$
a: The number of units with 1 station occupied and 1 time setting
b: The number of units with 2 stations occupied and 1 time setting
c: The number of units with 3 stations occupied and 1 time setting

d: The number of units with 4 stations occupied and 1 time setting

a2: The number of units with 1 station occupied and twice setting
b2: The number of units with 2 stations occupied and twice setting
c2: The number of units with 3 stations occupied and twice setting
d2: The number of units with 4 stations occupied and twice setting

a4: The number of units with 1 station occupied and 4 times setting
b4: The number of units with 2 stations occupied and 4 times setting
c4: The number of units with 3 stations occupied and 4 times setting
d4: The number of units with 4 stations occupied and 4 times setting

a8: The number of units with 1 station occupied and 8 times setting
b8: The number of units with 2 stations occupied and 8 times setting
c8: The number of units with 3 stations occupied and 8 times setting
d8: The number of units with 4 stations occupied and 8 times setting

Condition 4

$\{ (16\times A) + (54\times B) + (88\times C)\} \leq 2304$

A: Number of remote I/O station ≤ 64
B: Number of remote device station ≤ 42
C: Number of local station, stand by master station,
intelligent device station ≤ 26

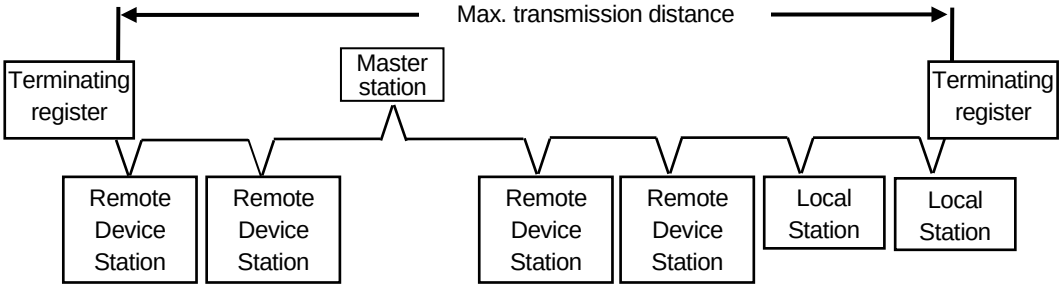


Fig. 1.4 Sample system configuration

Number of signals that can be communicated in remote station, local station and intelligent device station are shown in the tables below.

Number of bit points available for communication differs according to the extended cyclic setting and number of stations occupied. Version 1 setting is the same as one time setting in the table below.

Table 1.1 Bit points

Extended cyclic setting / No. of occupied stations	1 time setting		2 times setting		4 times setting		8 times setting	
	Input	Output	Input	Output	Input	Output	Input	Output
1 station	32	32	32	32	64	64	128	128
2 stations	64	64	96	96	192	192	384	384
3 stations	96	96	160	160	320	320	640	640
4 stations	128	128	224	224	448	448	896	896

One word point is equal to 16 bits.

Table 1.2 Word points

Extended cyclic setting / No. of occupied stations	1 time setting		2 times setting		4 times setting		8 times setting	
	Input	Output	Input	Output	Input	Output	Input	Output
1 station	4	4	8	8	16	16	32	32
2 stations	8	8	16	16	32	32	64	64
3 stations	12	12	24	24	48	48	96	96
4 stations	16	16	32	32	64	64	128	128

1.1.5.2 SUPPORTING ORGANIZATIONS

For details on CC-Link, refer to the website below.

Web : http://www.cc-link.org

1.1.6 MODBUS/TCP

1.1.6.1 FEATURES OF MODBUS/TCP

Modbus/TCP is the protocol where Modbus protocol is mounted on the protocol of TCP/IP. Modbus is the serial communication protocol which Modicon Inc. developed for their programmable logic controller (PLC) in 1979, employing the single master/multi-slave system. See “Appendix D3.0 EtherNet/IP–Adaptor (Slave) or Modbus TCP Server” when using Modbus TCP with robot controller.

1.1.6.2 SUPPORTING ORGANIZATIONS

For detailed information of Modbus, see the following website.

Web: http://www.modbus.org

1.1.7 CANOPEN

1.1.7.1 FEATURES OF CANOPEN

The physical features of CAN (Controller Area Network) open, the features of transmission media and communication characteristics of CANopen are described as follows:

1. Physical and transmission medium features:

(1) Two-wire shield twist pair cable
(2) Master/Slave and Peer-to-Peer capabilities
(3) Selectable baud rates from 10 kbit/s - 1 Mbit/s
(4) Max. distance 5000 m
(5) Use of sealed or open-style connectors

2. Communication characteristics

(1) Support for up to 127 nodes
(2) Node removal without severing the network

1.1.7.2 SUPPORTING ORGANIZATIONS

CiA is the international users' and manufacturers' group that develops and supports CANopen and other CAN-based higher-layer protocols. The nonprofit group was founded in 1992 to provide CAN-based technical, product and marketing information.

http://www.can-cia.org

1.1.8 PROFINET

1.1.8.1 FEATURES OF PROFINET

PROFInet employs industrial Ethernet communication technology. Performance levels of PROFINET are as follows.

1. NRT (Non Real-time)
   NRT is the communication based on TCP/IP. NRT is used for the unit communication which does not demand the real-time communication, or the parameter communication.

2. RT (Real-time)
   Mounting the soft protocol on the standard Ethernet hardware enables real-time communication at approximately 10 msec cycle times.

3. IRT (Isochronous Real-time)
   Compared to RT, IRT ensures high-precision of the communication in the same space of time (degree of determinism) with up to 1 msec cycle time and up to 1 μ sec jitter.

PROFInet enables real-time communication by employing the fast Ethernet technology. The features of transmission media and communication characteristics are described as follows:

1. Physical and transmission medium features:

(1) Shielded twist pair cable (twisted pair wire) or fiber optic cable
(2) Transmission speed: 100 Mbit/s
(3) Connector RJ45 or M12
(4) Compliance with IEEE 802.3

2. Communication characteristics

(1) TCP/IP protocols
(2) Real-time performance Provide packet priority based on IEEE 802.1Q

1.1.8.2 SUPPORTING ORGANIZATIONS

ROFIBUS standard specification and PROFINET standard specification are defined and promoted by an organization called PROFIBUS international (PI). For technical questions of PROFInet, contact your local profibus user organization. Refer to the web site below:

Web : http://www.profibus.com

1.1.9 CONTROLNET

1.1.9.1 FEATURES OF CONTROLNET

1. Physical and transmission medium features:

(1) Physical media: coaxial cable (R6/U), fiber
(2) Transmission speed: 5 Mbit/s
(3) Connector (standard): coaxial BNC
(4) Bus topology: linear trunk, tree, star, mix of any of above
(5) 1 segment length:
1,000 m at 5 Mbp/s (coaxial cable) (1,000 m with 2 nodes, 250 m with 48 nodes)
3,000 m at 5 Mbp/s (fiber)
(6) Number of repeaters: up to 5 in series, 6 segments in series (5 repeaters), 48 segments in parallel
(7) Device power: External power
(8) Data packet size: variable, 0 - 510 bytes
(9) Communication mode (Bus address specification): Master/Slave, Multi-Master, Peer-to Peer
(10) Device can be installed or removed under power

2. Communication characteristics

(1) Network system function
Detection of duplicate MAC ID
Fragmentation of message (block transfer)
(2) Number of nodes: Addressable node up to99
Tap without repeaters (node): 48
(3) Communication model: Producer/Consumer
(4) I/O data trigger: Polling, Cyclic, Change-of-State

1.1.9.2 SUPPORTING ORGANIZATIONS

ControlNet is supported by ControlNet International (CI), Industrial Ethernet Association (IEA), Open DeviceNet Vendor Association (ODVA). For more details on ControlNet, refer to the web site below.

Web: http://www.odva.org

1.1.10 ETHERCAT

1.1.10.1 FEATURES OF ETHERCAT

1. Physical and transmission medium features:

(1) Physical media: Ethernet CAT 5 cable
(2) Transmission speed: 100Mbit/s
(3) Connector: RJ45
(4) Bus topology: Mix of any of linear trunk, tree, star or daisy chain
(5) 1 segment length:
100 m at 100BASE-TS
2,000 m at 100BASE-FX (fiber)

2. Communication characteristics

(1) IEEE802.3 Physical layer
(2) Ethernet TCP/IP protocols
(3) Open protocol for application layer (CANopen/SERCOS)
(4) Max. number of nodes: 65535

1.1.10.2 SUPPORTING ORGANIZATIONS

EtherCAT is supported by EtherCAT Technology Group (ETG). For more details on EtherCAT, refer to the website blow.

Web: http://www.ethercat.org

1.1.11 CC-LINK IE

1.1.11.1 FEATURES OF CC-LINK IE

1. Physical and transmission medium features:

(1) Ethernet specification Compliance with IEEE802.3ab (1000BASE-T)
(2) Transmission medium: Shielded twist pair cable (category 5e)
(3) Transmission speed: 1Gbit/s
(4) Connector: RJ45
(5) Bus topology: line, star, ring
(6) Max. distance between stations: 100 m

2. Communication characteristics

(1) Communication system: Token passing system
(2) Maximum number of units to connect: 254 (Total number of master and slave stations)

1.1.11.2 SUPPORTING ORGANIZATIONS

CC-Link IE is supported by an association called CC-Link. For more details on CC-Link IE, refer to the websitebelow.

Web: http://www.cc-link.org

1.2 HOW TO PURCHASE

When purchasing an applicable Fieldbus Interface Card, please contact your nearest Kawasaki representative.

2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below.
[ ] indicates individual process for each fieldbus, and [ ] indicates common operation required for all fieldbus specifications.

1. Prepare the fieldbus interface board. (See chapter 3.)
↓
2. Set the fieldbus interface card. (See Appendix for each fieldbus.)
↓
3. Turn controller power ON.
↓
4. Set the allocation for the fieldbus interface. (Signal allocation setting.)
In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals set (via Aux. 0611) matches the number allocated in Aux.0608-1. (See chapter 5, Example 2.)
↓
5. Set the number of external I/O signals. (See chapter 5.)
↓
6. Set relation between physical I/O interface and master/slave ports. (See section 6.1.)
↓
7. Turn controller power OFF then ON.
↓
8. Set the signal allocation data (See section 6.2.)
↓
9. Set the order of signals for the master/slave ports. (See section 6.3.)
↓
10. Network configuration. (See Appendix for each fieldbus.)
↓
11. Start operation.

[NOTE]

In this manual, “Personal computer” refers to personal computers with Windows (Windows 3.1+). When setting up network on Windows, the execution environments must meet those required by the configuration tools.

2.1 REPLACEMENT PROCEDURE OF FIELDBUS MOTHER BOARD /PCI ADAPTOR BOARD

Follow the procedures below to replace fieldbus mother boards (1JF, 1QK, 1TJ, 1UK) / PCI adaptor boards (1UQ/1YQ).

1. Place the fieldbus interface board onto a new fieldbus mother board /PCI adaptor board.
2. Turn controller power ON
3. Start operation

2.2 REPLACEMENT PROCEDURE OF FIELDBUS INTERFACE BOARD

Follow the procedures below to replace the fieldbus interface board.
[ ] indicates individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See chapter 3.)
2. Set the fieldbus interface card. (See Appendix for each fieldbus.)
3. Turn controller power ON.
4. Network configuration. (See Appendix for each fieldbus.)
5. Start operation.

3.0 PREPARING FIELDBUS INTERFACE

Preparation of a motherboard is necessary to enable the robot controller to communicate with external devices via fieldbus. Use 1JF board or 1QK board as Motherboard for D series controller and 1JT board for E series controller. Use 1QK board when communicating as CC-Link master for D series controller.

3.1 1JF BOARD (D CONTROLLER)

The motherboard (1JF), mounted with fieldbus interface cards enables the robot controller to communicate via fieldbus. Connectors CN1 and CN2 on 1JF board are available for slave and master cards, respectively. There are three ways of using the connectors; only CN1, only CN2, or both CN1 and CN2. By mounting different types of fieldbus interface card to CN1 and CN2, two different types of fieldbus network can be supported. CC-Link master is not supported by 1JF board.

For example, if Anybus-S-DeviceNet card is mounted to CN1 connector, the controller can communicate via DeviceNet system. In this case, the AnyBus-S-DeviceNet card is the interface board. Moreover, by mounting a PROFIBUS-DP master card to CN2, the controller can also communicate via PROFIBUS system. (See Fig.3.1)

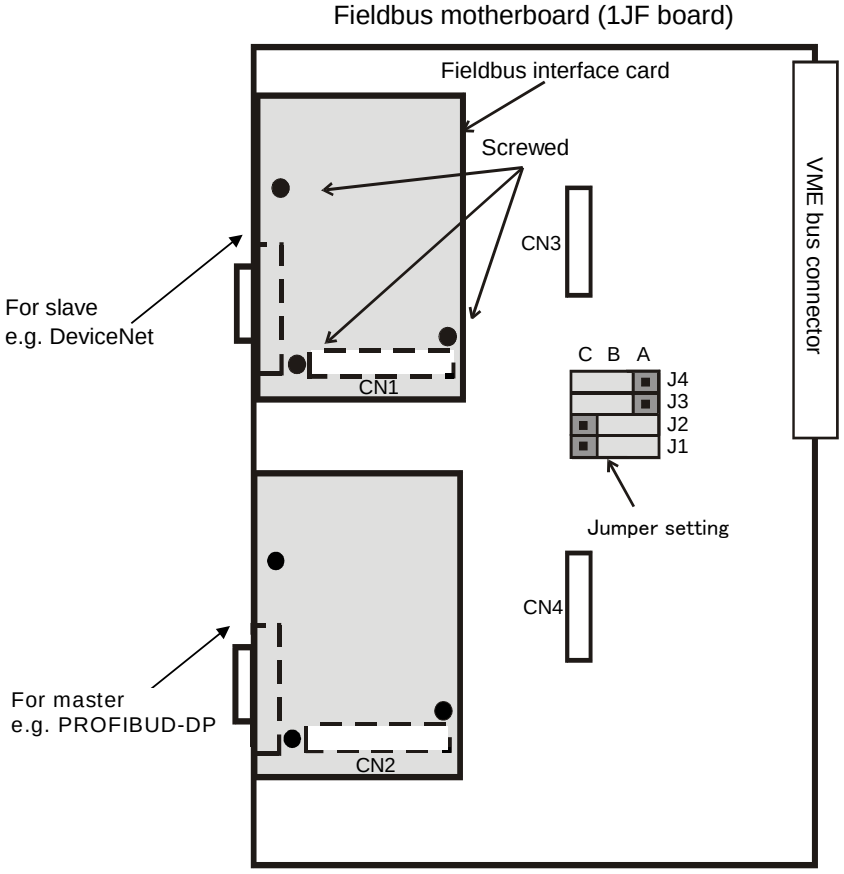


Fig.3.1 Fieldbus interface board

When using fieldbus card provided by vendor other than Kawasaki, mount the card to the fieldbus motherboard (1JF) by following the procedure below:

1. Connect application connector.
   Connect the application connector on the fieldbus interface card to connector CN1 and/or CN2 on 1JF board. See section 6.1 for more interface cards which can be connected to CN1 and/or CN2.

2. Fasten the card to 1JF board with screws.

3. Set jumpers as per below.

1) When interface card is mounted to connector CN1:
   J1 : Jumper A-B. (Indicates that the fieldbus interface card is mounted to CN1.)
   J2 : Jumper B-C.
   J3 : Jumper B-C.
   J4 : Jumper B-C.

(2) When interface card is mounted to connector CN2:
   J2 : Jumper A-B. (Indicates that the fieldbus interface card is mounted to CN2.)

4. Insert the 1JF board mounted with interface card (s) into the VME card rack.

5. Connect cables for fieldbus communication.

3.2 1QK BOARD (D CONTROLLER)

1QK board is used when communicating as CC-Link master. Connectors CN1 and CN2 are available on 1QK board.

Fieldbus interface cards that can be mounted to CN1 connector are the same ones that can be mounted to 1JF board CN1 connector. Only CC-Link master card can be mounted to CN2 connector. By mounting different types of fieldbus interface card to CN1 and CN2, two different types of fieldbus network can be supported.

For example, if Anybus-S-DeviceNet card is mounted to CN1 connector, the controller can communicate via DeviceNet system. And, if CC-Link master card is mounted to CN2 connector, the controller can communicate not only via DeviceNet, but also with CC-Link. (Figure 3.2)

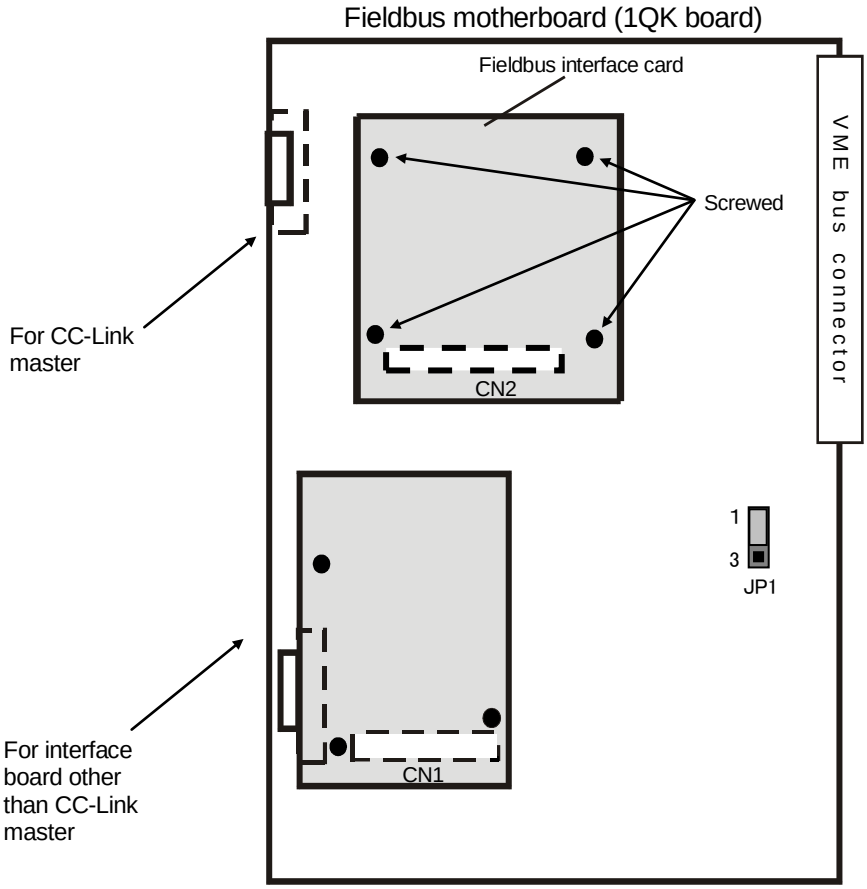


Figure 3.2 Fieldbus interface board

When using fieldbus card provided by vendor other than Kawasaki mount the card to the fieldbus motherboard (1QK) by the procedure below.

1. Connect application connector.
Connect the application connector on the fieldbus interface card to connector CN1 and/or CN2 on 1QK board. See section 6.1 for more interface cards which can be connected to CN1 and/or CN2.

2. Fasten the card to 1QK board with screws.

3. Short between 1-2 of Jumper 1.

4. Install the 1QK board mounted with the interface card in the VME card rack.

5. Connect to each fieldbus dedicated cables.

3.3 1TJ BOARD (E CONTROLLER)

The motherboard (1TJ board), mounted with fieldbus interface cards enables the robot controller to communicate via fieldbus for E controller.

Connectors CN1 and CN2 on 1TJ board are available for slave and master cards, respectively. For ControlNet, use CN3 and CN4 depending on the configuration of communication daughter board. There are three ways of using the connectors, only CN1, only CN2, or both CN1 and CN2. By mounting different types of fieldbus interface card to CN1 and CN2, two different types of fieldbus network can be supported. CC-Link master is not supported by 1TJ board.

For example, if AnyBus-S-DeviceNet card is mounted to CN1 connector, the controller can communicate via DeviceNet system. In this case, the AnyBus-S-DeviceNet card is the interface board. Moreover, by mounting PROFIBUS-DP master card to CN2 connector, the E controller can also communicate via PROFIBUS system. (See Fig.3.3)

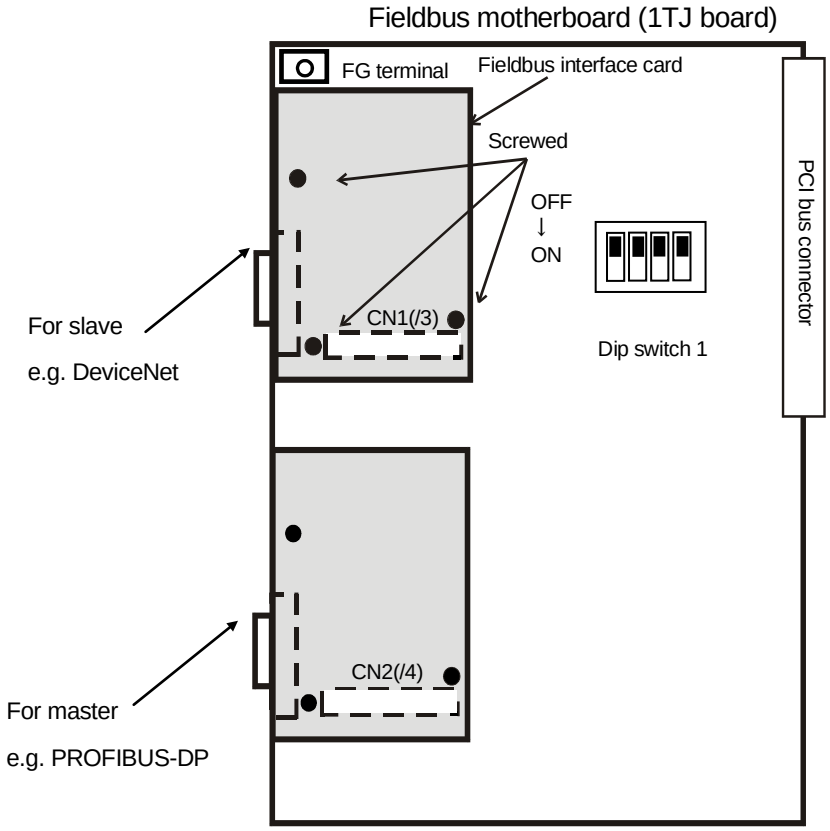


Fig.3.3 Fieldbus interface board

When using fieldbus card provided by vendor other than Kawasaki, mount the card to the fieldbus motherboard (1TJ) by following the procedure on the next page:

1. Connect application connector.
   Connect the application connector on the fieldbus interface card to connector CN1 and/or CN2 on 1TJ board. See section 6.1 for more interface cards which can be connected to CN1 and/or CN2.

2. Fasten the card to 1TJ board with screws.

3. Set all the switches of the dip switch 1 to OFF.

4. Install the 1TJ board mounted with interface card (s) in the card rack.

5. Connect the attached ground wire (KHI Part No.: 50977-0151) between FG terminal on 1TJ board and spacer on robot controller.

6. Connect cables for fieldbus communication.

[NOTE]

For E9x controller, do not mount 1TJ board onto the option slot No. 3 (rightmost slot) on the card rack. Otherwise, 1TJ board may interfere with the plate of the card rack, which may result in malfunction.

3.4 1UK BOARD (E CONTROLLER)

1UK board is used when communicating as CC-Link master. Connectors CN1 and CN2 are available on 1UK board.

Fieldbus interface cards that can be mounted to CN1 connector are the same ones that can be mounted to 1TJ board CN1 connector. Only CC-Link master card can be mounted to CN2 connector. By mounting different types of fieldbus interface card to CN1 and CN2, two different types of fieldbus network can be supported.

For example, if Anybus-S-DeviceNet card is mounted to CN1 connector, the controller can communicate via DeviceNet system. And, if CC-Link master card is mounted to CN2 connector, the controller can communicate not only via DeviceNet, but also with CC-Link. (Figure 3.4)

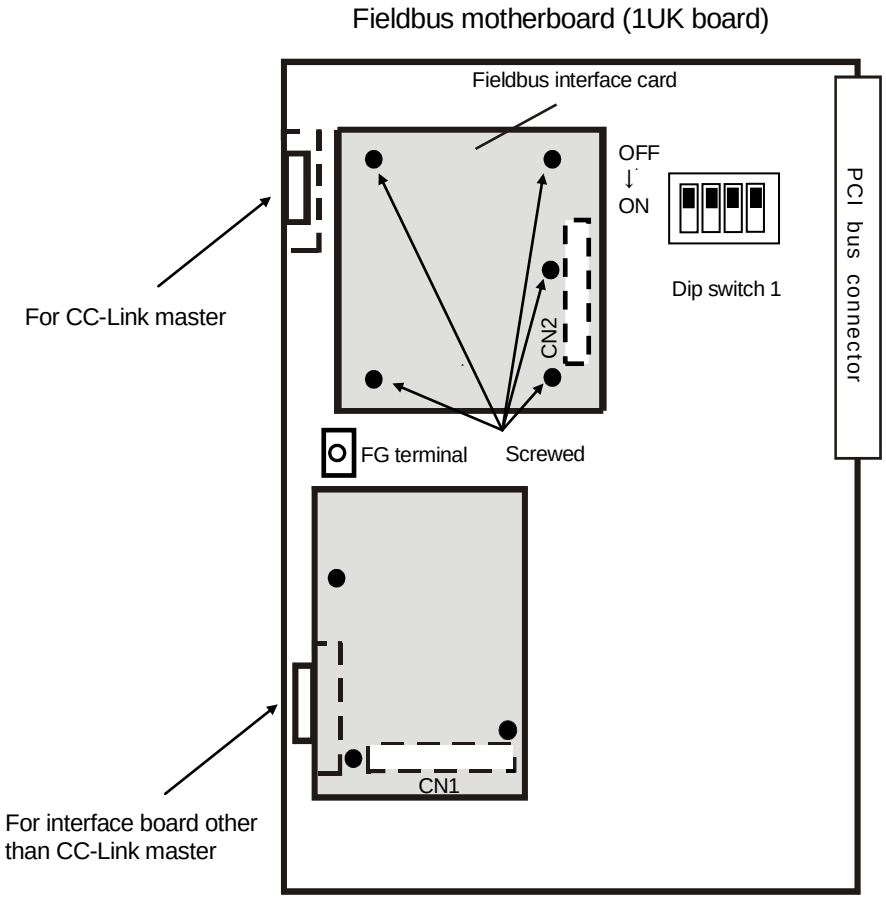


Figure 3.4 Fieldbus interface board

When using fieldbus card provided by vendor other than Kawasaki mount the card to the fieldbus motherboard (1UK) by the procedure below.

1. Connect application connector.
   Connect the application connector on the fieldbus interface card to connector CN1 and/or CN2 on 1UK board. See section 6.1 for more interface cards which can be connected to CN1 and/or CN2.

2. Fasten the card to 1UK board with screws.

3. Set all switches of the dip switch 1 to OFF as shown in the figure above.

4. Install the 1UK board mounted with the interface card in the VME card rack.

5. Connect the attached ground wire (KHI Part No.: 50977-0151) between the FG terminal on 1UK board and the spacer on robot controller.

6. Connect to each fieldbus dedicated cables.

[NOTE]

For E9x controller, do not mount 1UK board onto the option slot No. 3 (the far-right slot) on the card rack. Otherwise, 1UK board may interfere with the plate of the card rack, which may result in malfunction.

3.5 1UQ BOARD, 1YQ BOARD (PCI ADAPTOR BOARD FOR E CONTROLLER)

1UQ, 1YQ boards are used to mount PCI card.
Although 1UQ board and 1YQ board are the same in function, they are different in size. They have the following restrictions.

Controller	1UQ board	1YQ board
E0x/E7x	×Not available	○Available Note 1
E9x	×Not available	○Available Note 1,Note 2
E1x/E2x/E3x/E4x	○Available Note 1	○Available Note 1

Note 1: Other option boards can not be mounted on the right slot of 1UQ board/1YQ board.

Note 2: For E9x controller, 1UK board can not be mounted onto the option slot No. 3. If mounted, 1UK board may interfere with the plate of the card rack, which may result in malfunction.

1UQ board

INTERBUS master card or PROFInet master card is mounted on CN2 connector on 1UQ board.

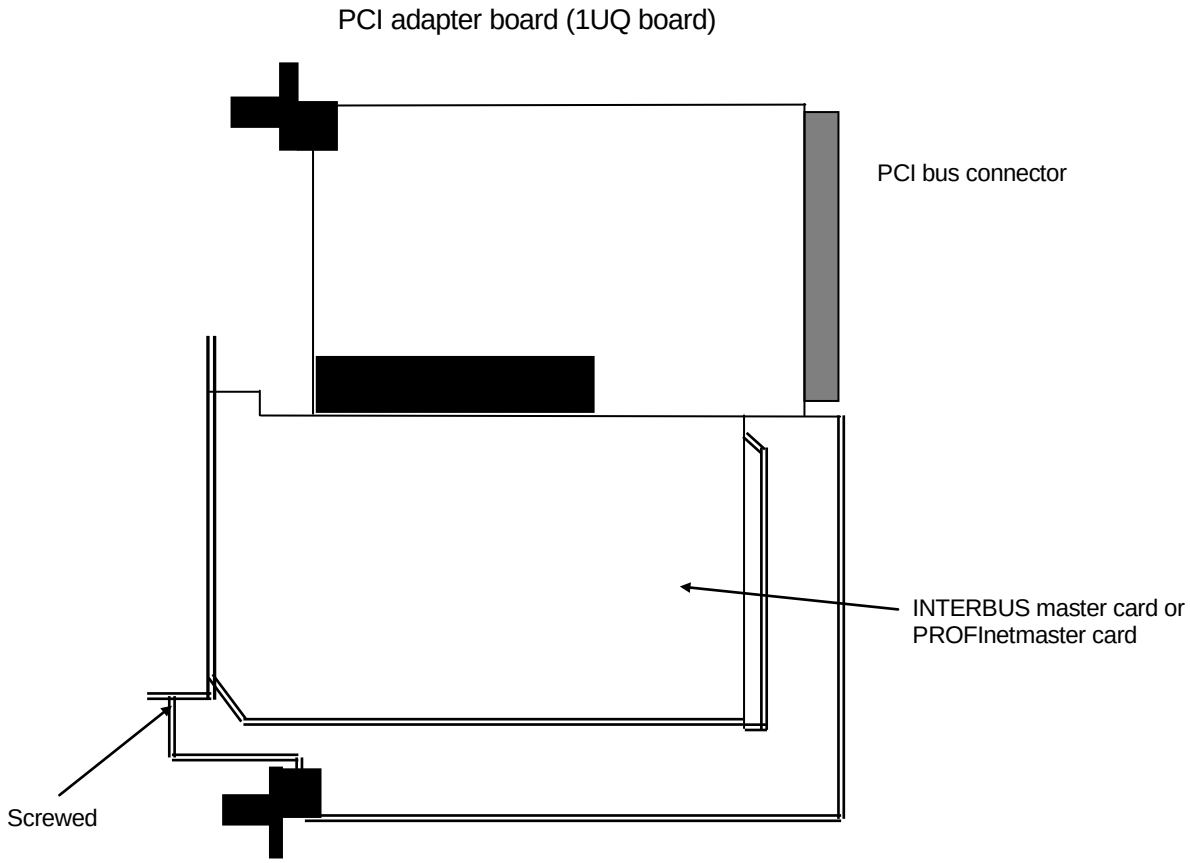


Figure 3.5.1 Fieldbus interface board

When using fieldbus card provided by vendor other than Kawasaki, mount the card to the PCI adapter board (1UQ board) provided by Kawasaki in the procedure below.

1. Mount the fieldbus interface card to the connector CN2 on 1UQ board.

2. Fasten the card to 1UQ board with screws.

3. Install the 1UQ board with the interface card in the VME card rack.

4. Connect to each fieldbus dedicated cables.

1YQ board

Mount INTERBUS master card or PROFInet card onto CN4 connector on 1YQ board.
When using fieldbus card provided by vendor other than Kawasaki, mount the card to the PCI adapter board (1YQ board) provided by Kawasaki in the procedure below.

1. Fit the convex of the plate (attached on 1YQ board) into the groove on the front panel of fieldbus interface card to mount, and then fix it with M3 screw.

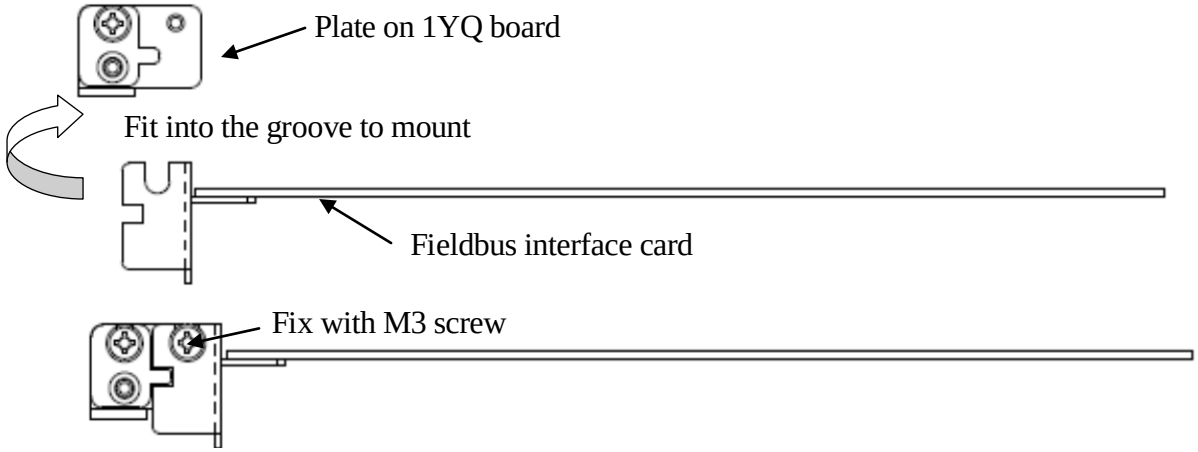


Figure 3.5.2 plate on 1YQ board＋fieldbus interface card

[**NOTE**]

Fit the convex on the plate into the groove on the front panel of fieldbus interface card. Otherwise, fieldbus interface card may interfere with boards on the other slots, which may result in malfunction.

2. Mount the fieldbus interface card with the plate onto 1YQ board, and then fix it with M3 screw.

3. Connect the attached ground wire (KHI Part No.: 50977-0151) between FG terminal on 1YQ board and spacer on robot controller.

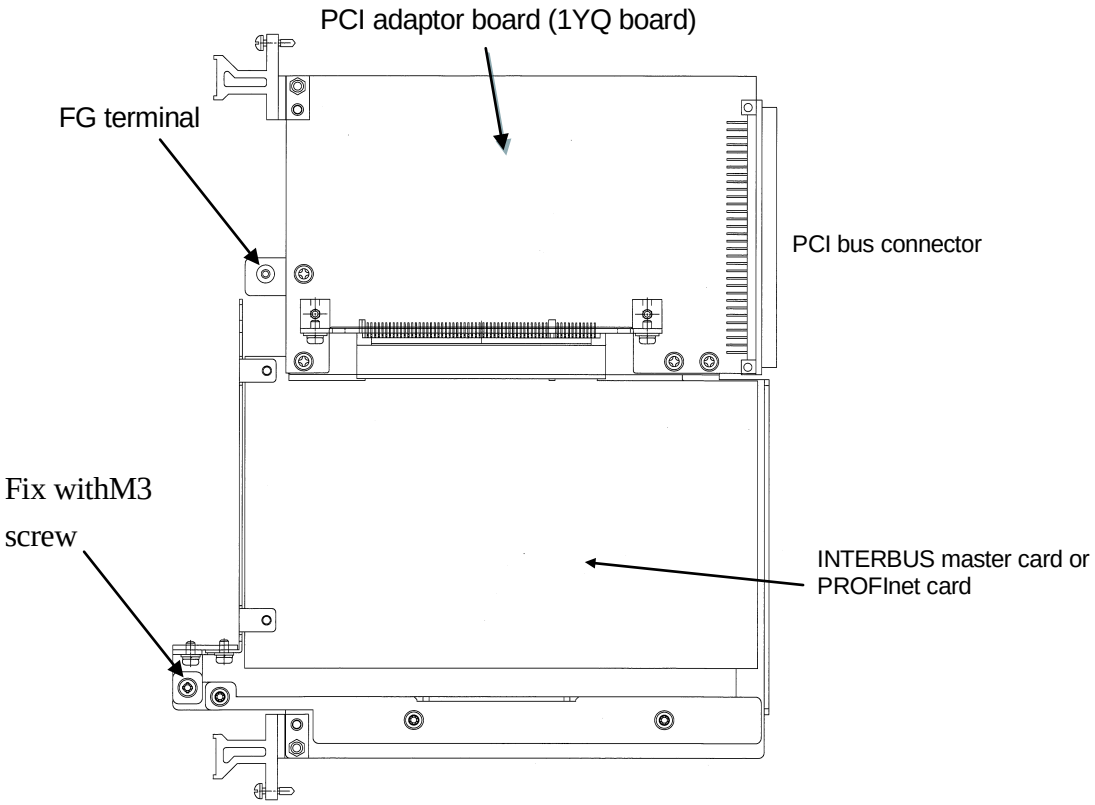


Fig. 3.5.3 1YQ board＋fieldbus interface card

4. Insert the 1YQ board with fieldbus interface card into the card rack.

NOTE: When another option board is mounted next to 1YQ board, do not install or /and uninstall the option board. Otherwise, fieldbus interface card may interfere with boards on other slots, which may result in malfunction.

5. Connect to each fieldbus dedicated cables.

NOTE: For E0x/E7x/E9x controller, make sure to provide the clearance between the interface card front panel and the top surface (or controller cover panel for E7x). Refer to the clearance restrictions below to select the appropriate cable connectors.

	E0x	E7x	E9x
Clearance from front panel on interface card to top surface	61.8mm	51.8mm	51.8mm

4.0 FLOW AND SETTING OF SIGNALS IN AS SYSTEM

Assign AS application signals to each channel in Local port, Master port, or Slave port in AS system in order for communication to be possible with other devices. Fig.4.1 shows an example of signal numbers and flow between fieldbus and local I/O.

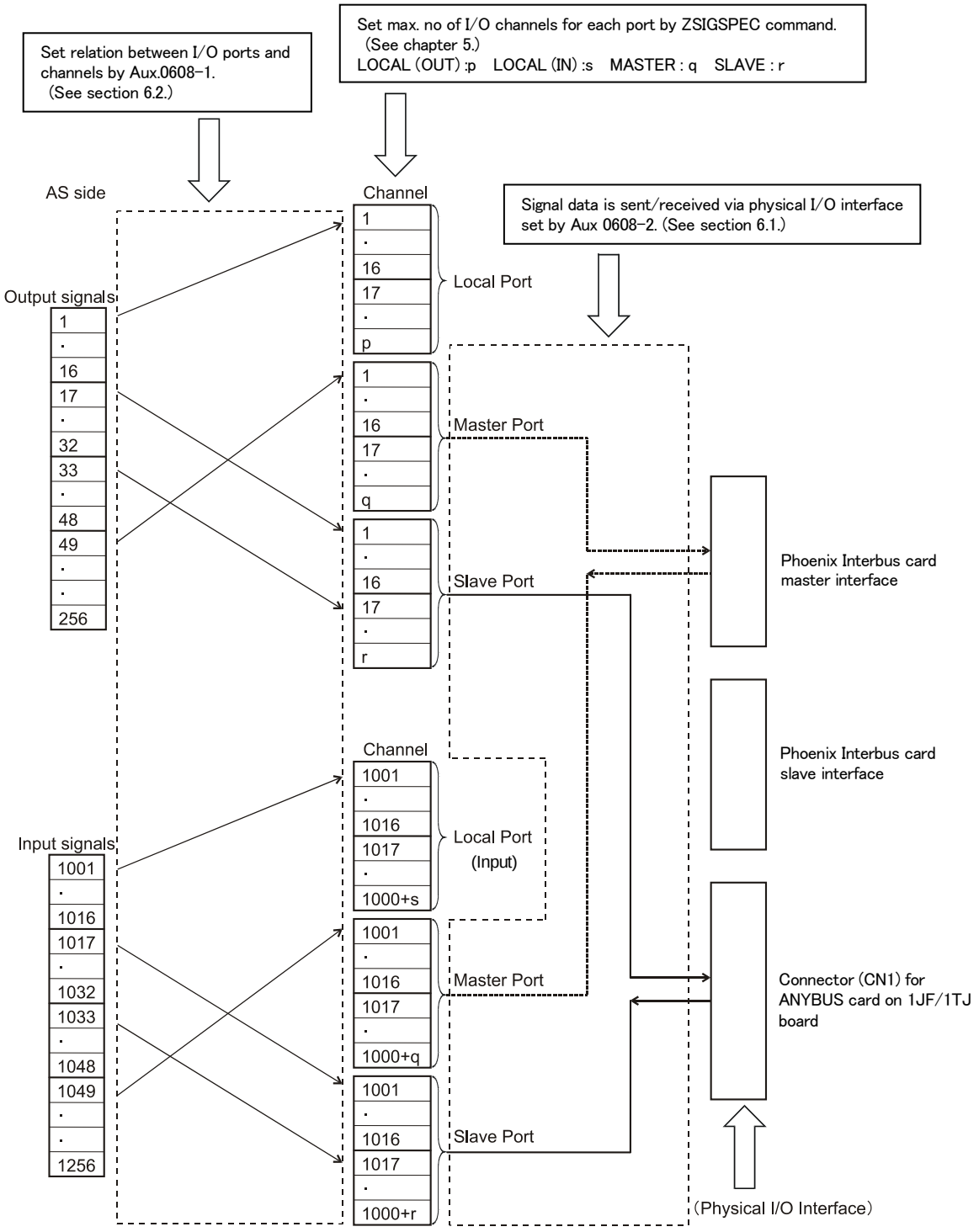
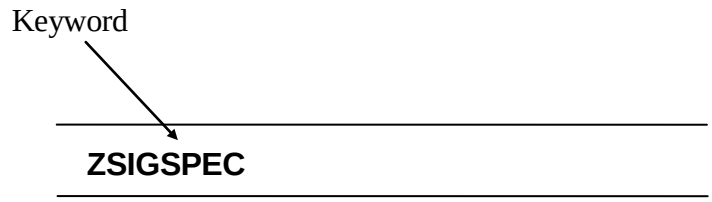


Fig.4.1 Flow and setting of signals

5.0 SETTING THE NUMBER OF EXTERNAL I/O SIGNALS

Use ZSIGSPEC command to set the number of signals for fieldbus communication in AS system.

EXAMPLE



Always enter a space between the keyword and the parameter.

↵ represents the Enter (Return) key in the examples.

This command defines signal numbers for channels in Ports: Local (Output, Input), INTERNAL, MASTER and SLAVE as DO, DI, INT, MAS and SLA in Fig 4.1.

Monitor command

ZSIGSPEC

Function

Displays and sets max. number of external I/O signals.

Explanation

The current number of signals and message are displayed. (See example 1.)
MAS gives the signal numbers for the master port and SLA for the slave port. When not changing the setting, just press ↵.

1. ZSIGSPEC sets only in the software. Setting is invalid unless hardware corresponds to it.
2. Set the signal numbers in multiples of 16.
3. Max. number of external I/O signals are 960:
   LOCAL (DI) + MAS + SLA ≤ 960
   LOCAL (DO) + MAS + SLA ≤ 960
4. Turn controller power OFF, then ON to activate the number of I/O signals set as I/O data length for the physical fieldbus interface.

[**NOTE**]

Ensure that the max. number of signals set by ZSIGSPEC is consistent with the setting in [Aux. 0608-1]. If not, the max. number of signals cannot be set by ZSIGSPEC command. (See Example 2.)

Example 1

When increasing the number of master (MAS) and slave (SLA) signals.

```
>ZSIGSPEC ↵
              DO,   DI,    INT,    MAS,   SLA
              64    64     128     32     32
Change? (If not, Press RETURN only.)
, , , 112, 64
              DO,     DI,     INT,     MAS,     SLA
              64      64      128      112      64
Change? (If not, Press RETURN only.)
```

Example 2

When reducing the number of master (MAS) signals.

```
>ZSIGSPEC ↵
                DO,     DI,     INT,    MAS,    SLA
                32      32      128     32      32
Change? (If not, Press RETURN only.)
, , , 16, 48
Illegal input data. Change? (Enter 1 to execute)
```

Probable cause

If the signal allocation is set as per [Aux. 0608-1] in Fig. 5.1 below, the number of the master signals is 32. The data will not be consistent with the ZSIGSPEC command setting for 16 signals resulting in display of error message: P0100 Illegal input data.

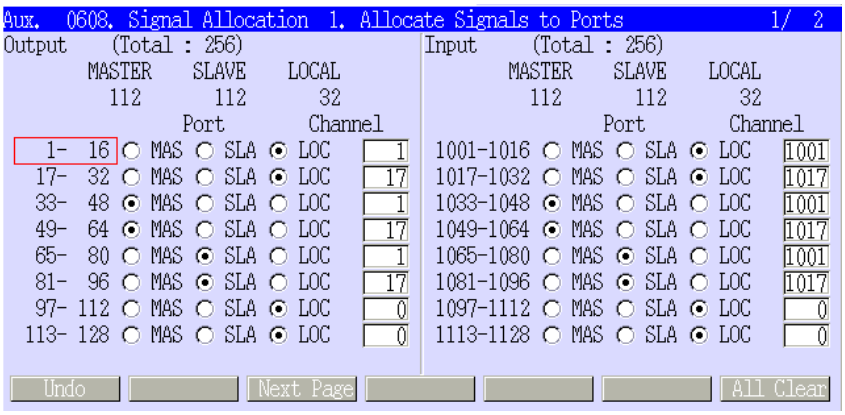


Fig.5.1 Setting example of Aux. 0608-1.

Countermeasure

1. When 1 is entered:

   Signal allocation data is changed. Fix the signal allocation setting to enable IO communication.

2. When 1 is not entered:

   There are two ways to change the number of external I/O signals via ZSIGSPEC command.

   a. Allocate 16 signals for master (MAS) by [Aux. 0608-1] as shown in Fig. 5.2 below.
      See section 6.2 on this setting method.

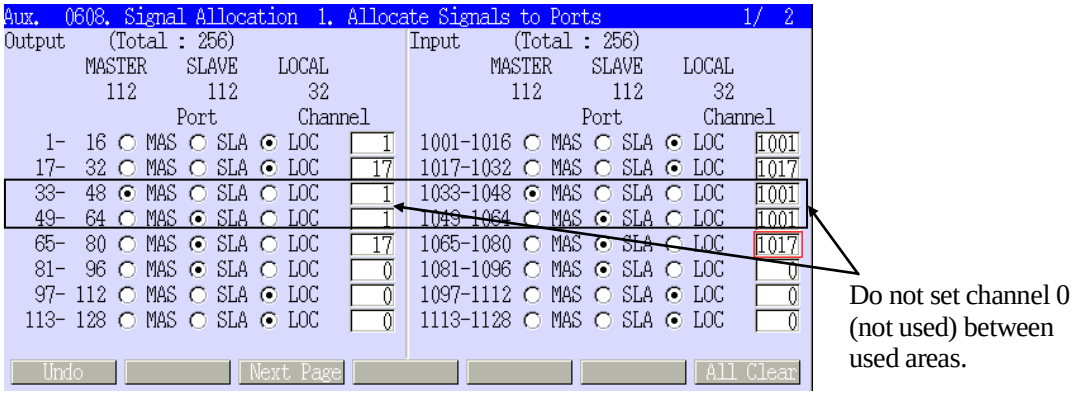


Fig.5.2 Changes of the setting.

b. Set 0 in all channels as shown in Fig. 5.3, using the <All Clear> key. Change the number of external I/O signals via ZSIGSPEC command. Then, set the signal allocation by [Aux. 0608-1] again.

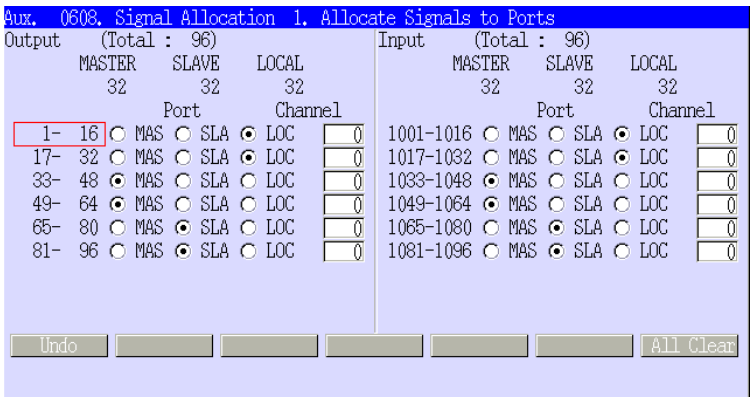


Fig.5.3 Changes of the setting.

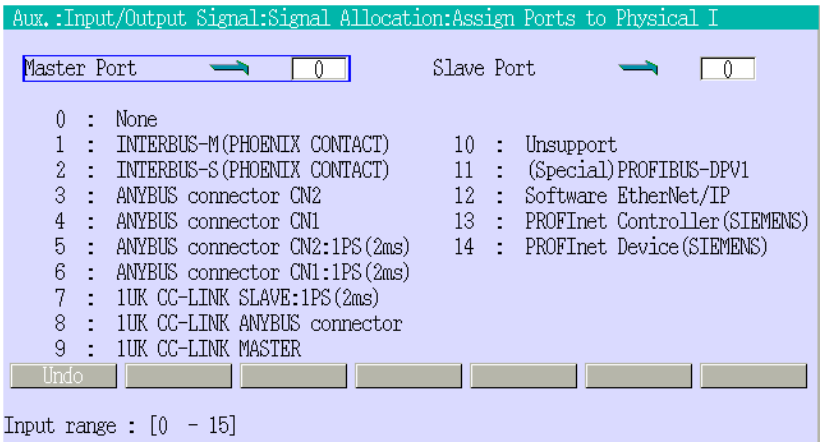
6.0 SETTING FOR FIELDBUS INTERFACE

Set the allocation for the fieldbus interface by [Aux.0608]-[1 Allocate Signal to Ports] and [Aux.0608]-[2 Allocate Ports to Physical Interface].

6.1 RELATING PHYSICAL I/O INTERFACE AND MASTER/SLAVE PORTS (AUX.0608-2)

Select a number to allocate the physical I/O interface to the master/slave ports. If not using an interface board, input 0 (zero). Setting example is shown below.

Select [Aux function] in the pull-down menu displayed on the teach pendant. Input Aux. no. 0608 and press ↵ to call up the Aux. function 0608, and then select [2. Allocate Ports To Physical Interface]. The screen shown below is displayed.



Selection number

1: INTERBUS-M (PHOENIX CONTACT)
Assumes an INTERBUS-VME/PCI board manufactured by PHOENIX CONTACT is used.

2: INTERBUS-S (PHOENIX CONTACT)
Assumes an INTERBUS-VME board manufactured by PHOENIX CONTACT is used.

3: ANYBUS connector CN2/CN4 AnyBus master card is assumed to be mounted to connector CN2 on 1JF/1TJ board as physical I/O interface. Connector CN2 supports following interface cards: AnyBus-M PROFIBUS and AnyBus-M DeviceNet. AnyBus-S DeviceNet, AnyBus-S PROFIBUS, AnyBus-S INTERBUS, AnyBus-M EtherNet/IP, AnyBus-S EtherNet/IP, AnyBus-S PROFInet, 1PS board, AnyBus-S ControlNet, Anybus-S EtherCAT, Anybus-S CC-Link IE.

4: ANYBUS connector CN1

An AnyBus card, other than AnyBus PROFIBUS-MASTER card, is assumed to be mounted to connector CN1 on 1JF/1TJ board as physical I/O interface. AnyBus PROFIBUS-MASTER card is not compatible with connector CN1/CN3. Connector CN1 supports following interface cards: AnyBus-S DeviceNet, AnyBus-M DeviceNet, AnyBus-S PROFIBUS, and AnyBus-S INTERBUS, AnyBus-M EtherNet/IP, AnyBus-S EtherNet/IP, AnyBus-S PROFInet, 1PS board, AnyBus-S ControlNet, Anybus-S EtherCAT, Anybus-S CC-Link IE.

5: ANYBUS connector CN2: 1PS (2ms)

1PS board is assumed to be mounted to connector CN2 on 1JF/1TJ board as physical I/O interface. I/O signal processing time is shorter than when selecting methods 3 or 4, though processing load increases.

6: ANYBUS connector CN1: 1PS (2ms)

1PS board is assumed to be mounted to connector CN1 on 1JF/1TJ board as physical I/O interface. I/O signal processing time is shorter than when selecting methods 3 or 4, though processing load increases.

7: 1QK CC-LINK slave: 1PS (2 ms) (D controller)
1UK CC-LINK slave: 1PS (2 ms) (E controller)

1PS board is assumed to be mounted to connector CN1 on 1QK board as physical I/O interface. I/O signal processing time is shorter than when selecting method 8, though processing load increases.

8: 1QK ANYBUS connector (D controller)
1UK ANYBUS connector (E controller)

ANYBUS board or 1PS board is assumed to be mounted to connector CN1 on 1QK board as physical I/O interface. The following interface cards are supported: (AnyBus-S DeviceNet、AnyBus-M DeviceNet、AnyBus-S PROFIBUS、AnyBus-S INTERBUS, AnyBus-M EtherNet/IP, AnyBus-S EtherNet/IP, 1PS board, Anybus-S EtherCAT, Anybus-S CC-Link/IE

9: 1QK CN2 (CC-Link-MASTER) (D controller)
1UK CN2 (CC-Link-MASTER) (E controller)

CC-Link master board is assumed to be mounted to connector CN2 on 1QK board as physical I/O interface.

10: Dedicated to DeviceNet slave

AnyBus-S DeviceNet is assumed to be mounted to connector CN2 on 1JF/1TJ board as physical I/O interface. For 1JF/1TJ board, select 3 or 4 if “Unsupport” is displayed.

11: (Special) PROFIBUS-DPV1 (Master)
AnyBus PROFIBUS- DPV1 (Master) is assumed to be mounted to connector CN2 on 1JF/1TJ board as physical I/O interface.

12: Software EtherNet/IP
EtherNet/IP communication is executed by using EtherNet port (port 2) on main CPU bord.

13: PROFInet Controller (SIEMENS)
CP1616 card made by SIEMENS is assumed to be mounted to connector CN2 on 1UQ board as physical I/O interface.

14: PROFInet Device (SIEMENS)
CP1616 card made by SIEMENS is assumed to be mounted to connector CN2 on 1UQ board as physical I/O interface.

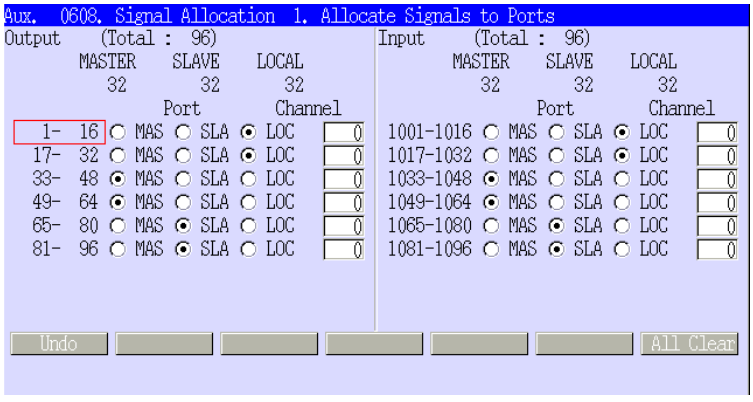
6.2 SETTING DATA FOR SIGNAL ALLOCATION (AUX.0608-1)

⚠ CAUTION

When the numbers of signals set by Aux. 0608-1 do not match the numbers set by ZSIGSPEC command, a confirmation message is displayed on screen at controller power ON and when loading data file from the floppy disk, etc. After displaying this message, the controller executes the process of either changing the number of signals or aborting the loading of the data.

Allocate the signal numbers (Output 1 to 960, Input 1001 to 1960) for AS application to the Master, Slave, and Local (1GW(1HW) /1TW board) ports of the I/O interface middle buffer in multiples of 16. Follow the procedure below to set the signal allocation data:
1. Select [Aux function] in the pull-down menu displayed on the teach pendant.
2. Input Aux. no. 0608 and press ↵ to call up Aux. function 0608.
3. Select [1. Allocate Signal to Ports].

Sample screen below shows 96 channels have been allocated for both Input/Output signals.



Signal number

Corresponds to the signal numbers used in the program. Signal numbers are displayed and set in multiples of 16.

Port

Allocates the signal numbers to the Master, Slave or Local ports in units of 16. Use SELECT key to choose the port. Button " • " indicates currently selected port.

Channel

Sets the first channel number of the Master, Slave and Local ports to be assigned with a set of 16 signals. Use the number key to input.

[**NOTE**]

1. Set 0 for all the unused signal numbers. In some versions, 0 cannot be set within the range defining the used signals. For example, when 128 signals are used, channel 0 cannot be set between signal numbers 1 and 128.
2. When setting the channels for the Master, Slave and Local ports, do not exceed the number of signals set by ZSIGSPEC.
3. First channel number in every 16 channels are set by the channel setting. Do not overlap the range of 16 channels.
4. Up to 960 can be set for both Output and Input signals. In Aux. 0608-1, they are displayed over 8 pages and are set simultaneously.
5. The setting data is saved as system data.

Signal Number All Clear Function

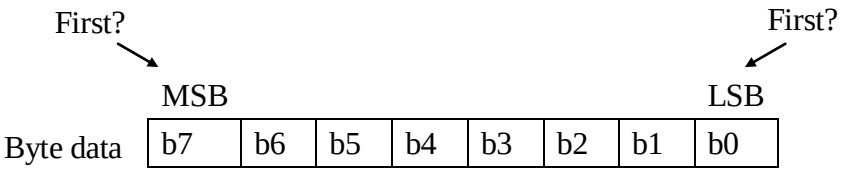
Use <All Clear> key to reset all signal numbers to zero (0).

When <All Clear > key is pressed, a confirmation message will appear. Select [YES] to reset all signal numbers to zero (0). Select [NO] to cancel the operation. The signal number settings will remain as they were set.

6.3 SETTING SIGNAL ORDER FOR MASTER/SLAVE PORTS (AUX.0608-3)

In fieldbus system, controller communicates with other devices by transmitting AS signal data (bit definition) of byte or word data. The signal order for external I/O signals transmitted from/to the Master and Slave port can be set by [Aux.0608]-[3 Set Signals Order]. There are two ways for setting the signal order; bit order in a byte and Byte order in a word. For the bit order in a byte, select either LSB or MSB for the first bit. For the byte order in a word, select either Little Endian or Big Endian.

1. Bit order in a byte:
Select either LSB or MSB for the smallest AS signal number in one byte data.



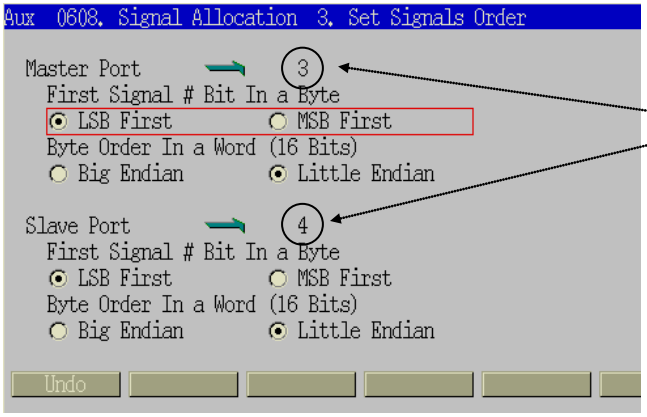
2. Byte order in a word
Select Little Endian or Big Endian.

For example, data 0×12 and 0×34 are stored in lower and upper address, respectively.

	Address	Byte
Word in address 0	0	0×12
	1	0×34
Word in address 2	2	•
	3	•

In Little Endian, the word value in address 0 is 0×3412.
In Big Endian, the word value in address 0 is 0×1234.

Example



Allocated interface numbers are displayed on the screen, but the setting cannot be changed. To change the setting for the physical I/O interface, set by Aux. 0608-2.

How to set

1. Master/Slave Port

The numbers set by Aux.0608-2 are displayed. Note that when 1 or 2 is set in Aux. 0608-2, the signal order cannot be set by Aux. 0608-3.
1: INTERBUS-M (PHOENIX CONTACT)
2: INTERBUS-S (PHOENIX CONTACT)

2. LSB First/MSB First

Select either LSB or MSB for the first bit by SELECT on the teach pendant.

3. BIG ENDIAN / LITTLE ENDIAN

Select either Big Endian or Little Endian by SELECT on the teach pendant.

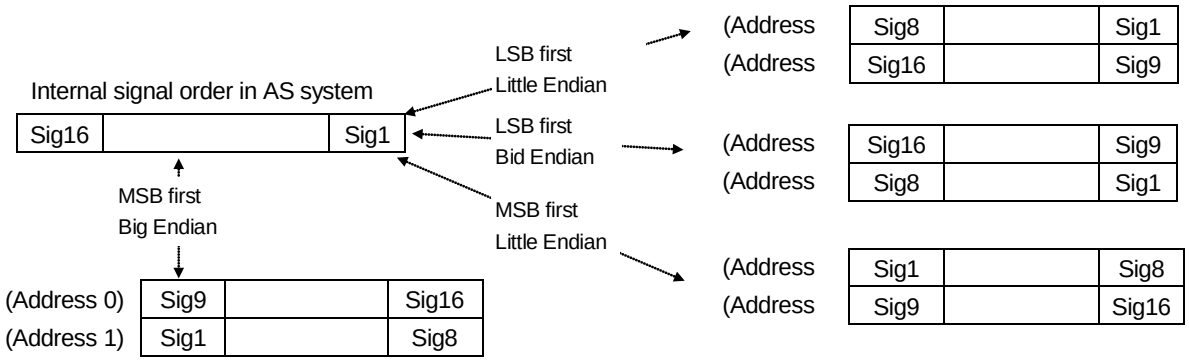
Default

Default setting differs depending on the interface card mounted. See the table below.

	PROFIBUS (Master/Slave)	DeviceNet (Master/Slave)	INTERBUS (Slave)	Others
Bit order in a BYTE	LSB first.	LSB first.	MSB first.	LSB first.
Byte order in a WORD	LITTLE ENDIAN	LITTLE ENDIAN	LITTLE ENDIAN	LITTLE ENDIAN

Definition of signal order (Example)

When external I/O signals are set in 16 channel units, the bit and byte orders are shown below.
Sig1 indicates the first signal of the external I/O signals.



6.4 DISPLAYING FIELDBUS I/F BOARD FIRMWARE VERSION

To see the firmware version of the fieldbus interface cards, execute ID command or select [Aux. 0804] – [Software Version].

Firmware version is not displayed for the following fieldbus interface card:
INTERBUS-VME board manufactured by PHOENIX CONTACT

For details on other items displayed besides firmware version, see the Operation Manual or AS Language Reference Manual.

Example

In this example, firmware version is displayed via ID command for a system installed with AnyBus-M PROFIBUS card in the master port, and AnyBus-M DeviceNet card in the slave port.

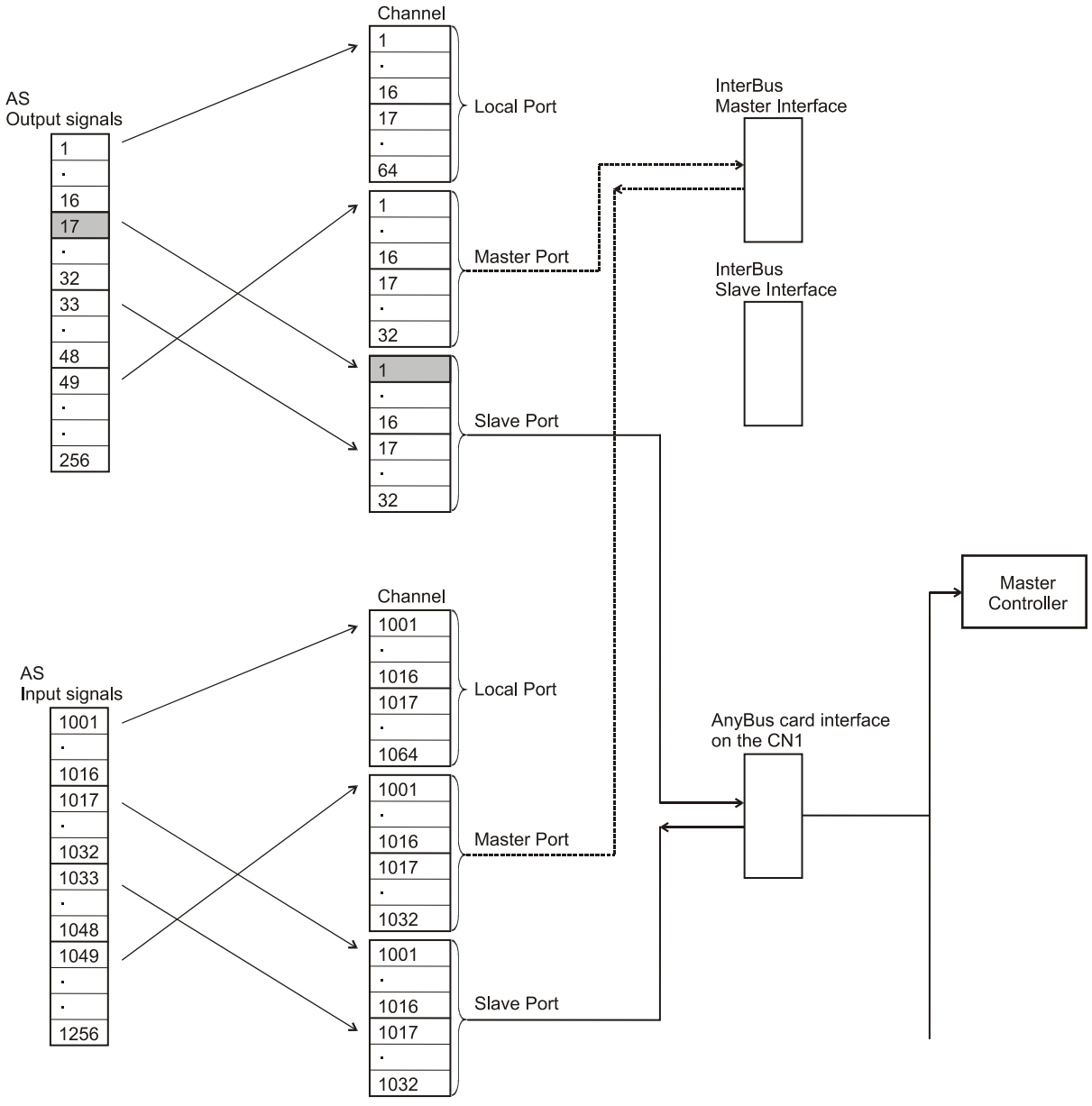
```
>ID ↵
        Robot name        : FS010N-B001    Num of axes: 6    Serial No.1
        Master port       : V01.000 04.06.97   version
        Slave port        : 1.31   version
        Number of signals: output=32          input=32          internal=256
        Clamp number      :2    MOTION TYPE: 2    SERVO TYPE:2
        ACC. & DEC. VARIABLE BY WEIGHT   : OFF

[Software version]
===AS group===  : AS_0140030F 2006/06/02 11:31
User IF AS          : UAS0140030F 2006/05/30 20:01
User IF TP          : UTP0140030F 2006/05/30 20:01
Arm control AS              : AAS0140030F 2006/05/30 20:01
User IF AS Message file     : MAS10030FJP 2006/04/20 14:39
User IF TP Message file     : MTP10030FJP 2006/04/18 19:10
Arm data file       : ARM0140030F 2006/04/18 18:33
=== Servo group ===   : SV_0400001C 2006/05/25 10:31
>
```

7.0 EXAMPLE OF SIGNAL DEFINITION

A sample allocation of external I/O signals is shown below. The max. number of signals (ON/OFF information) for the Master and Slave ports is set to 32. AS output signal Nos.17 through 32 and 33 through 48 are allocated to the Slave port. When executing monitor command Signal 17, the 17th output signal is sent to the Master Controller via Slave port channel 1 and the AnyBus card interface.

```
>ZSIGSPEC ↵
DO,    DI,    INT,    MAS,    SLA
64     64     128     32      32
```



8.0 ERROR MESSAGES

This section describes error messages related to the fieldbus system.

8.1 PROBABLE ERRORS IN FIELDBUS COMMUNICATION

The controller errors that might occur during fieldbus communication, their causes and countermeasures are as follows.

(D4500): FIELD-BUS interface board is not installed.
Probable cause : Interface board specified in Aux. 0608-2 is not installed.
Countermeasure : 1. Turn controller power OFF and install the interface board specified by Aux. 0608-2 into the correct slot.
2. If the interface board has already been installed, check if I/O interface is allocated.
3. Check LED indicator on the interface card.
4. Check the jumper setting on 1JF/1TJ board.

(D4501): ABMA-PDP) I/F module error. nn xx
Probable cause : Error occurred in ABMA-PDP module due to misinstallation or malfunction. "nn" indicates the version of the firmware. "xx" (8 figures) indicates the error sub-code for the device.
Countermeasure : 1. Check the error sub-code and remove the cause. See section 8.1 "Error Sub-code for PROFIBUS-DP Master" for more details.
2. Check if 1JF/1TJ board and interface card are installed, and turn controller power ON.
3. If this error recurs, check if the indicator (LED1. Ready) on the interface card is turned OFF. If it is ON, reconfigure the network. If it is OFF, contact the card manufacturer. (See section D8 on LED indicator.)

(D4502): FIELD-BUS-INIT) Error Reply. xx
Probable cause : Error returned because the message to establish the communication path for the master/slave was defective, etc. during initialization of the interface card
Countermeasure : 1. Check LED indicator on the interface card and accommodate I/O data length with the master if necessary.
2. Turn controller power OFF and then ON.
3. Check fieldbus cables.
4. If the error message is still displayed, note the defect code "xx", and please inform Kawasaki.

5. Check if I/O data length exceeds the max. limit handled by each fieldbus interface card.

(D4503): FIELD-BUS-INIT) Reply timeout. xx

Probable cause : Reply message was not received in the specified timeout period due to defective hardware, etc. when initializing the interface board.

Countermeasure : 1. Check LED indicator on the interface card and identify the error cause, such as disconnected cables, mismatch in I/O data lengthes in the master/slave cards, trouble in communication path, and remove the cause.
2. Turn controller power OFF then ON.
3. If the error message is still displayed, note the defect code "xx", and please inform Kawasaki.

(D4504): ANYBUS) OUT/FB.CTRL request timeout. xx

Probable cause : Access to the data area for reading input signal information was not accepted due to hardware trouble.

Countermeasure : 1. Check LED indicator on the interface card and reset the error.
2. If the error message is still displayed, note the defect code "xx", and please inform Kawasaki.

(E1004): INTER-bus board is not ready.

Probable cause : INTER-bus board is not ready after a certain period of time elapsed When the board is booted,.

Countermeasure : 1. Turn controller power OFF and then ON.
2. Check the cables on the board.
3. Check the settings on the dipswitches.

(E1013): INTER-bus board is not installed.

Probable cause : INTER-bus board is not installed on the card rack.

Countermeasure : 1. Install INTER-bus board on the card rack.
2. Check if INTER-bus board is installed properly.
3. Check the settings on the dipswitches.

(E1018): INTER-BUS status error.

When Location "xx1.xx2" is displayed.

Probable cause : Error occurred in communication cables. Code figures indicates the location of the slave device in which the error occurred. Figures vary depending on the network system.
Example: 3.1 indicates Bus Segment is 3 and Device is 1.

Countermeasure : Check the following points;
1. Disconnection in the cables.
2. Defect in the slave device.
3. Incorrect setting of the baud rate.

When the code "xxxx" is displayed.
Probable cause : The following two causes are considered;
1. Set parameter error of INTERBUS
2. Control process error of INTERBUS board
Countermeasure : Check the set parameters and the actual network environment.
Error sub-code indicates the details of the probable cause and countermeasure. For more information, refer to the following manuals.
User Manual
Firmware Services and Messages
Designation:IBS SYS FW G4 UM E
Order No.: 27 45 18 5
PHOENIX CONTACT

(E4500): ANYBUS) IN-AREA request timeout. xx
Probable cause : 1. Error lamp is ON.
When writing output signal data, the request for the access to the data writing area was rejected due to hardware trouble.
2. Error lamp is OFF.
When writing output signal data, access to the data writing area could not be given due to defective hardware.
Countermeasure : 1. Check LED indicator on the interface card and reset the error.
2. If the error message is still displayed, note the defect code "xx", and please inform Kawasaki.

(E4501): ANYBUS) OUT/FB.CTRL release timeout. xx
Probable cause : Access to the data area for reading input signal information was not released due to hardware trouble.
Countermeasure : 1. Check LED indicator on the interface card and reset the error.
2. If the error message is still displayed, note the defect code "xx", and please inform Kawasaki.

(E4510): DN) Master status. xx

Probable cause : The status of the master port changed during communication via DeviceNet due to cable disconnection to the slave port, etc. "xx" indicates the status code. (See Table 8.2.)

Countermeasure : Check the status and remove the error cause.

(E4511): DN) Node status. xxxx

Probable cause : The status of the slave node changed because the I/O communication via DeviceNet failed due to cable disconnection to the slave. Sub-code "xxxx" consists of the MAC_ID (2 figures) + status code (2 figures). (See Table 8.2.)

Countermeasure : Refer to the status code and remove the cause by checking cables, etc.

Table 8.1 DeviceNet status code

Value (hex.)	Description
00	Normal or not on the scanlist.
46	Duplicate MAC_ID error
47	Scanner configuration error
48	Device communication error
49	Incorrect device type
4A	Port overrun error
4B	Network fault
4C	No CAN message
4D	Incorrect data size
4E	No device
4F	Transmission error
50	Node in idle mode
51	Node in fault mode
52	Fragmentation error
53	Node initializing error
54	Uninitialized node
55	Received buffer overflow
56	Node changed to idle mode.
5B	Bus off
5C	No power supply to bus.
63	System error

(E4512): ABM-DN) Mailbox error.

Probable cause : Error returned because mailbox was not accepted due to defective setting of the parameter in DEVNET monitor command, etc.

Countermeasure : Check MAC_ID of the specified slave and if necessary re-enter the parameter and execute DEVNET monitor command again.

(E4520): ABMA-PDP) Status STOP. xx

Probable cause : The status of AnyBus PROFIBUS-DP master changed to STOP because an error in the slave was detected during I/O communication in Auto Clear mode. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check if the fieldbus cable is disconnected.
2. Check the error sub-code, remove the cause, and reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.

(E4521): ABMA-PDP) Status OFFLINE. xx

Probable cause : The status of AnyBus PROFIBUS-DP master changed to OFFLINE due to error in ABMA-PDP module. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check the error sub-code and remove the cause, then reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP master for more details.
2. If error recurs, turn controller power OFF then ON.

(E4522): ABMA-PDP) I/O Data Communication error. xx

Probable cause : Communication was disconnected during I/O communication because configuration data was downloaded to the interface card. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : Check the error code, remove the cause, and reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.

(E4523): ABMA-PDP) Timeout of sending I/O data. xx

Probable cause : Output signals from AS system could not be processed within the specified time because the load of ABMA-PDP module became high. "xx" (8 figures) indicates the error sub-code of the device status.

Countermeasure : 1. Check if fieldbus cable is disconnected.
2. Check the error code, remove the cause, and reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.

(E4524): ABMA-PDP) Timeout of receiving I/O data. xx

Probable cause : Input signals from the slave could not be processed within the specified time because the load of ABMA-PDP module became high. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check if fieldbus cable is disconnected.
2. Check the error code, remove the cause, and reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.

(E4525): ABMA-PDP) Timeout of sending message. xx

Probable cause : Transmission message could not be processed within the specified time because the load of ABMA-PDP module became high. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check if fieldbus cable is disconnected.
2. Check the error code, remove the cause, and reset the error. See section 8.1 Error Sub-code for PROFIBUS-DP Master for more details.

(E4526): ABMA-PDP) Timeout of receiving message. xx

Probable cause : Receiving message could not be processed within the specified time because the load of ABMA-PDP module became high. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check if fieldbus cable is disconnected.
2. Check the error code, remove the cause, and reset the error. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.

(E4527): ABMA-PDP) Check configuration data. xx

Probable cause : Configuration was not completed due to incorrect data or parameter. This error might occur even if error was reset after downloading configuration data. "xx" (8 figures) indicates the error sub-code for the device.

Countermeasure : 1. Check the error code and correct the configuration data and parameter, then download again. See section 8.2 Error Sub-code for PROFIBUS-DP Master for more details.
2. Remove the cause and reset the error. When the number of I/O signals has been changed by ZSIGSPEC, turn controller power OFF then ON.

(E4528): PROFIBUS) Slave Diag-error response detected. xx

Probable cause : Error returned due to incorrect parameter in the slave diagnosis command. "xx" (2 figures) indicates the error sub-code. If A1 (hex.) is returned for "xx", the specified node address is out of range.

Countermeasure : 1. Check the specified remote node address because it might not be configured and remove the error cause.
2. Check if the field bus cable is disconnected.

(E4529): PROFIBUS) Statistic counter-error response detected. xx
Probable cause : Error returned due to incorrect parameter in the slave diagnosis command. "xx" (2 figures) indicates the error sub-code.
Countermeasure : 1. Check the error sub-code and remove the error cause.
2. Check the specified remote node address because it might not be configured and remove the error cause.

(E4530): DN) Master line is disconnected.
Probable cause : DeviceNet cable connected to slave device is disconnected.
Countermeasure : Check for wiring if there is cable disconnection to slave device or disconnection of connectors/ cables.

(E4531): CC-LINK) Communication is disconnected.
Probable cause : One of the following error occurred in 1PS board:
memory transmission error, cycle counter error
Countermeasure : 1. Remove the cause and reset the error.
2. If error recurs, replace the board.

(E4532): CC-LINK) 1PS Communication Environment error
Probable cause : The initial settings for 1PS board do not match the master setting, and communication via CC-Link is not available. (Baud rate setting, station setting, number of extended cyclic)
Countermeasure : Check the following points. Turn OFF the controller power and fix any problems found, then turn it back ON.
1. Do the protocol/ cyclic expansion match that of the master?
2. Is the baud rate correct?
3. Is the station no. as specified?

(E4533): CC-LINK) Watchdog timeout error
Probable cause : 1PS board has stopped due to watchdog timeout error within the board. Or, there was no response from master board within the specified time during handshake process between CC-Link master and AS.
Countermeasure : 1. Turn controller power OFF/ON.
2. If error recurs, replace the board.

(E4534): CC-LINK) Parameter error xx

Probable cause : Parameter setting data do not match with CC-Link master specifications. xx is the error code.

Countermeasure : 1. Check the error code and resolve error according to its countermeasure, then reset the parameter. See error code listing in 8.3.

(E4535): CC-LINK) Parameter setting timeout error

Probable cause : Processing to set parameter for CC-Link master did not complete within set time.

Countermeasure : 1. Reset the error.
2. If error recurs after resetting the error, turn OFF/ ON controller power.
3. If error still occurs, check the dip switches on the master board.

(E4536): CC-LINK) Abnormality found in master board. xx

Probable cause : A critical error has occurred within the master device. The output data is cleared when this error occurs. X is the error code.

Countermeasure : 1. Check the error code and correct device and cable settings according to it. See error code listing in 8.3.
2. Turn OFF/ ON the controller power.
3. Replace the board if so indicated.

(E4537): CC-LINK) Master board initialization error xx

Probable cause : A critical error has occurred when initializing the master.
X shows the initialization status at when the error occurred.

Countermeasure : 1. Reset the error.
2. If error recurs after resetting the error, turn OFF/ ON controller power.
3. If error still occurs, check the dip switches on the master board.

(E4538): CANopen) Network is disconnected.

Probable cause : 1. The CANopen cable is disconnected or broken.
2. The network configuration was executed.

Countermeasure : 1. Check for disconnection or breakage of the CANopen cable.
2. Execute error-reset, and begin the initialization of the AnyBus card.

(E4540): PROFINET(CP16) Detected alarm signal.xx

Probable cause : CP1616 ProfinetIO controller detected alarm signal. xx shows the code of alarm contents.

Countermeasure : Handle errors depending on the contents of alarm. For details, contact the vendor .

(E4541): PROFINET(CP16) System is in offline status.
Probable cause : Mode is not changed to operation mode due to the error occurred in the board.
Countermeasure : Turn controller power OFF and then ON.

(E4542): PROFINET(CP16)) Access error occurred. xx
Probable cause : Error occurred in CP1616 card. xx shows the code of error contents.
See below for the contents of codes 301, 30A, 3FF;
301: Devices do not exist.
30A: Configuration data and the installed device mismatch.
3FF: A critical error has occurred
Countermeasure : Handle errors depending on the displayed contents
See below for countermeasures of codes 301, 30A, 3FF;
301: Connect devices.
30A: Check the configuration data.
3FF: Contact the vendor .

(E4543): PROFINET(CP16) Detected Watch dog error.
Probable cause : There is no access to CP1616 card for the specified period of time or more.
Countermeasure : 1. Turn the controller power OFF and then ON.
2. If the error cannot be resolved, replace the CP1616 board.

(E4550): PROFINET(CP16 Device) Module exceeds the maximum size.
Probable cause : The number of modules exceeds 5, or the module size exceeds 128 bytes.
Countermeasure : Change the number of modules to 5 or less , or change the module size to 128 bytes or less.

(E4551): PROFINET(CP16 Device) Access error occurred. xx
Probable cause : Error occurred in CP1616 card. xx is the code that represents the following error content.
30A: Configuration data are different from the data length of actually installed device.
30E: There is no communication with firmware.
3FF: A critical error has occurred
Countermeasure : Handle errors depending on the displayed code
30A: Check the configuration data.
30E: Reset CP1616 by configuration tool.
3FF: Replace CP1616 board.

(E4552): PROFINET(CP16 Device) Reply timeout.
Probable cause : Communication with IO controller was disconnected.
Countermeasure : 1. Check if the cable is connected properly.
2. Check if IO controller operates properly.

(P4500): FIELD-BUS) Interface not enable.

Probable cause : 1. PROFIBUS (/DEVNET) command was executed without allocating the fieldbus interface first.
2. Interface card for PROFIBUS (/DEVNET) is not installed.

Countermeasure : 1. Check if the fieldbus interface is allocated.
2. Check the type of the installed interface card.

(P4501): DEVNET) Node nn not in the scanlist.

Probable cause : DEVNET monitor command was executed to a slave that is not in the scanlist. "nn" indicates the MAC_ID.

Countermeasure : Check the MAC_ID in the DEVNET monitor command and re-enter the correct parameter, then execute DEVNET monitor command again.

(P4502): DEVNET) Already in that mode.

Probable cause : Attempt was made by DEVNET command to change to an operation mode that was already set for the master.

Countermeasure : Check the input parameter and execute DEVNET monitor command if necessary.

(P4505): CC-LINK) Version check error.

Probable cause : The version of the master and 1PS differs.

Countermeasure : Use master and 1PS board with same version. If the versions match, link is restored automatically.

(P4506): EN/IP-M) Setting already changed.

Probable cause : ETNIPM monitor command was executed to change the operation mode setting of the master, but the specified mode is already set.

Countermeasure : Check the parameters input, and execute ETNIPM command as necessary.

(P4507):FIELD-BUS) Cannot execute with old AnyBus card firmware.

Probable cause :This error occurs during download operation of the configuration data. The version of the installed AnyBus-M DeviceNet card firmware does not support loading operations.

Countermeasure :If the firmware version of the AnyBus-M DeviceNet card is 1.27 or older, configuration data cannot be downloaded. Install a later version AnyBus-M DeviceNet card.

(P4508):FIELD-BUS) Cannot communicate with interface card.

Probable cause : This error occurs during download or upload operation of the configuration data. This may be caused by:
1. There are other tasks accessing the DeviceNet master card
2. The communication between the interface card and AS was not processed within given time due to heavy load in the DeviceNet master card, etc.

Countermeasure : Confirm that the fieldbus cables are properly connected. Then,
1. Retry the process
2. If the error message appears again, I/O communication processing may not be carried out properly. Turn OFF/ON the controller power and retry.

(P4509):FIELD-BUS) Wrong interface card type error.

Probable cause : This error occurs during download or upload operation of the configuration data. This may be caused by:
1. DeviceNet master card is not installed.
2. The installed fieldbus interface card is not a DeviceNet master card.
3. DeviceNet master card is not selected in I/O Interface allocation set in Aux. 0608-2.

Countermeasure : 1. Install the correct DeviceNet master interface card.
2. Check the I/O Interface allocation in Aux. 0608-2.

(P4510):FIELD-BUS) Initialization on the card is not complete.

Probable cause :Initialization of the installed DeviceNet master interface card is in process and could not execute upload/ download operation.

Countermeasure : Wait until the initialization is complete and then retry.

(W4500): FIELD-BUS) Slave port OFFLINE.

Probable cause : Power to the master port is cut off, or the slave port is turned offline due to disconnection of communication line.

Countermeasure : Check the master port and communication line, remove the error cause, and wait until the line is connected.

(W4501): FIELD-BUS) Master port OFFLINE.

Probable cause : Master port was turned offline due to disconnection of the communication line.

Countermeasure : Check the slave port and communication line, remove the error cause, and wait until the line is connected.

(W4502): CC-LINK) Abnormal data link in master. %X

Probable cause : There was abnormality in data link and input/ output processing was aborted.
X shows the condition of the line:

0: Initial status
1: In standby for parameter reception (Only for local station)
2: Data link processing.
3: Data link interrupted.
4: Polling (No polling request)
5: Polling (Line fault)
6: Polling (Other)
7: Line test in process
8: Parameter setting test in process
9: Automatic link restoration in process
FF: Resetting

Countermeasure : Check for problems in the slave or the communication route, and remove the problem.
Check for following items:
1. Disconnection of cables.
2. Disconnection of connectors.
3. Mistaken wiring.

8.2 ERROR SUB-CODE FOR PROFIBUS-DP MASTER

Error sub-code “xx” for PROFIBUS-DP master is displayed by eight figures (hexadecimal). The code composed of four sub-codes as below. Each of the 4 sub-codes indicates a corresponding value in DPRAM in AnyBus PROFIBUS-DP master card.

Table 8.2 Sub-code

Code	xx	xx	00	xx
Symbol name	ErrRemAddr	ErrEvent	Reserved	DeviceErr
Value	2 figures Hexadecimal	2 figures Hexadecimal	2 figures (00)	2 figures Hexadecimal

1. ErrRemAddr:
Indicates the node address where the error occurred. Device in this table means AnyBus PROFIBUS-DP master module.

Table 8.3 ErrRemAddr

Value	Description
00H - FEH	The smallest value among node addresses in error. See Fig.8.4 on the error cause.
FFH	Error occurred inside the device. See Fig.8.5 on the error cause.

2. ErrEvent:

Indicates the error cause. There are external and internal errors. The former are detected in one of the devices on the network. The latter is detected inside the AnyBus PROFIBUS-DP master module.

Table 8.4 ErrEvent (External error)

Value	Description	Error source	Countermeasure
00H	Remote node is OK.	-	-
03H	Remote node does not function.	Remote node	Check if the remote node complies with the PROFIBUS-DP standards or if the correct GSD file is used.
09H	No reply data.	Remote node	Check bus cables.
11H	No reply from slave.	Remote node	Check bus cables and the remote node address.
12H	Device is not in the logical token ring.	Device	Check the FDL (Fieldbus Data Link Layer) master address and highest station address in the other master system.

Table 8.5 ErrEvent (Internal error)

Value	Description	Error	Countermeasure
00H	No error.	-	-
32H-35H	Internal error.	Device	Contact HMS.
36H	No master parameter.	Device	Download the configuration data again.
37H	Master parameter is wrong.	Project planning	Contact HMS.
38H	No remote node parameter.	Project planning	Download the configuration data again.
39H	Remote node parameter is wrong.	Project planning	Contact HMS.
3AH	Duplicate node address.	Project planning	Check the remote node addresses.

3BH	Offset address for the specified transmission process data is beyond the acceptable range.	Project planning	Check the offset address for the transmission data.
3CH	Offset address for the specified receiving process data is beyond the acceptable range.	Project planning	Check the offset address for the receiving data.
3DH	Remote node data area is overlapping in the receiving process data area.	Project planning	Check the offset address for the receiving data.
3EH	Remote node data area is overlapping in the sending process data area.	Project planning	Check the offset address for the sending data.
CAH	No free segment.	Device	Contact HMS.
D4H	Reading error of the configuration data.	Device	Download the configuration data again.
D5H	System fault.	Device	Contact HMS.
Others	- (Not available.)	-	Contact HMS.

3. DeviceErr: Indicates error conditions in the master device.

Table 8.6 DeviceErr

	Symbol	Description
00H	-	-
0EH		OS module, Firmware download.
32H	RAM_TEST	RAM check failure.
35H	FLASH_TEST	Checksum failure of FLASH PROM.
64H-6BH	SYSTEM	Internal system error.
C8H	Unknown_IRQ	Received unknown interrupting signal due to system crash, etc.
C9H	Watchdog	Internal watchdog is invalid.
CAH	TX_IRQ	Unexpected interrupting signals are sent from serial channel.
CBH	RX_IRQ	Unexpected interrupting signals are received from serial channel.
FCH	Download active	Currently downloading the firmware or database.
FDH	Bootloader	Currently activating the bootstrap loader, but not the firmware.

8.3 CC-LINK ERROR LIST

Error code	Error details	Cause of error occurrence (details)	Corrective action
B008	Carrier detection error	Carrier detection continuously in “H”.	Check the line.
B009	Station number switch setting error	Switch setting has been changed while on-line.	Return the switch setting to the original state.
B083	All station error	There are no stations connected.	Connect stations.
B084	Sending block switching error	Block could not be switched by block change command. (H/W error).	Replace H/W.
B088	Monitoring time up error	A line error has occurred.	Check the line.
B102	Link error	A line error has occurred.	Check the line.
B110	Transient data cannot be received.	A line error might have occurred.	Check the line.
B11	Transient data receiving order error	A line error might have occurred.	Check the line.
B112	Transient data length error	A line error might have occurred.	Check the line.
B113	Transient data ID error	A line error might have occurred.	Check the line.
B114	Link error	A line error might have occurred.	Check the line.
B115	Link error	A line error might have occurred.	Check the line.
B116	Packet error	A line error might have occurred.	Check the line.
B201	Corresponding station error during sending	A data link error occurred at the corresponding station during transient transmission.	Check the communication status of other stations, whether or not a temporary error invalid station is specified, or if the corresponding station is stopped.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B202	Data length error	A line error might have occurred if the packet data length did not match at transient transmission.	Check the line. Set data length that satisfies the condition.
B203	CT value error	CT value in CC-Link transient frame is incorrect.	Set correct CT value.
B204	Error sending buffer could not be obtained	Buffer could not be obtained when sending error response.	Wait a while and then retransmit (transient overload status).
B205	Target station error (Not intelligent device)	A transient request was issued to other than the intelligent device station.	Check the target station.
B301	Processing request error during link stop	Line test request was issued while the link was stopped.	Perform a line test while the link is being established.
B302	Specified station number setting error	The specified station number exceeded the highest communication station number during temporary error invalid request/ temporary error invalid cancel request.	Specify a station number that is no greater than the highest communication station number.
B303	Specified station number not set error	The station number was not specified during temporary error invalid request / temporary error invalid cancel request.	Set a specified station number. (SW0003, SW0004 to SW0007)
B304	Line test error station detected (Error in receiving status)	An error was detected in a remote station, intelligent device station or standby master station when a line test was performed.	Check that the slave station is operational and that the cable in not disconnected.
B305	Line test error station detected (Error in respond data)	An error was detected in the respond data when a line test was performed.	Replace the slave station that is the target of the line test.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B306	Specified station number setting error	A station number other than the head station number was specified during temporary error invalid request/ temporary error invalid cancel request.	Specify a head station when temporary error invalid request/ error invalid request/ temporary error invalid cancel request is requested.
B307	All stations data link error	All stations were in data link error status when one of the following requests was made. ・SB0000 (data link restart) ・SB0002 (data link stop)	Request again after the data link becomes normal.
B308	Station number setting error (installation status)	The station number of the slave station is outside of the range between 1 and 64.	Check there are no duplicating station numbers for the installed modules (including number of occupied stations).
B309	Station number overlap error	The station number of the connected module was duplicated (including number of occupied stations). However, this excludes the duplicate head station number.	Check the module station number.
B30A	Loading / parameter consistency error	The station types of the module are different from parameter settings or number of stations exceeds the parameter setting. Example: Module parameter setting Remote device remote I/O Intelligent remote I/O Device remote device	Set the correct parameters.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B30B	Loading/parameter consistency error	The contents of the installation status and network parameters do not match. (No match)	Set the contents of the installation status and network parameter to match.
B30C	Standby master station specification error	SB000 1 was turned ON in station other than master station or in system where no standby master exists.	Check the system for standby master station.
B30D	Initial status	Temporary error invalid station specification and SB requests were issued before starting the link.	Issue the requests after the data link is started.
B310	Data link restart error	Data link restart (SB0000) was executed for the station that had stopped a data link.	Execute Data link restart (SB0000) for the station that has stopped a data link with Data link stop (SB0002).
B311	Data link stop error	Data link stop (SB0002) was executed for the station that had stopped a data link.	Execute Data link stop (SB0002) for the station that is performing a data link
B312	Standby master station absence error	Forced master to standby master switching (SB000C) was executed in the system where no standby master station exists or in the system where the standby master station had become faulty.	After starting the data link of the standby master station, execute Forced master to standby master switching (SB000C).
B313	All station fault error	Forced master to standby master switching (SB000C) was executed in the system where all stations had become faulty.	After starting the data link of the standby master station, execute Forced master to standby master switching (SB000C).

Error code	Error details	Cause of error occurrence (details)	Corrective action
B315	Forced master station switching error	Forced master switching (SB000C) was instructed again while the master station was being switched to the standby master station.	Check ON/OFF of Forced master switching (SB000C).
B381	Station number switch setting error	Station number switch was set outside the setting range.	Set station number switch within setting range.
B383	Baud rate switch setting error	Baud rate switch was set outside the setting range.	Set baud rate switch within setting range.
B384	Station number setting error (parameter)	The station number (including the number of occupied stations) of the station information parameters was set to other than 1H to 40H.	Set within the range of “1H to 40H”.
B385	Total number of stations error (parameter)	The total number of occupied stations set with the station information parameter exceeded 64.	Set a parameter value of 64 or less.
B386	Number of occupied stations setting error (parameter)	Number of all occupied stations in the station information parameter was set to 0.	Set the occupied station number to a value between 1 to 4.
B387	Delay time setting error (parameter)	Delay timer was set to other than 0 to 100.	Set a value within the setting range of 0 to 100.
B388	Station type setting error (parameter other than 0 to 3)	Station type in the station information parameter was set to other than 0 to 3. (Ver. 1 mode only)	Set a value between 0 to 3.
B389	Data written in unavailable area error	Data was written into unavailable area of the dual port RAM.	Write into available area of the dual port RAM.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B38A	Remote I/O station setting error (parameter)	The number of remote device stations was set to 65 stations or more with the station information parameter.	Set the remote I/O station to 64 stations or less.
B38B	Remote device station setting error (parameter)	The number of remote device stations was set to 43 stations or more with the station information parameter (address 20H to 5FH).	Set the remote device station to 42 stations or less with the station information parameter.
B38C	Intelligent device station setting error (parameter)	The number of intelligent device stations (including local stations) was set to 27 stations or more with the station information parameter.	Set the intelligent device station to 26 stations or less with the station information parameter.
B38D	Invalid station specified error (parameter)	"Other than module head station number" or "Station number not specified in the parameter" was set with the invalid station specification parameter. Example of other than head station number: A bit other than that for station number 5 was ON for a module occupies 4 stations (station numbers 5 to 8).	Set the "Head station number of the module." Do not specify any of the stations not specified with the parameter.
B38E	Communication buffer assignment error (parameter)	The total size of the communication buffers in the station information parameter exceeded 4k words.	Set the total size of the communication buffer to 4K words or less.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B38F	Automatic update buffer assignment error	Data was written into unavailable area of the dual port RAM.	Write into available area of the dual port RAM.
B390	Standby master station specification error (parameter)	The standby master station parameter was set to value other than 1 to 64.	Specify the standby master station to a value within the range from 1 to 64).
B391	Retry count setting error	The retry count parameter was set to value of other than 1 to 7.	Set a value within the range of 1 to 7.
B392	Operation when CPU is down specified error	The operation when the CPU is down specification parameter was set to value other than 0 or 1.	Set to 0 or 1.
B394	Number of automatic return stations setting error (parameter)	Number of automatic return stations parameter was set to value other than 1 to 10.	Set a value within the range from 1 to 10.
B396	Station number overlap error (parameter)	A duplicated station number was specified with the station information parameter.	Set so that station numbers are not duplicated.
B397	Station information setting error (parameter)	The station information parameter setting does not meet the following condition. (16×A)+ (54×B)+ (88×C)≦2304 A: Number of remote I/O stations B: Number of remote device stations C: Number of intelligent device stations (including local stations)	Set the parameter so that it meets the condition shown on left.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B398	Number of occupied stations setting error (parameter)	The number of occupied stations in the station information parameter (address 0220H to 025F) was set to a value other than 1 to 4.	Set a value within the range from 1 to 4.
B399	Number of connected modules setting error.	The number of connected modules parameter was set to a value other than 1 to 64.	Set a valued within the range of 1 to 64.
B39B	Reserved station setting error	All stations were set as reserved stations.	Check the reserved station settings.
B39C	Standby master station setting error For Ver.1: Other than 2 or 3 For Ver.2: Other than 6,9,C,F	Any other than intelligent device station has been set to the station type for the "Standby master station No." specified in the master station network parameter. The mode setting is different between the master and standby master stations.	Specify the standby maser station as an intelligent device station. Make the same setting to the maser and standby master stations.
B39D	Reserved station 0 points setting error	0 point is set to a non-reserved station or in Ver.1 mode.	Set the station of reserved 0 points setting as a reserved station.
B39E	8/16-points remote I/O station setting error	8 and 16 points setting made to stations other than remote I/O station.	Set 8/6 points to remote I/O stations.
B3A1	Standby master setting illegal	At the time of parameter setting with dedicated instruction, an illegal value has been set to switch 5 of the intelligent function module switch setting.	Set a correct value to switch 5 of the intelligent function module switch setting.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B3A3	Assignment error	RX/RY and RWw/RWr assigned over maximum number allowed. In the remote net Ver.2 mode or remote net additional mode, total points for remote stations (RX/RY) set in the station information has exceeded the maximum of 8192.	Check the points for remote stations (RX/RY, RWw/RWr) in the station information setting.
B3A4	Parameter mismatch	When the standby master station was operating as the master station with the master station duplex function, the network parameter setting of the faulty master station was changed.	Return the network parameter setting of the master station to the original value.
B3A5	Mode illegal (parameter)	The mode (Ver2/Ver1) set with hardware switch differs from the mode set in parameter setting.	Check the parameter setting and hardware switch setting.
B601	Command type error	An unsupported command type was set.	Set correct command type.
B602	Sending buffer could not be obtained	Sending buffer could not be obtained.	Wait a while and then retransmit (transient overload status).
B603	Sending buffer could not be obtained	Sending buffer could not be obtained.	Wait a while and then retransmit (transient overload status).
B604	Line test in processing	Transient transmission was sent when a line test was in progress.	Wait a while and then retransmit.
B605	Transient storage buffer could not be obtained	Transient buffer could not be obtained.	Wait a while and then retransmit.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B606	System data could not be obtained	System data could not be obtained.	System data should be obtained in the current system.
B60C	Error detected in line test (response data error)	Error was detected in the received response data during line test.	Replace the slave station that is the target of the line test.
B701	Transient request overload error	There are too many transient requests to the corresponding station.	Wait a while and then retransmit
B771	Transient request overload error	There are too many transient requests to the corresponding station.	Wait a while and then retransmit (transient overloaded status).
B772	Sending buffer standby over max.	Data in standby to obtain sending transient buffer has exceeded the available limit.	Wait a while and then retransmit (transient overloaded status).
B773	Receiving buffer standby over max.	Data in standby to obtain receiving transient buffer has exceeded the available limit.	Wait a while and then retransmit (transient overloaded status).
B774	Transient request error	The target station was not an intelligent device station.	Check if the target station is an intelligent device station.
B778	Request time out	A response was not received from the requested station.	Check the requested module and cables.
B802	Access code error	An access code that does not exist was used.	Use the correct access code.
B803	Data points error	The number of data points is out of range.	Set the number of data points to within 1 to 960 bytes.
B804	Attribute definition error. Transient transmission unsupported station specification error	The attribute definition was invalid. Alternatively, transient transmission was performed even though the target station does not support transient transmission.	Review the attribute definition. Check the designation of the target station number, as well as the function version and software version of the target local station.

Error code	Error details	Cause of error occurrence (details)	Corrective action
B805	Data points error	The number of data was out of range.	Set the range to within 1 to 100when writing, and 1 to 160 when reading
B807	Address definition error	The address was not a multiple of 16 when the bit device was accessed.	Set the address to a multiple of 16 when accessing the bit device.
B80A	Data length error	Data length was not the correct length.	Check the data length.
B80D	Setting range error	The specified combination (addresses and points) exceeded the valid processing range.	Set so that the number of processing points does not exceed the device range.
B812	Total number of points at transient over 960 bytes	Total number of points at transient has exceeded 960 bytes.	Reduce the total number of points within 960 bytes.
B823	Remote control mode error	The mode setting of the remote control was incorrect.	Check the mode specification
B903	Transient request error	A transient request was issued to a station that has not secured a communication buffer area.	Secure a communication buffer area with a parameter.
B904	Communication buffer size setting error	The communication buffer size of the corresponding station was out of range when a dedicated instruction was executed.	Set the communication buffer size of the corresponding station within the range.
B9FE	Parameter sum check error	Sum check in parameter setting area was abnormal.	Check sum check.
B9FF	S/W hand shake error	An error occurred while handshaking to check if the driver is alive.	Replace user board.
BA01	Sum check code error	Sum check value for ROM is different. (H/W error)	Replace module.
BA02	Network parameter error	Parameter was not set correctly.	Set correct parameter.

Error code	Error details	Cause of error occurrence (details)	Corrective action
BA03	Dual port RAM error code	Data could not be written/read to/from the dual port RAM. (H/W error)	Replace the interface board.
BA04	Work RAM error code	Data could not be written/read to/from the work RAM. (H/W error)	Replace the interface board.
BA07	Self loop receiving data comparison error	Self loop data is not transmitted normally. (H/W error)	Replace the interface board.
BA08	Transmission path error	Transmission path error	Check the line.
BA0A	Refresh frame receiving span error 1	Refresh frame receiving span error 1	Check the line.
BA0B	Refresh frame receiving span error 2	Refresh frame receiving span error 2	Check the line.
BA0C	Carrier detection error	Carrier detection continuously in “H”.	Replace the interface board.
BA0D	Transmission table access error	Transmission table access error	Replace the interface board.
BA0E	Switch changed while power supplied	Alarm was given because the switch was changed while the power is supplied.	Do not change switches while the power is supplied.
BA0F	Continuous sending time error	Continuous sending time error	Check the line.
BA10	Sending buffer access error	An error occurred when accessing to sending buffer.	Replace the interface board.
BA11	Polling status judgment bit	Polling status judgment bit	Check the line.
BA12	CRC error flag error	An error occurred in CRC error flag.	Check the line.
BA13	Abort error flag error	An error occurred in abort error flag.	Check the line.
BA14	Time out error flag error	An error occurred in time out error.	Check the line.
BA15	Buffer over flag error	An error occurred in buffer over flag.	Replace the interface board.

Error code	Error details	Cause of error occurrence (details)	Corrective action
BA16	Receiving frame address error flag error	An error occurred in receiving frame address error flag.	Replace the interface board.
BA17	Retry flag error	An error occurred in retry flag.	Check the line.
BA19	Corresponding station error	The corresponding station that is being tested stopped communication during line test.	Check the cables and the corresponding station.
BA1B	All stations error	All stations stooped communication during line test 1.	Check the cables.
BA1C	Station number duplication error	The station number of the occupied station already exists.	Check the station number and the number of occupied stations.
BA1D	Over maximum station number error	The total number of stations and occupied stations has exceeded 64.	Check the station number and the number of occupied stations.
BBC1	Mode number switch error	The mode switch setting is out of range.	Check the mode.
BBC2	Station number setting error	The station number setting switch setting of the module is other than 0 to 64. Alternatively, the last station number is greater than 64.	Check the station number and the number of occupied stations of the module.
BBC3	Baud rate switch error	Baud rate was set to other than 0 to 4.	Set the baud rate values within 0 to 4.
BBC5	Master station duplication error	Multiple master stations exist on the same line. Alternatively, line noise was detected at power on.	Reduce the number of master stations on the same line to one. Alternatively, check the line status.
BBC7	MFP/HW error detection	MFP chip does not become ready.	Replace the interface board.
BBC9	Sum check error	Sum check value is out of range.	Set the sum check values within the range.

Error code	Error details	Cause of error occurrence (details)	Corrective action
BD85	Hardware error detection	A hardware error was detected.	Check hardware.
BD87	User board error detection	WDT error occurred for NMI.	Replace the interface board.
BF01	Sending buffer storage position error	The data was set to a sending buffer not assigned by DA setting value.	Check receiving/ sending buffer assignment and DA values.
BF02	Receiving/ sending buffer size error	The size of the header data was larger than the size of receiving/ sending buffer.	Check the receiving/ sending buffer size.
BF03	Data size error	The data received/ sent was larger than the size of receiving/ sending buffer.	Check the receiving/ sending buffer size.
BF04	Transient communication corresponding station error	Transient communication was carried out with a station that is not set or with a station that is not an intelligent device station.	Check the parameter setting.
BF10	Response sending error	No data was received or there is no data in standby.	Send response after receiving request. Alternatively, check values for SW000A.

APPENDIX A DEVICENET

A1.0 OUTLINE OF DEVICENET FOR ROBOT CONTROLLER

AnyBus-S DeviceNet card is used for Device Net slave communication. AnyBus-M DeviceNet card is used for master communication. Dipswitch setting determines the function of the board. AnyBus-S and AnyBus-M DeviceNet cards comply with the DeviceNet specifications release 2.0 Vol.1 and 2 by ODVA. General data are shown below.

Table A1 AnyBus/DeviceNet general data

AnyBus DeviceNet

Item	Description
Vendor ID	HMS Fieldbus Systems AB (90)
Product type	Communication adapter (12)
Product code	Slave: (12) Master: (14)
Product name	Slave: AnyBus- S DeviceNet
	Master: AnyBus- M DeviceNet

In the DeviceNet object-oriented model, robot controller supports the following communication specifications.

Table A2 Communication specifications

Device type	Communication adapter
Baud rate	Selectable 125 kbit/s, 250 kbit/s or 500 kbit/s
Number of I/O signals	Max. 960 inputs / 960 outputs
Predefined Master/Slave Connection Set	Slave: Group 2 Only Server
	Master: Group2 Client/ Server/ UCMM support
Communication service	Polling
Transmission medium	Thick cable, Thin cable Components of one cable One twisted pair signal line One twisted pair power line One drain wire
Number of slave stations	Max. 63
Number of MAC_ID (Address on DeviceNet)	0 to 63

[NOTE]

The connectivity with all DeviceNet products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all DeviceNet products.

A2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

↓

2. Set the fieldbus interface card.

   Set the baud rate and MAC_ID by dip switches. (See Section A3.3 for slave, A4.3 for master.)

↓

3. Turn robot controller power ON.

↓

4. Set the allocation for the fieldbus interface. (Signal allocation setting)

   In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)

↓

5. Set the number of external I/O signals. (See Chapter 5.)

↓

6. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

↓

7. Turn robot controller power OFF then ON.

↓

8. Set the signal allocation data. (See Section 6.2.)

↓

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

↓

10. Network configuration.

   For slave: Configure the network following the manual for the master device (such as PLC). When using the network configuration tool (e.g. RSNetWorx configuration software from Rockwell Automation Inc.), install EDS file into the specified area following the manual of the configuration tool.

   For master: Configure the network by RSNetWorx configuration software from Rockwell Automation Inc. or via Aux. 0608-6 Device Net Setting. For configuration using RSNetWorx software, refer to “RSNetWorx For DeviceNet Getting Results Guide”.

↓

11. Start operation.

A3.0 DEVICENET - SLAVE

A3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of slave board (Fig. A1) and interface board installed with 1JF/1TJ board and a slave board (Fig. A2) are shown below.

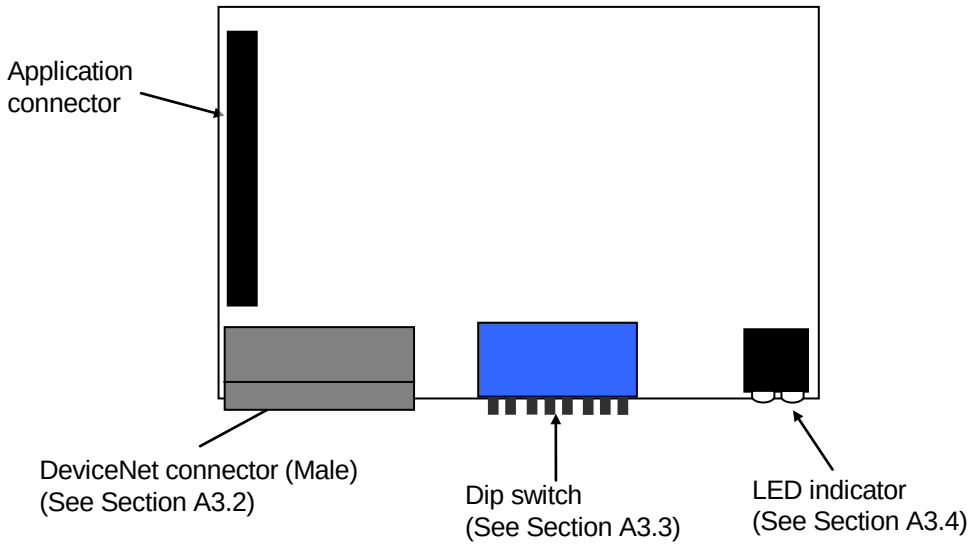


Fig. A1 Slave board (Plane view)

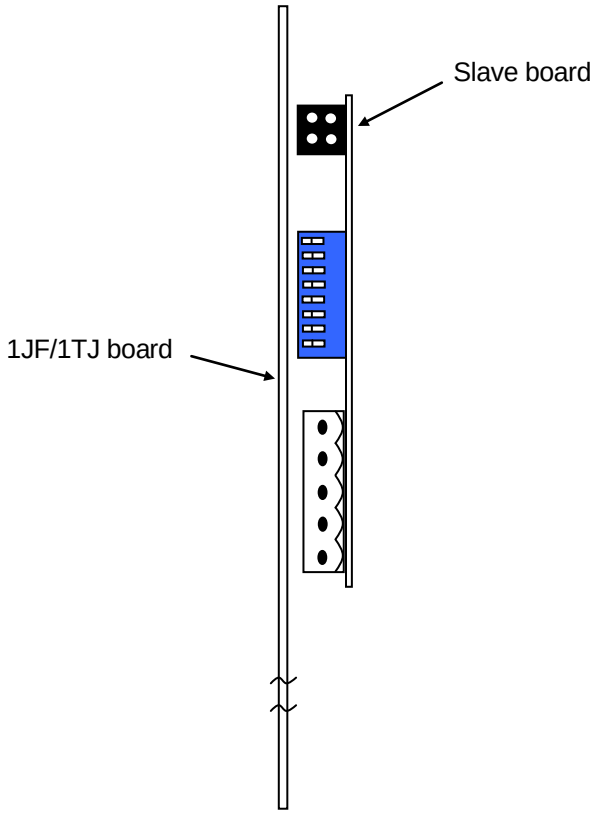


Fig. A2 Interface board (Front view)

A3.2 CABLE CONNECTION

The connection with cables, terminating resistor and connector (female) are shown in Fig.A3 below.

Attach a terminating resistor of 121 Ω to each end of trunkline, 4. CAN_H (white) and 2. CAN_L (blue). Do not attach to the end of droplines.

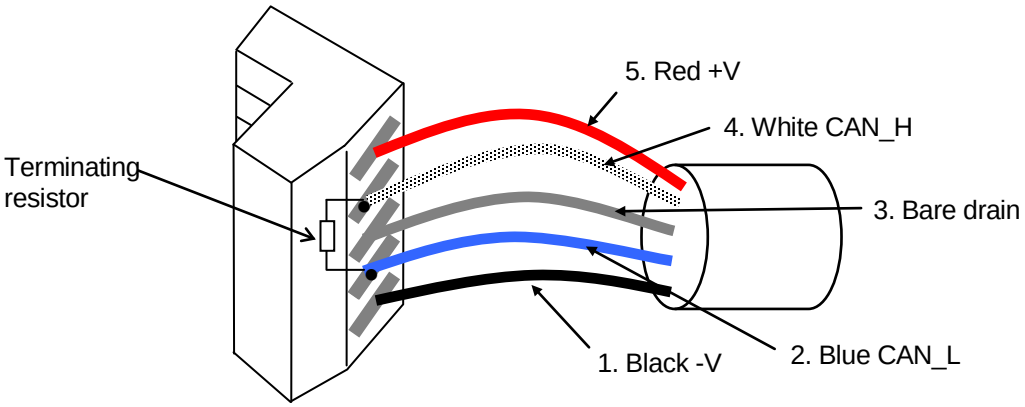


Fig. A3 Connectors and cables

In case of daisy chain connection, insert two of the same color wires into one hole (Fig.A4). Use the crimping terminal for the wires.

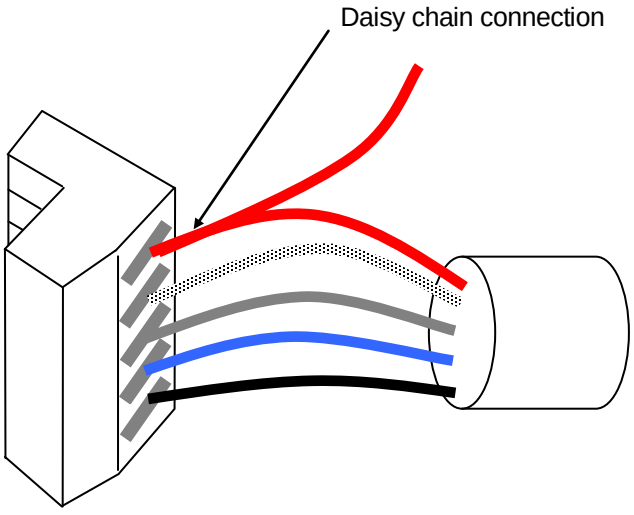


Fig. A4 Daisy chain connection

A3.3 CONFIGURATION

A3.3.1 BAUD RATE AND MAC_ID (ADDRESS)

When configuring DeviceNet network, information for the baud rate and MAC_ID are necessary.

1. Baud rate is selectable from 125, 250 or 500 kbit/s. All nodes in the network must have the same baud rate.
2. MAC_ID is an address assigned on the network, no two nodes can have the same address. For MAC_ID, values from 0 to 63 are assigned.
3. Dip switches 1 and 2 set the baud rate, and 3 to 8 set the MAC_ID.

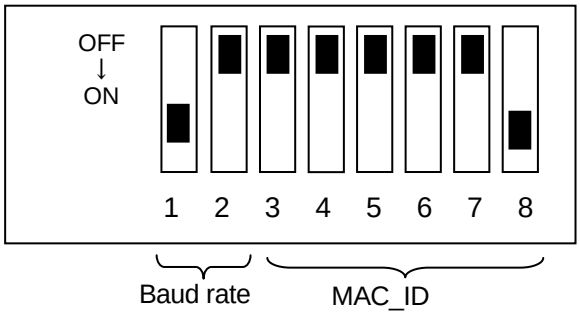


Fig. A5 Dip switches

Table A3 Baud rate

Baud rate [kbit/s]	Dip switch 1-2
125	0 0
250	0 1
500	1 0
Reserved	1 1

0:OFF, 1:ON

Table A4 MAC_ID

MAC_ID (Address)	Dip switch 3-8
0	0 0 0 0 0 0
1	0 0 0 0 0 1
2	0 0 0 0 1 0
3	0 0 0 0 1 1
⟆	⟆
62	1 1 1 1 1 0
63	1 1 1 1 1 1

0:OFF, 1:ON

In Fig A5, the baud rate is 500 kbit/s and MAC_ID is 1.

A3.3.2 EDS FILE

EDS (Electronic Data Sheet) is an ASCII file containing the necessary information for the device. The EDS file is required when using network configuration tools (e.g. RSNetWorx configuration tool software from Rockwell Automation Inc.) to configure the network. In this case, install the EDS file into the personal computer before executing network configuration. When installing EDS file, follow the manual of the configuration tool. The EDS file for the slave board is provided by Kawasaki.

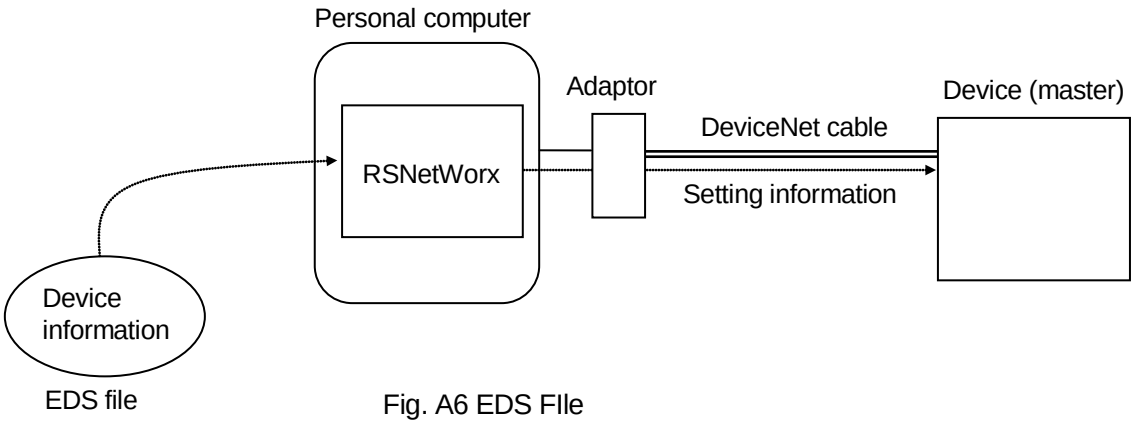
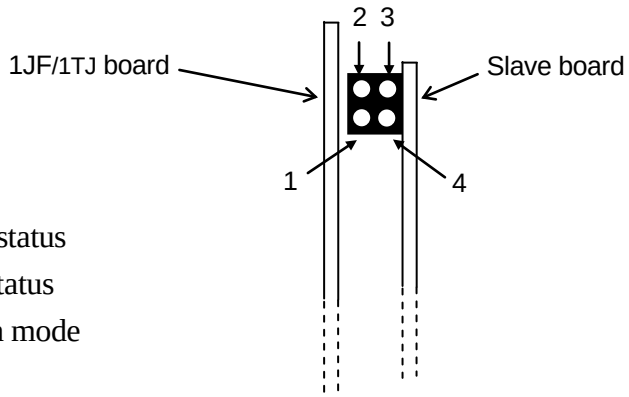


Fig. A6 EDS FIle

A3.4 LED INDICATOR

The slave board has four LEDs on the front of the card and one on the card. The specifications for the LEDs are as shown below.



LED1: Reserved
LED2: Network status
LED3: Module status
LED4: Operation mode

Fig. A7 Front view of LED Indicator

Table A5 LED indicator

Name of LED	Status	Description
2. Network status	OFF	Not powered or not online
	Green	Link OK, online, at least one connection established
	Flashing green	Online, not connected
	Red	Critical link failure
	Flashing red	Connection time out
3. Module status	OFF	No power to device
	Green	Device operational, module status OK
	Flashing green	Data size bigger than configured
	Red	Unrecoverable fault
	Flashing red	Minor fault

Watchdog LED (on slave board)

Table A6 Watchdog

Name	Status	Description
Watchdog	Flashing green (1 Hz)	Module is initialized and running.
	Flashing green (2 Hz)	Module is not initialized
	Flashing red (1 Hz)	RAM check fault
	Flashing red (2 Hz)	ASIC and Flash ROM check fault
	Flashing red (4 Hz)	DPRAM check fault

A4.0 DEVICENET - MASTER

A4.1 MECHANICAL OVERVIEW OF MODULE

The outline view of the master board (Fig. A8) and interface board installed with 1JF/1TJ board and master board (Fig. A9) are shown below.

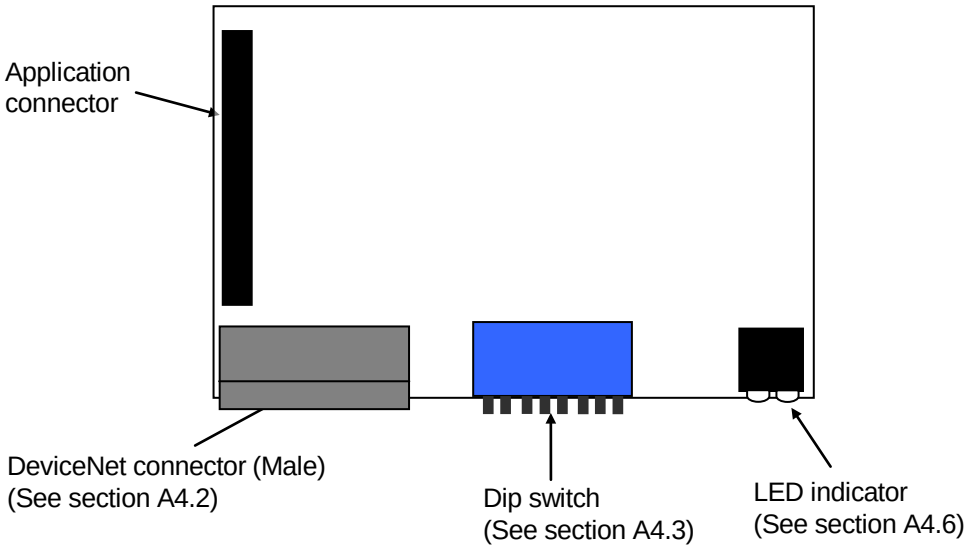


Fig. A8 Master board (Plane view)

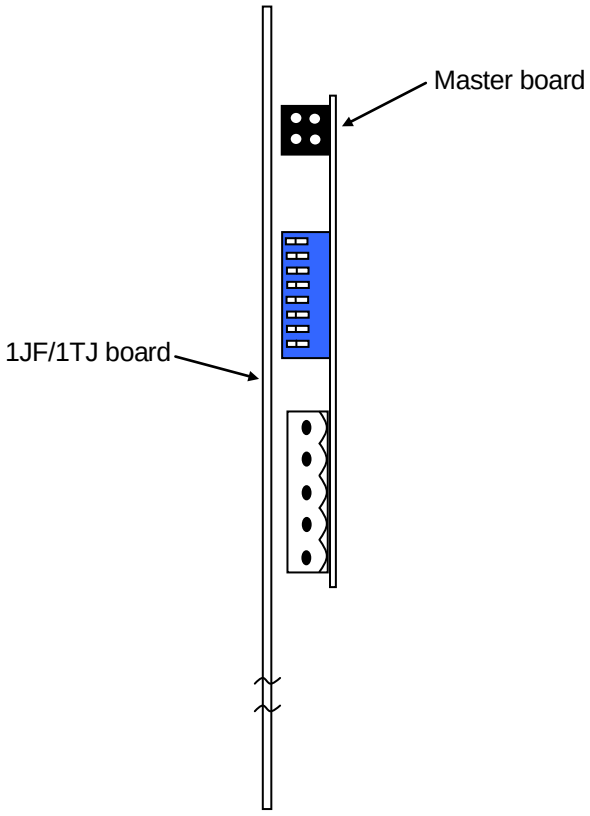


Fig. A9 Interface board (Front view)

A4.2 CABLE CONNECTION

The connection with cables, terminating resistor and connector (female) are shown in Fig.A12 below.

Attach a terminating resistor of 121 Ω to each end of trunkline, 4. CAN_H (white) and 2. CAN_L (blue). Do not attach to the end of droplines.

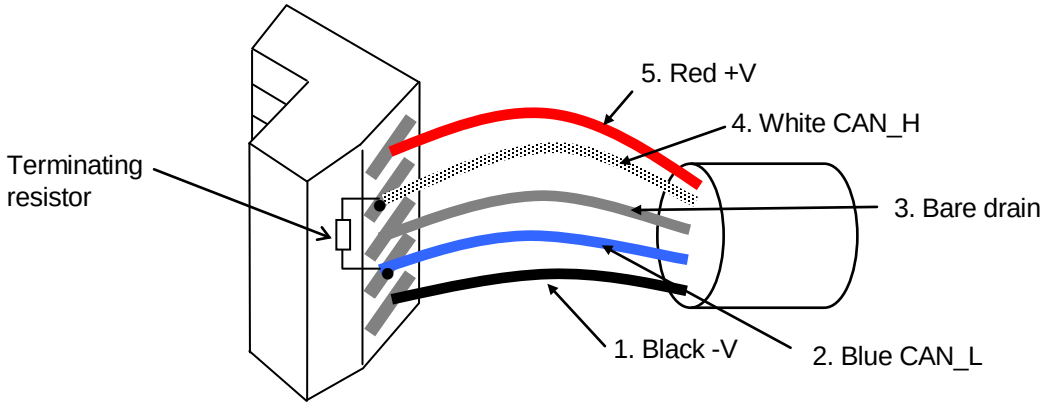


Fig. A10 Connectors and cables

In case of daisy chain connection, insert two of the same color wires into one hole (Fig.A11). Use a crimping terminal for the wires.

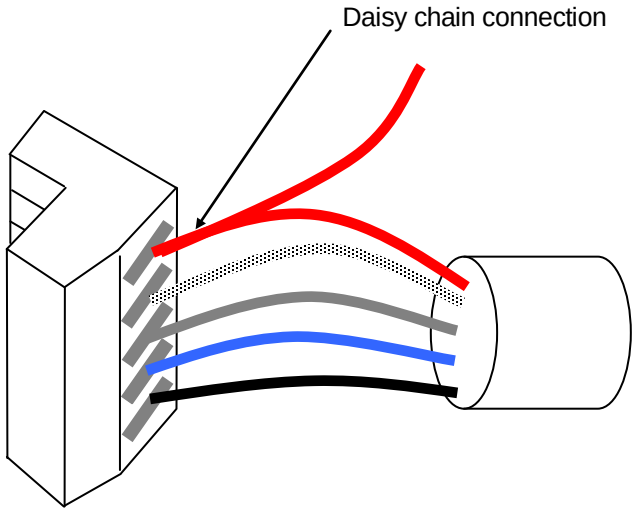


Fig. A11 Daisy chain connection

A4.3 CONFIGURATION

A4.3.1 BAUD RATE AND MAC_ID (ADDRESS)

When configuring DeviceNet network, information for the baud rate and MAC_ID are necessary.

1. Baud rate is selectable from 125, 250 or 500 kbit/s. All nodes in the network must have the same baud rate.
2. MAC_ID is an address assigned on the network, no two nodes can have the same address. For MAC_ID, values from 0 to 63 are assigned.
3. Dip switches 1 and 2 set the baud rate, and 3 to 8 set the MAC_ID.

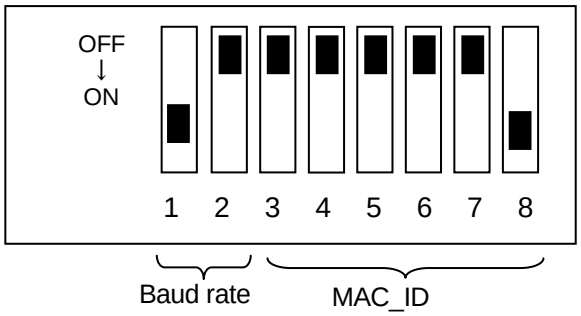


Fig. A12 Dip switches

Table A7 Baud rate

Baud rate [kbit/s]	Dip switch 1-2
125	0 0
250	0 1
500	1 0
Reserved	1 1

0:OFF, 1:ON

Table A8 MAC_ID

MAC_ID (Address)	Dip switch 3-8
0	0 0 0 0 0 0
1	0 0 0 0 0 1
2	0 0 0 0 1 0
3	0 0 0 0 1 1
⟩	⟩
62	1 1 1 1 1 0
63	1 1 1 1 1 1

0:OFF, 1:ON

In Fig A12, the baud rate is 500 kbit/s and MAC_ID is 1.

A4.3.2 NETWORK CONFIGURATION

To change the network configuration for below purposes, the network must be reconfigured:
1. To change number of I/O signals by ZSIGSPEC monitor command
2. To add or delete slave device, etc.

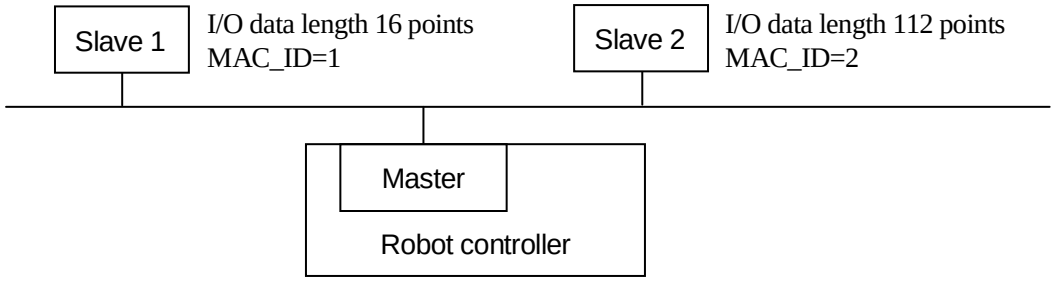
There are two ways of network configuration:
1. Using RSNetWorx configuration tool from Rockwell Software.
2. Using Aux. 0608-6 DeviceNet Setting.

For both methods, the scan interval (Interscan Delay), scan rate (Foreground and Background to Poll Ratio), and scan list are set using the configuration tool (RSNetWorx). In scan list, specify the slave device that is to become the I/O communication target.

The example below describes the relation between I/O signal assignments in AS system and I/O data map for master board.

Example

When the number of I/O signals for the master is 128.




```
>ZSIGSPEC
 DO,     DI,     INT,    MAS,    SLA
 48      48      32      128     80
Change? (If not, press RETURN only.)
```

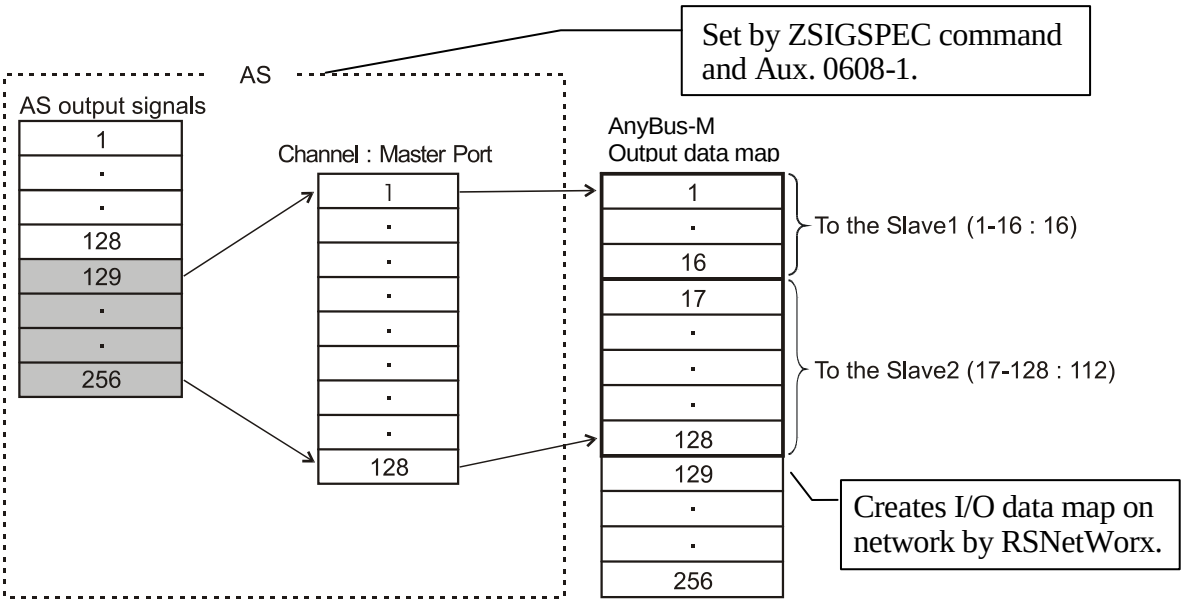


Fig. A13 Example of output signal flow

In this example, 128 channels are assigned in AS system as output signal nos. 129 to 256 to the master port. Two slaves, Slave 1 and Slave 2, are connected on the DeviceNet, each having 16 I/O and 112 I/O signals respectively. The network is configured so that signals from 1st to 16th bit and from 17th to 128th bit in the master board output data map are sent to slaves 1 and 2, respectively. In conclusion, AS output signal nos. 129 to 144 are the output data for slave 1, and nos. 145 to 256 are for slave 2.

[NOTE]

Note that AS applications do not control or recognize which signal is communicating with which slave.

1. Using RSNetWorx

Fig. A14 shows the operation procedures for robot controller and RSNetWorx when configuring the network.

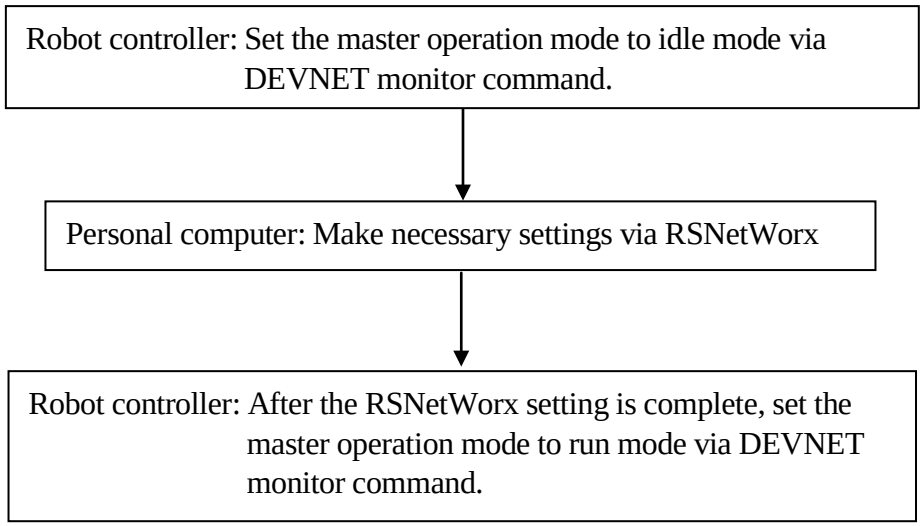


Fig. A14 Operation procedures for robot controller and RSNetWorx

Table A9 on the next page shows the procedures for configuring the network via RSNetWorx. The scanlist created by RSNetWorx includes information for each node (I/O data size, etc.) on the DeviceNet. Refer to the RSNetWorx manual for more details on this operation.

Table A9 Outline procedure for RSNetWorx

Step	Robot controller	Operations in RSNetWorx
1	>DEVNET 1 (Set to Idle mode)	
2		Start up RSNetWorx
3	Start up all slaves.	
4		Click on Online button. All nodes on DeviceNet network are displayed.
5		Click on [Master] icon. Window for the master setting is displayed.
6		Double click on Scanlist tab.
7		Upload confirmation message is displayed. (If no message is displayed, click on Upload button.) Upload the scanlist.
8		Create the scanlist.
		Select the necessary slaves from the Available Devices area and press > to register it in Scanlist area.
		Click on Edit I/O parameter button to set the data length for the slave. 1. Check "☐Polled" check box. 2. Set the I/O data size. Rx Size, Tx Size
9		Click on Module tab. Set Interscan Delay and Foreground to Background Poll Ratio for the master.
10		Create input data map for the master.
		Click on Input tab. Use Auto Map function.
11		Create output data map for the master.
		Click on Output tab. Use Auto Map function.
12		After finishing the setting, click on Apply button. Download the scanlist.
13	>DEVNET 2 (Set to Run mode)	
14	Start communication	

2. Using Aux. 0608-6 DeviceNet Setting

To configure the network without using RSNetWorx, use Auxiliary Function 0608-6. There are six functions to the DeviceNet Setting function.

(1) Scanner Set
Sets and displays scanner (master) data.

(2) Scan List Set
Sets data necessary for IO communication with connected slave device.
(Vendor ID, IO data length, IO map offset value, etc. for slave)

(3) Scan List Remove
Deletes scan list setting data from the slave with the specified MAC_ID

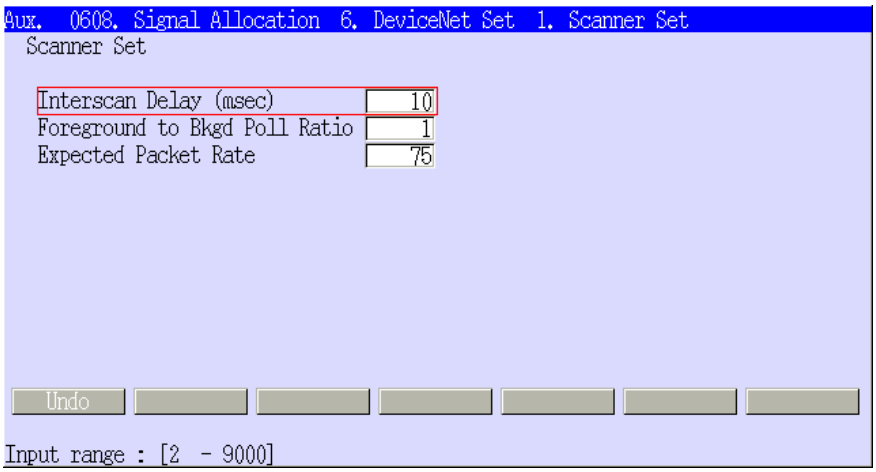
(4) Configuration Data Display
Displays data for the slave device that is given I/O data length for I/O communication.

(5) Upload
Reads configuration data from Master board. Beware that the configuration data in the controller is over written.

(6) Download
Writes the configuration data onto Master board and stores the data.

1.Scanner Set

Sets and displays scanner (master) data.



Interscan Delay

Sets the time to wait for the next scan so that the master device can complete communication. Enter the scan delay time in the input box. Settable range is 2 to 9000 ms. Default setting is 10 seconds.

[**NOTE**]

Processing might not complete within the set time depending on the number of signals.

Foreground to B(ac)kg(roun)d Poll Ratio

Sets the ratio between the number of polling device messages to the number of I/O scans. For example if this value is set to 10, the device is polled every 10 scans. Default setting is 1.

Settable range: ABM-DEV : 1-65535

Expected Packet Rate

Sets connection time out rate. Calculate the rate as shown below.
Time out = Expected packet rate × 4 (msec)

Settable range: 0 to 65535
Time out is invalid when set to 0.

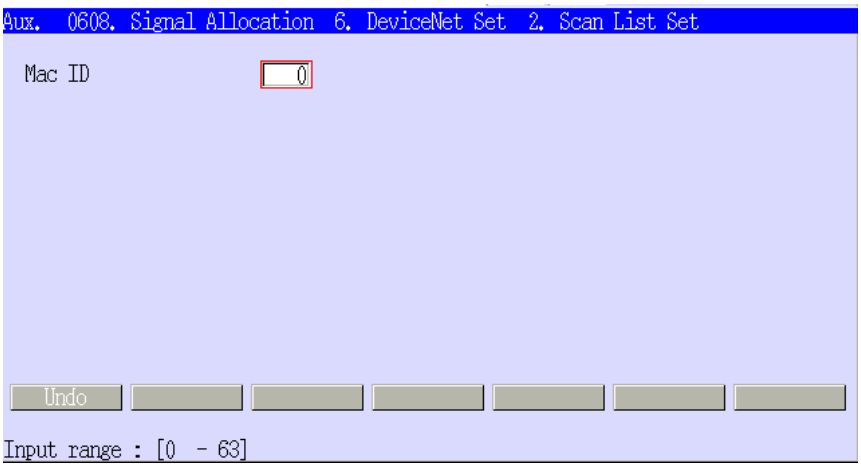
[**NOTE**]

Expected packet rate depends on the function of the master device. Be careful when changing the value.

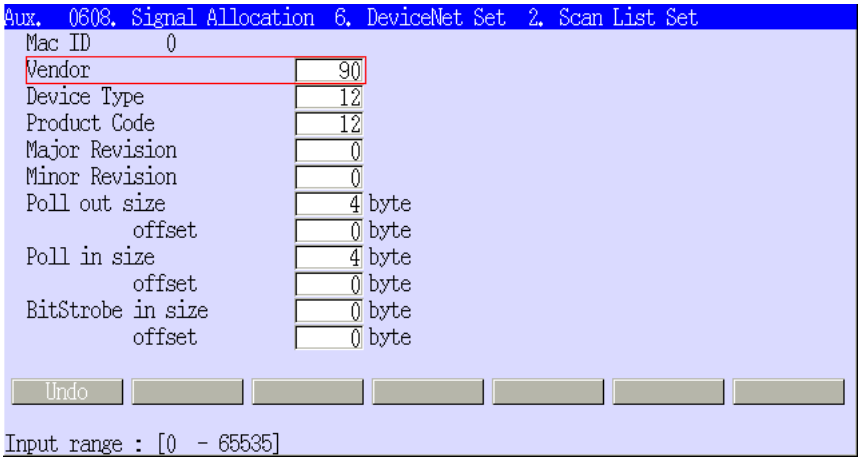
2. Scan List Set

Sets slave device data such as vendor ID, IO data length, IO map offset value, etc., necessary for IO communication.

(1) First, enter the MAC_ID and press ↵.



(2) Next, the data for the specified slave is displayed. Set necessary data.



Vendor ID (Electronic key) *

Set as necessary according to the data in EDS file.

Device Type (Electronic key) *

Set as necessary according to the data in EDS file.

Product Code (Electronic key) *

Set as necessary according to the data in EDS file.

Major Revision (Electronic key) *
Set as necessary according to the data in EDS file.

Minor Revision (Electronic key) *
Set as necessary according to the data in EDS file.

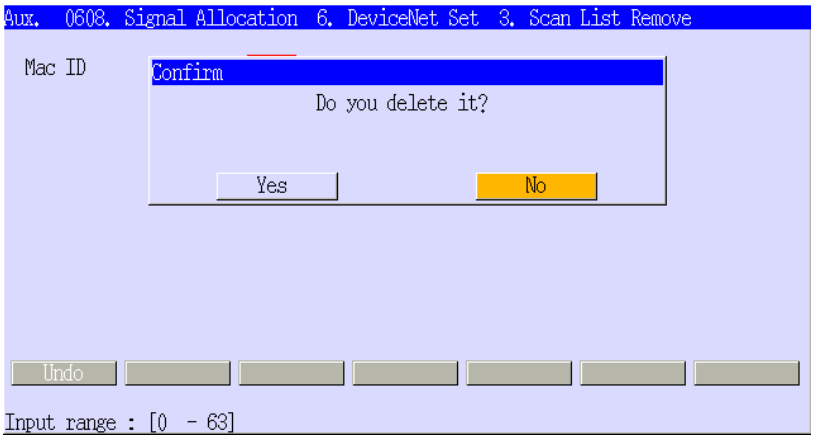
Poll out size/ offset
Set the number of external output signals for the corresponding slave. Set the offset values for output signal map as necessary.

Poll in size/ offset
Set the number of external input signals for the corresponding slave. Set the offset values for input signal map as necessary.

BitStrobe in size/ offset
Set the number of external input signals of the corresponding slave. Set the offset values for input signal map as necessary.

Note* The values set for items 1 to 5 (marked as electronic key) functions as electronic keys. At time of IO communication, it is checked if the set value matches the actual information for the slave device. For example, if the vendor ID is set, IO communication will be possible only with the device with the same vendor ID. Setting 0 nullifies the electronic key and the heck is not carried out.

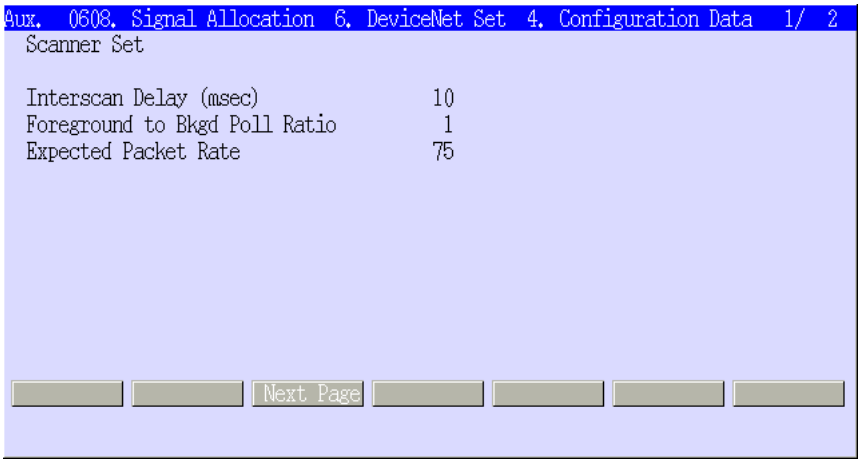
3. Scan List Remove
Clears and sets to zero, the scan list data for the slave with the specified MAC_ID. Selecting [Yes] clears all scan list data of the specified slave. Selecting [No] cancels the deletion. The scan list data of the specified slave is stored.



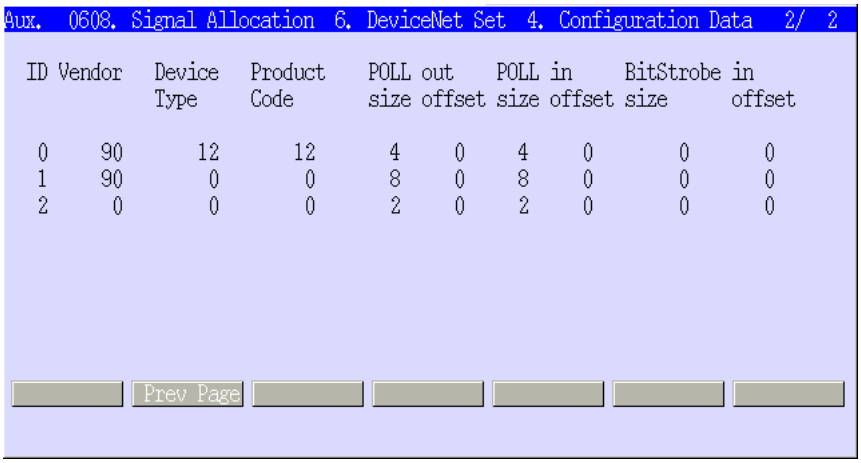
4. Configuration Data

Displays only data for valid slave device.

Page 1 shows the scanner data.



The following page(s) shows the scan data for the valid slave device(s).



5. Upload

Reads and stores the configuration data from Master board. The configuration data already stored in the memory is overwritten by the data that is uploaded.

Enter [1] after the confirmation message to start upload.

[NOTE]

1. Make sure the slave is connected before starting upload. Otherwise, configuration data might not be uploaded.
2. Do not carry out message communication while upload is being carried out.

6. Download

Writes and stores the configuration data onto Master board.

Enter [1] after the confirmation message to start download.

[NOTE]

1. Do not change the operation mode of the master device.
2. Do not carry out message communication while download is being carried out.

A4.3.3 EDS FILE

EDS (Electronic Data Sheet) is an ASCII file containing all necessary information about the specified device type. In this system, RSNetWorx (network configuration tool) configures the network based on the EDS files for the master and slave(s). The EDS file for master board is provided by Kawasaki. For EDS file for slave, please use those provided by the vendor.

When using the RSNetWorx, EDS files for all nodes on the network must be installed into the personal computer which configures the network. To install EDS files, in the [Tools] menu of RSNetWorx, select [EDS Wizard] and follow the instructions.

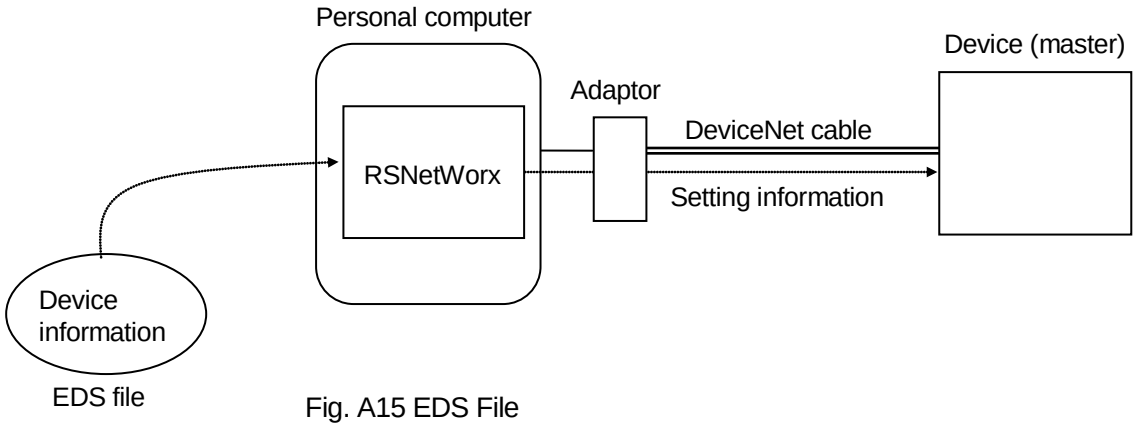


Fig. A15 EDS File

[**NOTE**]

No downloading of the EDS file is necessary when configuring via Aux. 0608-6.

A4.4 MONITOR COMMAND FOR DEVICENET MASTER

DEVNET function no. or **MAC_ID = device name**

Function

Executes the following process for the DeviceNet network.

1. Sets the operation mode for the master.
2. Sets the name for the specified device.

Parameter

1. Function No.

Specifies the constant number.

1: Sets the master in idle mode. (Available only for the master)

2: Sets the master in run mode. (Available only for the master)

2. MAC_ID

0 to 63 (Constant number): Specifies the MAC_ID for the processing device.

3. Device name

Sets the name for the specified device. (Character strings, alpha-numeric, Max. 7 characters) The name must start with an alphabet.

Explanation

1. Operation mode setting function: DEVNET function no. (1 or 2)

To use the configuration tool, the operation mode of the master must be changed to idle mode. Change the operation mode for the master by setting the function no. 1 or 2. When configuring the network, set to 1 (idle mode). When starting communication after completing the network configuration, set to 2 (run mode).

Example 1

When setting the master to the idle mode.

```
>DEVNET 1
```

2. Device name setting function

Names the specified device. This device name is displayed on the node status screen on the teach pendant. The device is named Nodenn as default when no name is assigned to a device that exists on the network. “nn” is the MAC_ID number. For example, if MAC_ID no. is 7, the device name will be named “Node7”. The specified module name is written into the file as an auxiliary data when the data is saved. It is read from the file when loaded and then the name is set.

Example 2

When naming the device whose MAC_ID is 1 as “sensor 1”.

```
> DEVNET 1= sensor 1
```

[**NOTE**]

If a fatal error occurs in the specified slave or master, this command might not be valid.

A4.5 DEVICENET NODE STATUS DISPLAY

A4.5.1 DEVICENET NODE STATUS DISPLAY (TEACH PENDANT)

This function displays on the teach pendant the status of each node connected to the master. There are three types of node status: Active, Idle and Fault. If the node is not registered in the scanlist for the master, its status is not displayed.

1. How to start
Starting from the teach pendant.
(1) Activate C area to display the pull-down menu.
(2) Select [Signal Monitor].
(3) Select [Fieldbus Node Status].
(4) When network status other than DeviceNet is displayed, scroll by using S + ← or S + →

2. Screen display
Fig. A17 shows that only DeviceNet master is supported. DeviceNet Node Status covers two pages. Scroll by using S + ↓ or S + ↑.

Page 1: MAC_ID 0 to 35. Page 2: MAC_ID 36 to 63.

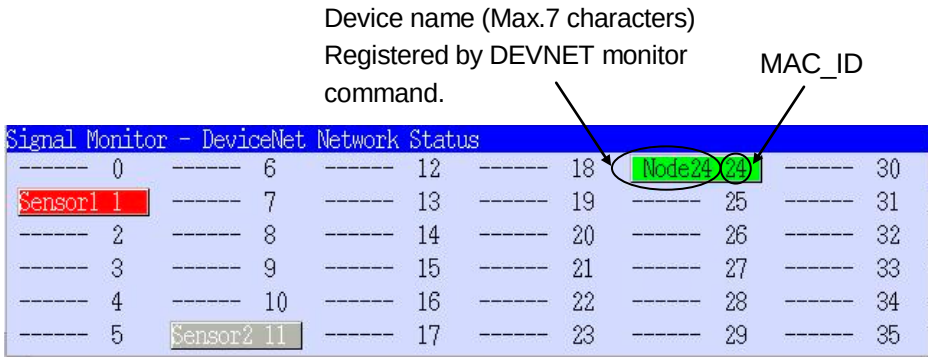


Fig A16 Example of screen display (1/2 page)

When the applicable MAC_ID does not exist on the network (not on the scanlist), the node status is displayed as "------".

The character background colors show the following status:Red: Fault
Gray: Idle
Green: Run
No character background color: Unregistered (Not registered on the scanlist at time of network configuration)

Example

When the network is configured like Fig. A18 and the node status is displayed like Fig. A19, each node status is shown in Table A11. If the device with the specified MAC_ID is not connected to the network (not registered on the scanlist) and has no device name, "------" is displayed.

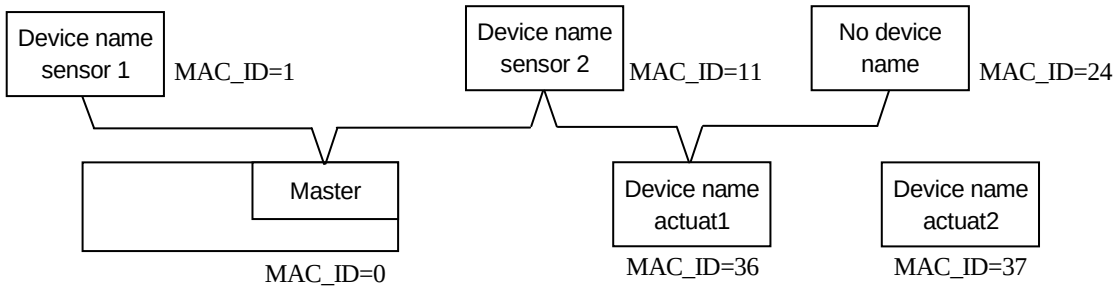


Fig. A18 Example of network configuration

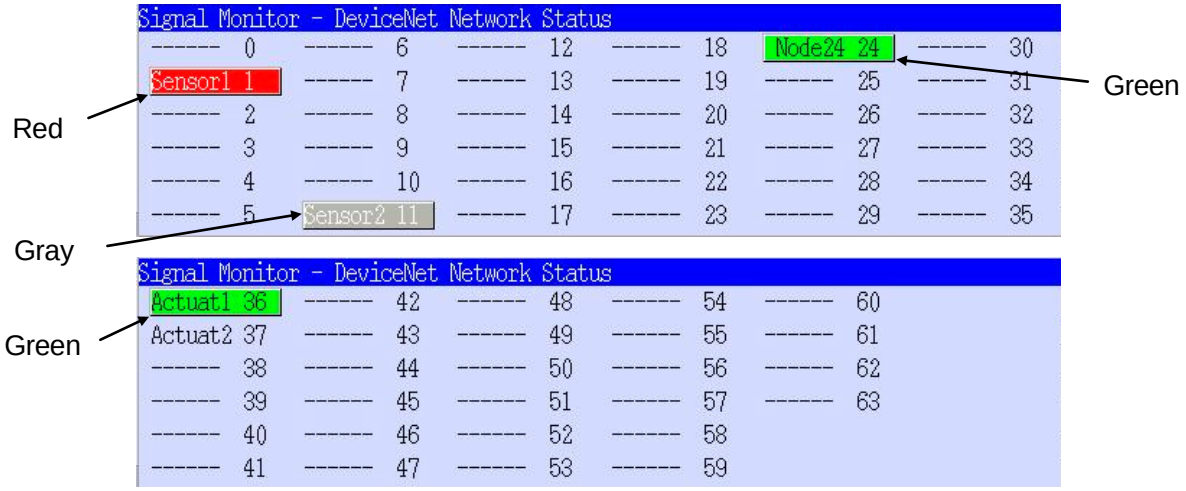


Fig. A18 Example of screen display

MAC_ID	Device name	Status
1	Sensor 1	Fault status
11	Sensor 2	Idle status
24	Node 24	Run status, but no device name is set.
36	Actuat 1	Run status
37	Actuat 2	Not connected (Device name is registered, but the device was not registered on the scanlist during network configuration.)

Table A11 Node status

[NOTE]

1. Name displayed on DeviceNet analyzer differs from the specified device name.
2. If device name is changed while nodes are displayed, the new name is not reflected on the status display. In order to display the new device name, close and re-open the display.

A4.5.2 DEVICENET NODE STATUS DISPLAY (FUNCTION)

DNSTATUS NODE ID

Function

Returns the status of the specified DeviceNet by node ID.

Parameter

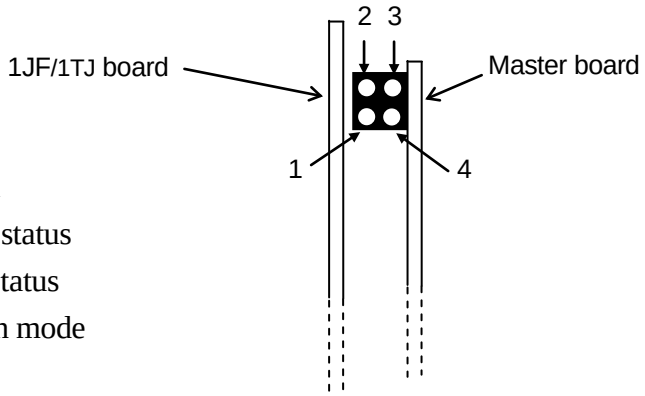
1. Node ID

Return values show the following status.

0: Not registered (Device is not registered on the scan list during network configuration)
1: Idle (Device is working normally. No IO communication)
2: Run (IO communication in progress)
3: Fault (Abnormality found in communication device. IO communication cannot be executed.)

A4.6 LED INDICATOR

The master board has four LEDs in the front of the card and one on the board. The specifications for the LEDs are as shown below.



LED1: Reserved
LED2: Network status
LED3: Module status
LED4: Operation mode

Fig. A19 Front view of LED indicator

Table A11 LED indicator

Name of LED	Status	Description
2. Network status	OFF	No power, not initialized, or no connection is established
	Flashing green	Online, but no connection is established.
	Green	Online, and one or more connections are established
	Flashing red	Minor fault (One or more connections have a minor fault)
	Red	Fatal fault
3. Module status	OFF	No power or not initialized
	Green	Module status is OK
	Flashing red	Minor fault
	Red	Major fault
4. Operation mode	OFF	No power or not initialized
	Flashing green	Idle mode
	Green	Run mode

Watchdog LED (on AnyBus card)

Table A12 Watchdog

Name	Status	Description
Watchdog	Flashing green (1 Hz)	Module is initialized and running
	Flashing green (2 Hz)	Module is not initialized
	Flashing red (1 Hz)	RAM check fault
	Flashing red (2 Hz)	ASIC and Flash ROM check fault
	Flashing red (4 Hz)	DPRAM check fault

APPENDIX B PROFIBUS

B1.0 OUTLINE OF PROFIBUS FOR ROBOT CONTROLLER

PROFIBUS interface card is connected to the fieldbus motherboard (1JF/1TJ board) in the controller via the application connector. As PROFIBUS interface card, AnyBus-M PROFIBUS-DP card is used as slave, and AnyBus PROFIBUS-DP/DPV1 master card is used as master. AS system connects easily to the fieldbus network with AnyBus-M PROFIBUS-DP/ DPV1* card communicating as a slave node with PROFIBUS-DP Master, and AnyBus PROFIBUS-DP master card communicating as a master node with PROFIBUS-DP slave.

NOTE* DPV protocol is defined as follows.

(1) DPV0 transmits data and diagnostics cyclically
(2) DPV1 transmits data cyclically /acyclically and warning handling
(3) DPV2 enables isochronal mode and data transmission broadcast.

The PROFIBUS interface has these features:

1. Protocol and Supported Functions

Slave: Fieldbus type: PROFIBUS-DP EN 50170 (DIN 19245)
Protocol version: Ver. 1.10
Protocol stack supplier: SIEMENS
Baud rate range: 9.6 kbit/s - 12 Mbit/s
Auto baud rate detection supported

Master: Fieldbus type : PROFIBUS-DP EN 50170 (DIN 19245)
Protocol stack supplier: SIEMENS
Baud rate range: 9.6 kbit/s - 12 Mbit/s

2. Physical interface

Transmission medium:	PROFIBUS bus line, type A or B specified in EN50170
Topology:	Master-Slave communication
Fieldbus connector:	9 pin female DSUB
Cable:	Shielded copper cable, twisted pair
Isolation:	The bus is isolated from the other electronics with an on board DC/DC converter. Bus signals (A-line and B-line) are isolated via photo couplers.

3. Configuration and Indicator

Address:	1-99
Node address:	Up to 124 nodes
Cyclic I/O data size:	Max. 120 bytes input and 120 bytes output (960 points)
	Bus terminator switch on board
LED indicator:	(Slave) On-line, Off-line, Fieldbus diagnostics
	(Master) Module status and fieldbus status

4. Data exchange

I/O data transmission: The module only supports cyclic I/O data transmission.
Acyclic data transmission (DPV1) is not available.
Master supports “Get_Slave_Diagnostics” (diagnostics function for slave) as a class 1 service.

5. Network configuration tool

DP master:	HMS SYCON (HMS)
DPV1 master:	AnyBus NetTool (HMS)

Consult HMS about the usage restrictions etc. of each tool.

[NOTE]

The connectivity with all PROFIBUS products has not been confirmed. It is generally possible; however, Kawasaki does not guarantee the connection with all PROFInet products.

B1.1 SUPPLIER OF PROFIBUS PRODUCTS

This company is a supplier of cables for PROFIBUS.

LAPP KABEL (U.I.LAPP GmbH & Co.KG)
Contact: Hans Euler
Dept: Produkt Marketing
Schulze-Delitzsch-Str.25/Postf.800640
Stuttgart
D 70565
GERMANY

Tel: ++++(0)711 7838 410
Fax: ++++(0)711 7838 733

We recommend using configuration tool (HMS) to configure the system for AnyBus PROFIBUS master. Please contact HMS Industrial Networks AB if purchasing the configurator.

Address: HMS INDUSTRIAL NETWORKS AB
Box 4126
300 04 Halmstad
SWEDEN
Tel: +46 35 17 29 00
Fax: +46 35 17 29 09
e-mail: Info@hms.se
web: www.anybus.com

B2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

↓

[2. Set the fieldbus interface card.]

Set the termination and node address (slave). (See Slave: B3.2.2, B3.3.2, Master: B4.2.2)

↓

3. Turn controller power ON.

↓

4. Set the allocation for the fieldbus interface. (Signal allocation setting)

In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)

↓

5. Set the number of external I/O signals. (See Chapter 5.)

↓

6. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

↓

7. Turn controller power OFF then ON.

↓

8. Set the signal allocation data. (See Section 6.2.)

↓

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

↓

[10. Network configuration.]

(Slave) Install GSD file into the personal computer that has the network configuration tool. (See section B3.3.)

(Master) Configure the network using network configuration tool (HMS) on the personal computer installed with the GSD files of each DP slave. (See Section B4.3.4.)

↓

11. Start operation.

[NOTE]

The selected port is not communicating with DP slave if “Offline” is displayed for that port. Check the PROFIBUS cable connection and confirm that the slave is active.

B3.0 PROFIBUS - SLAVE

B3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of AnyBus-S PROFIBUS-DP card is shown below.

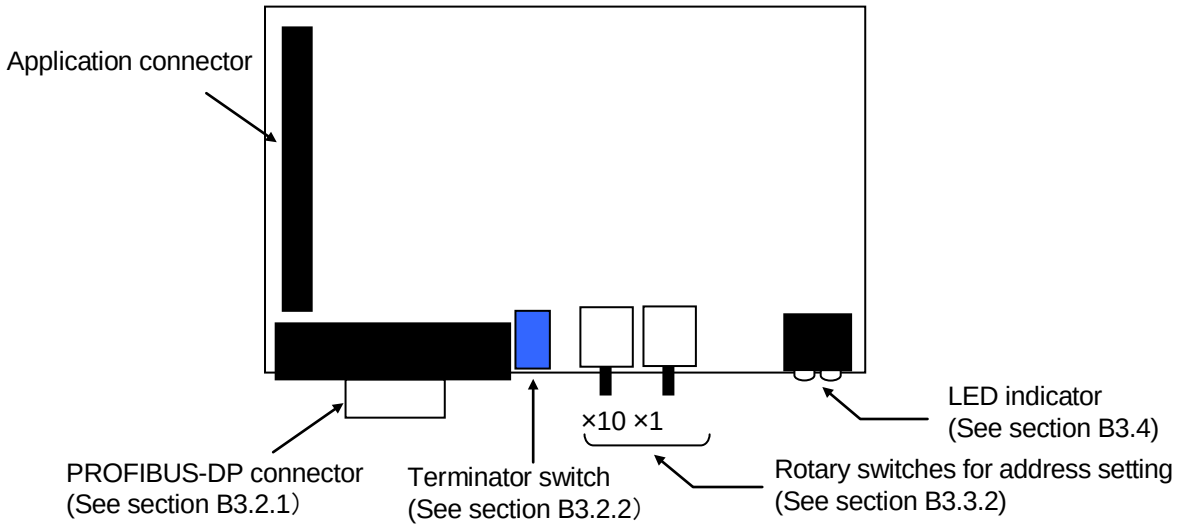


Fig. B1 AnyBus-S PROFIBUS-DP card (plane view)

B3.2 CABLE CONNECTION

B3.2.1 PROFIBUS-DP CONNECTOR

Use a 9-pin female D-SUB connector as recommended in PROFIBUS-DP EN 50170 (DIN19245). Kawasaki does not guarantee the performance of other connectors.

In normal applications, A-line, B-line and Shield are used. Table B1 shows the signal assignment.

Table B1 Signal assignment

Pin	Name	Function
Housing	Shield	Connected to PE
1	NC	-
2	NC	-
3	B-line	Positive RxD/TxD based on RS 485 specification
4	RTS	Request To Send*
5	GND BUS	Isolated GND from RS 485 side**
6	+5V BUS	Isolated +5 V from RS 485 side**
7	NC	-
8	A-line	Negative RxD/TxD based on RS 485 specification
9	NC	-

NOTE* RTS is used in some equipment to set the direction of transmission.

NOTE** +5 V BUS and GND BUS are used as bus terminating resistors. Some devices, like optical transceivers (RS485 to fiber optics), might require external power supply from these pins.

B3.2.2 TERMINATOR

The end nodes in a PROFIBUS-DP network must be terminated to avoid reflections on the bus line. For this AnyBus-S-PROFIBUS-DP card is equipped with a terminator switch. If the node is at either end of the network, the terminator switch must be ON. Otherwise the switch must be OFF.

Table B2 Terminator switch

Terminator switch ON	Bus termination enabled. If the module is at the last or first module, the bus terminator must be set ON, or an external terminator connector must be used.
Terminator switch OFF	Bus terminator disabled.

[**NOTE**]

When using an external termination connector, set the terminator switch to OFF.

B3.3 CONFIGURATION

B3.3.1 BAUD RATE

The baud rate on PROFIBUS-DP network is set in the master. AnyBus-S PROFIBUS-DP module detects baud rate automatically, no manual setting is necessary. Baud rates supported by AnyBus-S PROFIBUS-DP module are shown below.

9.6 kbit/s
19.2 kbit/s
93.75 kbit/s
187.5 kbit/s
500 kbit/s
1.5 Mbit/s
3 Mbit/s
6 Mbit/s
12 Mbit/s

B3.3.2 NODE ADDRESS

Before configuring the AnyBus-S PROFIBUS-DP module, the node address for the robot controller on the network must be set by the rotary switches on the AnyBus-S card. The address can be set from 1 to 99. The front view of the ANYBUS-S card installed on 1JF/1TJ board is shown below. (Fig. B2)

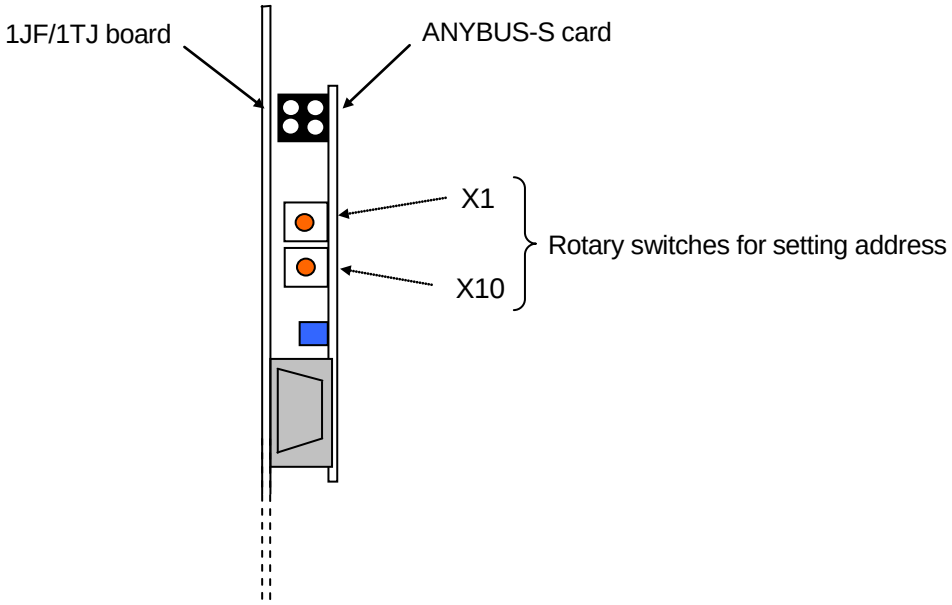


Fig. B2 Front view of Interface board

The bottom switch indicates the second digit and the upper switch indicates the first digit.
The address is expressed in decimal and set in double digits using the two rotary switches.

Address = (Bottom switch setting × 10) + (Upper switch setting × 1)

[NOTE]

The node address cannot be changed during operation.

B3.3.3 GSD FILE

GSD file is a data sheet containing all necessary information about each device. Each device on PROFIBUS-DP network is associated with a GSD file which is used for network configuration. Therefore, install the GSD file into the personal computer that executes the network configuration. The GSD file for ANYBUS-S-PROFIBUS-DP is provided by Kawasaki.

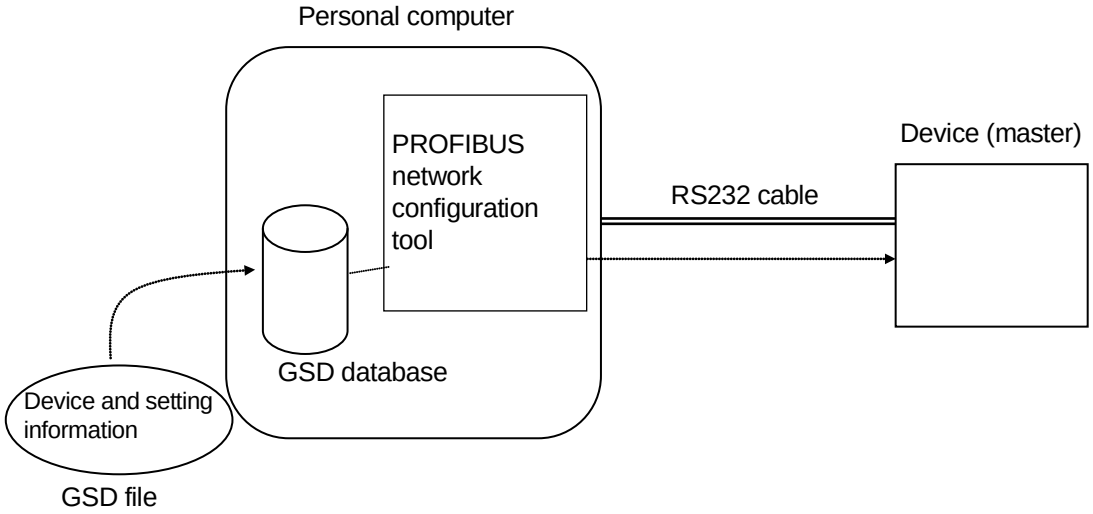


Fig. B3 GSD File

B3.4 LED INDICATOR

AnyBus-S card has four LEDs mounted at the front and one LED on the board. The functions of the LEDs mounted at the front are shown below.

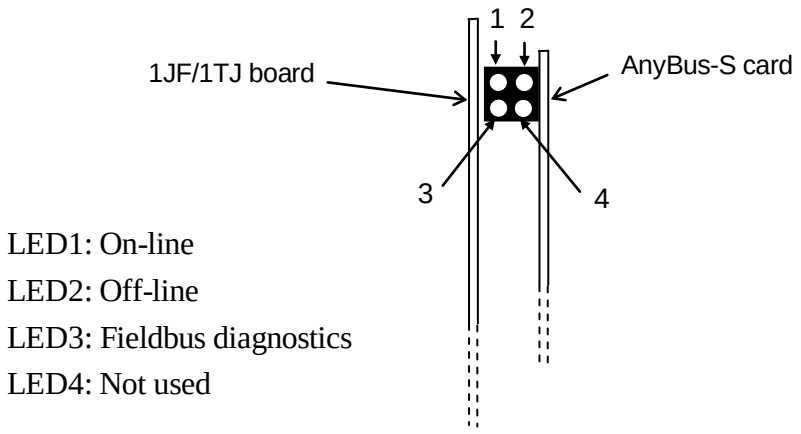


Fig. B4 Front view of LED indicator

Table B3 LED indicator

Name of LED	Status	Description
1. On-line	Green	Module is on-line on the fieldbus, data exchange is possible
	OFF	Module is not on-line on the fieldbus
2. Off-line	Red	Module is off-line on the fieldbus, data exchange not
	OFF	Module is not off-line on the fieldbus
3. Fieldbus diagnostics	Red, flashing (1 Hz)	Error in configuration: Input or output data length set during module initialization does not equal the length set during configuration of the network.
	Red, flashing (2 Hz)	Error in user parameter: The length or contents of the user parameter data set during module initialization does not equal the length or contents set during network configuration.
	Red, flashing (4 Hz)	Error in initialization of the PROFIBUS communication ASIC
	OFF	Diagnostic program has not executed.

Watchdog LED (on AnyBus card)

Table B4 Watchdog

Name	Status	Description
Watchdog	Green, flashing (1 Hz)	Module is initialized and running.
	Green, flashing (2 Hz)	Module is not initialized
	Red, flashing (1 Hz)	RAM check fault
	Red, flashing (2 Hz)	ASIC and Flash ROM check fault
	Red, flashing (4 Hz)	DPRAM check fault

B4.0 PROFIBUS - MASTER

B4.1 MECHANICAL OVERVIEW OF MODULE

The outline view of AnyBus PROFIBUS-DP master card is shown below.

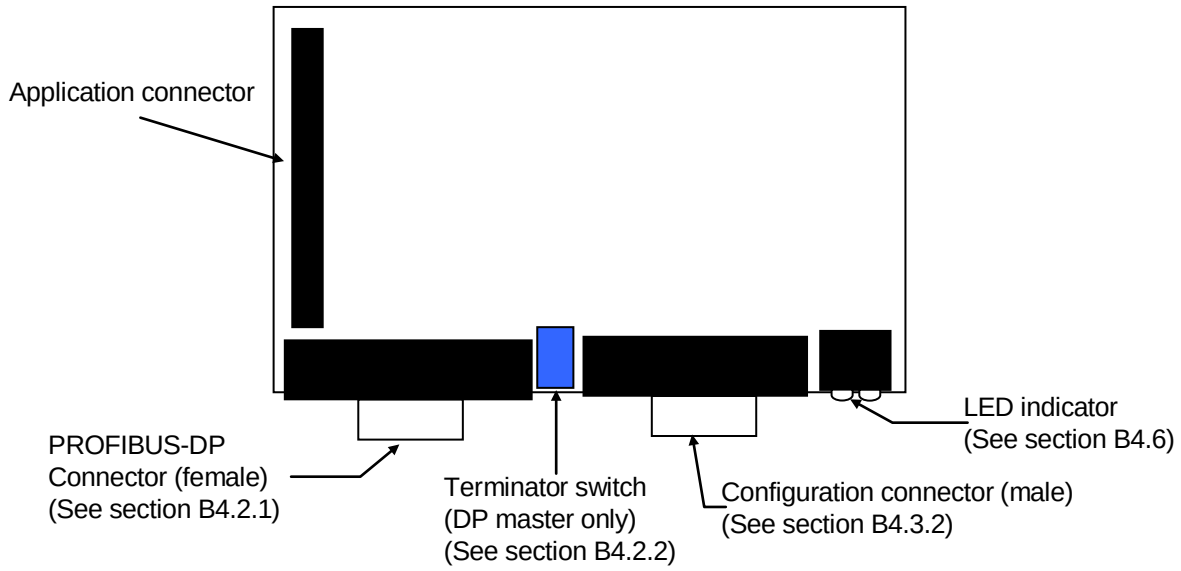


Fig. B5 AnyBus PROFIBUS-DP master card (plane view)

B4.2 CABLE CONNECTION

B4.2.1 PROFIBUS-DP CONNECTOR

Use a 9-pin female D-SUB connector as recommended in PROFIBUS-DP EN 50170 (DIN 19245). (Use a 9-pin male D-SUB connector for the PROFIBUS-DP cables.) Kawasaki does not guarantee the performance of other connectors. Table B5 shows the signal assignment for the PROFIBUS-DP connector (female).

Table B5 Signal assignment (PROFIBUS-DP connector)

Pin	Name
1	Shield
2	NC
3	B-line
4	RTS (TTL)
5	GND BUS
6	+5V BUS
7	NC
8	A-Line
9	NC
Housing	Shield

B4.2.2 TERMINATOR (DP MASTER ONLY)

The end nodes in a PROFIBUS-DP network must be terminated to avoid reflections on the bus line. For this AnyBus-PROFIBUS-DP master card is equipped with a terminator switch. If the node is at either end of the network, the termination switch must be ON. Otherwise the switch must be OFF.

Table B6 Terminator switch

Terminator switch ON	Bus terminator enabled. If the module is at the last or first module, the bus terminator must be set ON, or an external terminator connector must be used.
Terminator switch OFF	Bus termination disabled.

[**NOTE**]

When using an external termination connector, set the terminator switch to OFF.

B4.3 CONFIGURATION

B4.3.1 BAUD RATE

The baud rate on PROFIBUS-DP network is set by the configuration tool.
Baud rates supported by AnyBus PROFIBUS-DP master module are shown below.

9.6 kbit/s
19.2 kbit/s
93.75 kbit/s
187.5 kbit/s
500 kbit/s
1.5 Mbit/s
3 Mbit/s
6 Mbit/s
12 Mbit/s

B4.3.2 CONFIGURATION CONNECTOR

The configuration port is a non-isolated RS232 communication port. This port is used when downloading the configuration data into PROFIBUS-DP card. Table B7 shows the assignment for the 9 pin male D-SUB connector.

Table B7 Signal assignment (configuration connector)

Pin	Name	Function
1	-	-
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	-	-
7	RTS	Request to Send
8	CTS	Clear to Send
9	-	-
Housing	PE	Protective Earth

B4.3.3 GSD FILE

GSD file is a data sheet containing all necessary information about each device. Each device on PROFIBUS-DP network is associated with a GSD file which is used for network configuration. Install the GDS file into the personal computer that executes the network configuration.

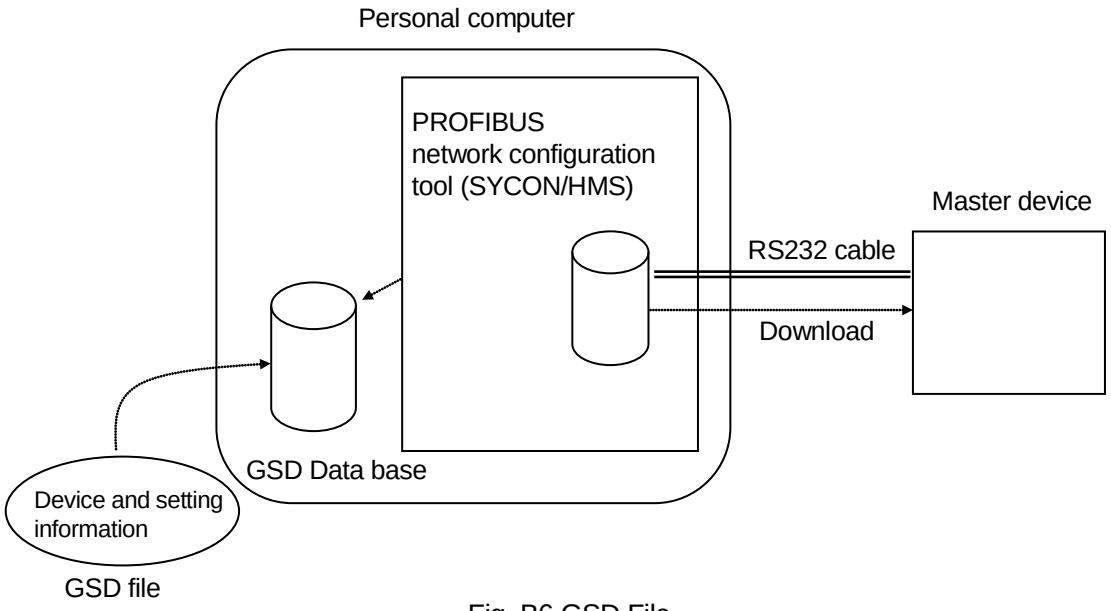


Fig. B6 GSD File

B4.3.4 NETWORK CONFIGURATION

B4.3.4.1 AS SYSTEM AND SYCON

When using a new PROFIBUS-DP master interface card or changing the number of I/O signals by ZSIGSPEC command, reconfigure the network without fail. Use the configuration tool software of HMS Industrial Networks AB for network including AnyBus PROFIBUS master card. Using configuration tool, specify the type and size of data to make the address table of input/output data for AnyBus master.

[NOTE]

Be advised as AS applications cannot control and recognize which signal is communicating with which slave.

The network example in Fig. B7 explains the relationship between the I/O signal assignment inside AS system and the setting of I/O address table for AnyBus PROFIBUS master.

Four slaves are connected on PROFIBUS and each slave has 8 I/O points.

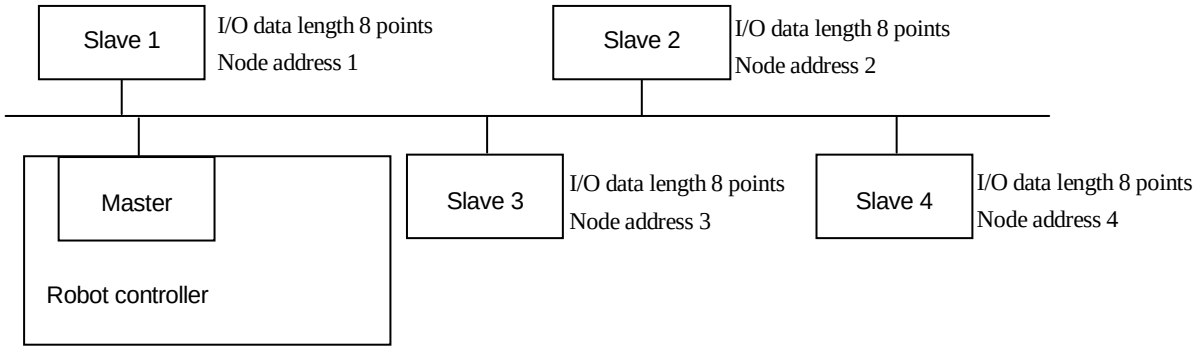


Fig. B7 Example of network

The number of external I/O signals is set 32 for the master port by ZSIGSPEC command.

```
>ZSIGSPEC ↵
DO,    DI,    INT,    MAS,    SLA
48     48     32      32      80
                    Change ? (If not, press RETURN only.)
```

Use configuration tool to make the address allocation table for AnyBus master. Allocates the data transmitted from Slaves 1-4 to the AnyBus input data area. (Table B8)

Table B8 Example of address table

Master address 125			
Node address	Device name (inside SYCON)	Data length	Assignment to input data area
1	Slave 1	1 byte	Bits 1 to 8
2	Slave 2	1 byte	Bits 9 to 16
3	Slave 3	1 byte	Bits 17 to 24
4	Slave 4	1 byte	Bits 25 to 32

AS input signals from No.1033 to 1064 are assigned to the master port by [Aux. 0608-1 Allocate Signal to Ports]. (Fig. B8)

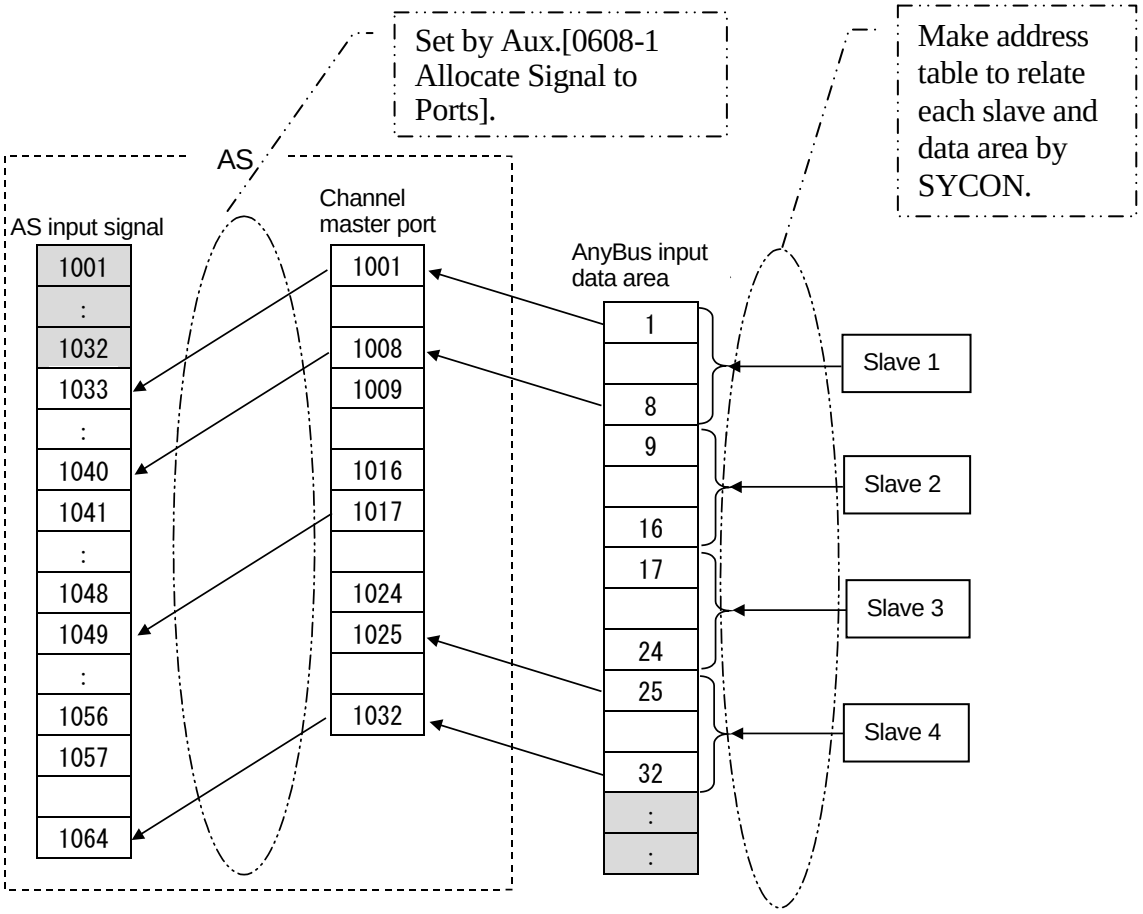


Fig. B8 Example of input signal flow

After configuration, the data transferred from Slaves 1-4 are assigned as below.

1. Data received from Slave 1 → AS input signal No.1033 to 1040.
2. Data received from Slave 2 → AS input signal No.1041 to 1048.
3. Data received from Slave 3 → AS input signal No.1049 to 1056.
4. Data received from Slave 4 → AS input signal No.1057 to 1064.

B4.3.4.2 CONFIGURATION PROCEDURE BY HMS SYCON (DP MASTER)

The following is an outline of the configuration procedure using the HMS SYCON configuration tool. Please refer to the HMS SYCON manual for more details.

1. Preparation

   Install GSD file associated with SYCON/HMS software. When downloading the configuration data, turn the motor power OFF.

2. Creating the configuration data file for the PROFIBUS-DP network.

   (1) Start HMS SYCON.

   (2) Select [File] → [New]. The bus line appears in the selected window.

   (3) Setting Master

      1) Select [Insert] → [Master].

      2) Move and click this cursor  on the position where the master is to be inserted.

      3) The “Insert Master” dialog box appears. Select the PROFIBUS-DP master from “Available masters” on the left.

      4) Click Add>> to add the selected master in “Selected masters” on the right.

      5) Specify “Station address” and “Description”.
         Station Address : Node address number (between 0 and 125)
         Description : Name of the master

   (4) Setting Slave

      1) Select [Insert] → [Slave].

      2) Move and click this cursor  on the position where the slave is to be inserted.

      3) The “Insert Slave” dialog box appears. Select PROFIBUS-DP slave from “Available slaves” on the left.

4) Click Add>> to add to "Selected slaves" on the right.

5) Specify the station address and description for the slave.
Station Address : Node address number (between 0 and 125)
Description : Name of the slave

6) Continue registration of all the slaves on the network in this selection window.

(5) Setting I/O data length for each slave.

1) Double click on the slave to set its I/O data length. The "Slave Configuration" window appears.

2) Select the necessary data length from the Module lists in the upper table and click Append Module. The data length appears in the lower table.

3) To remove the module, select it from the lower table and click Remove Module. The data length is removed.

3. Setting Bus Parameter.

(1) Select the master. (Move the cursor on the master and click it.)

(2) Select [Settings] → [Bus Parameter] from the menu item.

(3) Select the baud rate.

(4) When setting each parameter, select "By user" from Optimize field and click Edit Bus Parameter.

4. Downloading the configuration data into PROFIBUS master.

(1) Select [Settings] → [Device Assignment CIF Serial Driver], and select the port for downloading the configuration data.

(2) Select the master. (Move the cursor on the master and click it.)

(3) Select [Online] → [Download].

5. After confirming the completion of download, execute error reset.

B4.3.4.3 PROFIBUS-DPV1 MASTER

For PROFIBUS-DPV1 master, use NetTool (HMS) configuration software.

[**NOTE**]

Turn OFF and then ON the controller power after executing the configuration.

B4.4 MONITOR COMMAND FOR PROFIBUS MASTER

PROFIBUS remote node address = device name
or
remote node address = function no.

Function

Executes the following processes related to PROFIBUS network.
1. Sets a device name for the specified remote node.
2. Diagnoses PROFIBUS-DP slave

Parameter

1. Remote node address
   0 to 126 (Constant value): Specifies the remote node address for the target device.

2. Device name
   Specifies the name for the remote node device. (Character strings, alpha-numeric, Max.7 characters) The first character must be an alphabet.

3. Function No.
   1: Slave diagnostics

Explanation 1

1. Device name setting function
   Names the device. The device name is displayed by the node status display function on the teach pendant. (See section B4.5.) If a device exists on the network but its name is not specified, “Nodennn” is given as default. “nnn” is the address of the remote node. For example, if the remote node address is 7, its device name is Node7. The specified device name is written into the file as auxiliary data when saving, and it is set when loading from the file.

Example 1

The following command allocates remote node address 1 for device with a name of “sensor 1”.

```
> PROFIBUS 1=sensor 1
```

Explanation 2

2. Function No.

1: Slave diagnostics function

Diagnoses the slave with the specified remote node address. The diagnostic results are displayed by the items shown in the next page. If there is an error, “∗” is displayed in front of the appropriate item in the diagnostic result. See Tables B9 to B12 for descriptions of each item.

Table B9 Station_status_1

Item	Description
Master Lock	The specified slave has already been downloaded with parameters from another master and its access is locked.
Parameter Fault	When the parameter data sent by the master contains errors, this item is automatically set by the slave.
Invalid Slave Response	When the master received an invalid response from a slave, this item is set by the master.
Not Supported	Device could not execute all functions described in GSD file. This item is set by the slave.
Extended Diag	Indicates there are extended diagnostic results for options. This item is set by the slave.
Configuration Fault	Error occurred during configuration. The number of I/O signals in the slave and the configuration data from the master do not match.
Station Not Ready	Not ready for exchanging I/O data.
Station Non Existent	When there is no response from the slave on the bus, this item is set by the master.

Table B10 Station_status_2

Item	Description
Slave Deactivated	The slave is not active.
Sync Mode	Sync command has been received.
Freeze Mode	Freeze command has been received.
Watchdog On	Watchdog control has been activated.
Slave Device	Set by the slave.
Static Diagnostics	Master cannot execute I/O communication due to an error occurrence. In this case, it is necessary for the master to gather diagnostic information.
Parameter Req used	The slave requires parameters for the master.

Table B11 Station_status_3

Item	Description
Ext Diag Overflow	The master cannot receive the diagnostic result because it is too big for one DP diagnostic message.

Table B12 Other

Item	Description
Master Address	Address of the master (Decimal)
Ident Number	The number assigned by the PROFIBUS organization (Decimal)

Example 2

Executes slave diagnostics on the configured slave (node address 3).

```
>PROFIBUS 3=1
```

The Fig.B9 is an example of the diagnostic result.

```
Station_status_1
      Master Lock
      Parameter Fault
      Invalid Slave Response
      Not_Supported
      Extended Diag
      Configuration Fault
      Station Not Ready
      Station Non Existent

Station_status_2
      Slave Deactivated
      reserved
      Sync Mode
      Freeze Mode
    * Watchdog On
    * Slave Device
      Static Diagnostics
      Parameter Req used

Station_status_3
      Ext Diag Overflow
      reserved

Master Address : 2
 Ident Number : 4099
```

Fig. B9 Example of the diagnostic result

[NOTE]

If a fatal error has occurred in the master, this command might not be valid.

B4.5 PROFIBUS NODE STATUS DISPLAY

This function displays on the teach pendant, the status of each node connected to the master. There are two types of node status information: Active and Inactive. The node status is displayed by the character background color. Any node status information not configured by the master is not displayed.

1. How to start
Starting from the teach pendant.
(1) Activate C area to display the pull-down menu.
(2) Select [Signal Monitor].
(3) Select [Fieldbus Node Status].
(4) When network status other than PROFIBUS is displayed Scroll by using S + ← or S + →

2. Screen display
Fig. B10 shows that only PROFIBUS master is supported. PROFIBUS Node Status is displayed over four pages. Scroll by using S + ↓ or S + ↑

Page 1: Node address 0 to 35. Page 2: Node address 36 to 71.
Page 3: Node address 72 to 107. Page 4: Node address 108 to 126.

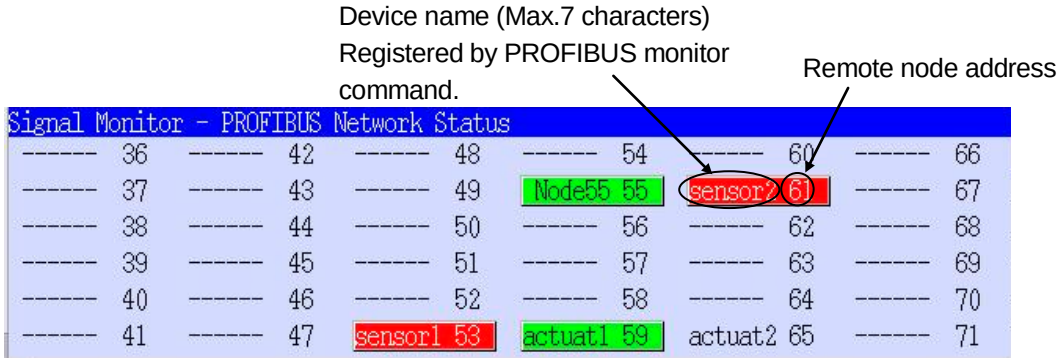


Fig. B10 Screen display example (2/4 page)

If the node is not configured and the device name is not set, the node status is displayed as "------". This indicates that the slave with the applicable remote node does not exist on the network.

The character background colors show the following status:
Red: Inactive
Green: Active
No character background color: Unregistered (Not configured)

[NOTE]

When robot error occurs, node status might not change from green to red. Some nodes might remain active (green) if PROFIBUS-DP is in Auto Clear mode.

Example

Table B13 shows each node status when the network is configured as shown in Fig. B11 and the node status is displayed as in Fig. B12. If a device has no name or remote node address configured for the network, "------" is displayed.

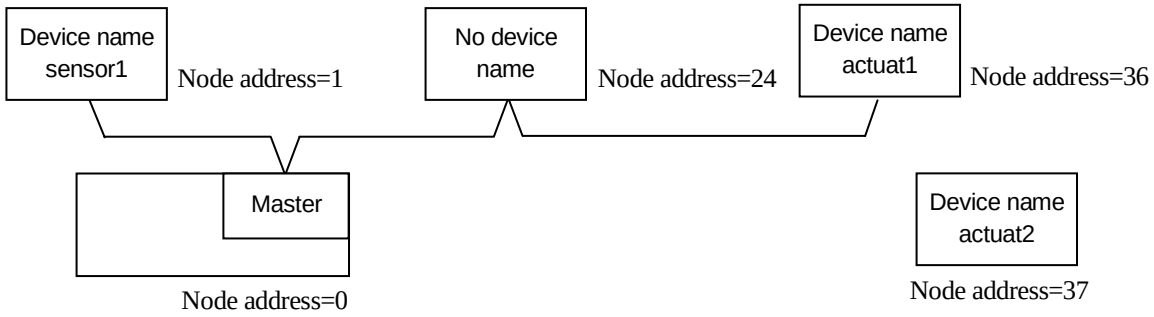


Fig. B11 Example of network configuration

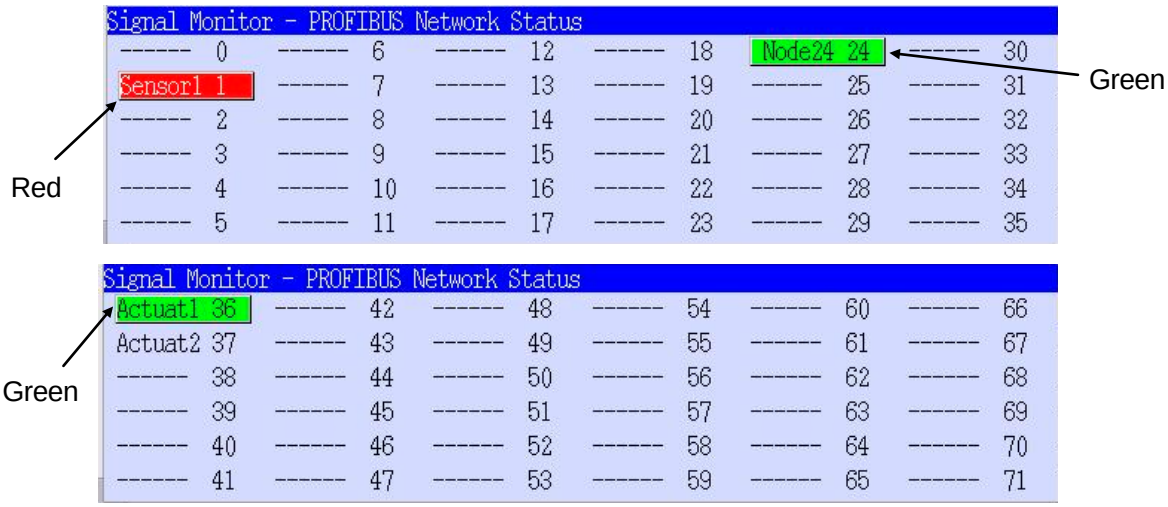


Fig. B12 Example of screen display

Table B13 Node status

Remote node address	Device name	Status
1	sensor1	Inactive status.
24	Node 24	Active status. Device name is not set.
36	actuat 1	Active status. Device name is set.
37	actuat 2	Not connected. (Device name is registered, but not configured.)

[NOTE]

1. Take note that the name on the PROFIBUS configuration tool differs from the device name set by PROFIBUS monitor command.
2. If device name is changed while nodes are displayed, the new name is not reflected on the status display. In order to display the new device name, close and re-open the display.

B4.6 LED INDICATOR

B4.6.1 DP MASTER

AnyBus card has four LEDs mounted at the front and one LED on the board. The functions of the LEDs mounted at the front are shown below.

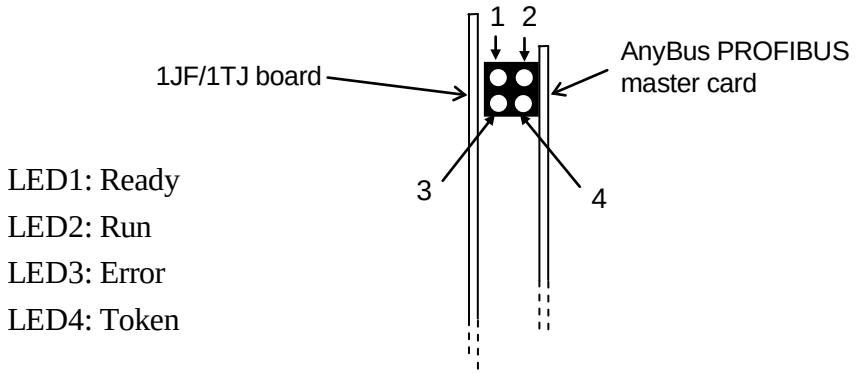


Fig. B13 Front view of LED indicator

Table B14 LED indicator

Name of LED	Status	Description
1. Ready	Green	Module is ready.
	Green, flashing (1 Hz)	No valid firmware (FLASH memory contains only bootloader)
	Green, flashing (4 Hz)	Hardware or system error, or firmware/configuration database download in progress
	OFF	Hardware error
2. Run	Green	I/O communication in progress
	Green, flashing (4 Hz)	Ready for communication
	Green, flashing (async)	Configuration error or fatal error
3. Error	Red	Error on communication line
	OFF	No error detected
4. Token	Green	Token acquired by PROFIBUS master

B4.6.2 DPV1 MASTER

AnyBus card has four LEDs mounted at the front of the board. The functions of the LEDs are shown below.

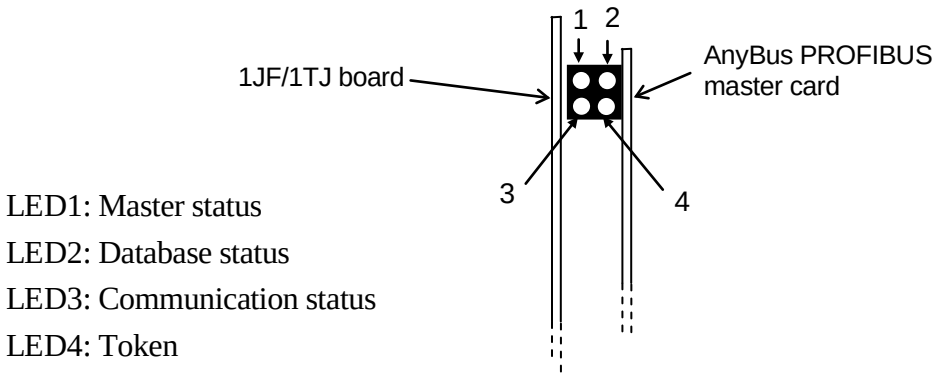


Fig. B14 Fronta view of LED indicator

Table B15 LED indicator

Name of LED	Status	Description
1. Master status	Green	Operation mode
	Green, flashing（1Hz）	Clear mode
	Red	Stop mode
	Red, flashing	Operating as passive HSBY master
	OFF	Offline
2. Database status	Green	Database OK
	Green, flashing	Database download in progress
	Red	Database invalid
	OFF	No database downloaded
3. Communication status	Green	Data exchange with all configured slaves
	Green OFF	Data exchange with at least one configured slave
	Red	Bus control error (cable trouble or configuration error)
	OFF	No communictaion
4. Token	Green	Token acquired by PROFIBUS master
	OFF	Token not acquired by PROFIBUS master
All	Red	Fatal error

APPENDIX C INTERBUS

C1.0 OUTLINE OF INTERBUS FOR ROBOT CONTROLLER

INTERBUS interface card is connected to the fieldbus motherboard (1JF/1TJ board) in the controller via the application connector. AnyBus-S INTERBUS card is used as the INTERBUS interface card, and it uses RS485 cable, not fiber optic cable. By this means, AS system can easily connect to the fieldbus network as slave for the INTERBUS. The AnyBus-S INTERBUS card can communicate as a slave node with the INTERBUS master, although it cannot initialize communication with other nodes. It can only respond to incoming commands. Use INTERBUS-S master board (Phoenix Contact) as a daughter board for master communication.

The AnyBus-S INTERBUS slave interface has features shown below:

1. Physical interface
   Transmission media: Two different INTERBUS lines
   Topology: Ring structure
   Fieldbus connector: 9 pin male DSUB, Phoenix Contact pluggable connector
   Cable: Shield cable, Three twisted pair
   Isolation: The bus is isolated from the other electronics by DC/DC converter. Bus signals are isolated via photo coupler.
   ASIC and circuit: Module is based on SUPI 3 and SRE 1 chip from Phoenix Contact.

2. Fieldbus data
   Baud rate: 500 kbit/s
   I/O data size: (Slave) Max. 20 bytes input and 20 bytes output

3. Data exchange
   Process data: Cyclic I/O data transmission

4. Other
   Use the AnyBus-S INTERBUS on the remote bus.

[NOTE]

The connectivity with all INTERBUS products has not been confirmed. It is generally possible; however, Kawasaki does not guarantee the connection with all INTERBUS products.

C2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

↓

[2. Set the fieldbus interface card.]

(Master) Set the execution environment by the dip switches on the master board.

↓

3. Turn robot controller power ON.

↓

4. Set the allocation for the fieldbus interface. (Signal allocation setting)

In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)

↓

5. Set the number of external I/O signals. (See Chapter 5.)

Note that the maximum number of I/O signals for AnyBus-S INTERBUS is 160.

↓

6 Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

↓

7. Turn robot controller power OFF then ON.

↓

8. Set the signal allocation data (See Section 6.2.)

↓

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

↓

[10. Network configuration.]

Make network configuration by CMD tool (Configuration, Monitoring and Diagnostics type Software). (Refer to the manual for the master for more details.) No setting file is necessary for configuration.

↓

11. Start operation.

C3.0 INTERBUS - SLAVE

This section describes the AnyBus-S INTERBUS card by HMS. This card uses RS485 cable and not fiber optic cables.

C3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of the AnyBus-S INTERBUS card is shown below.

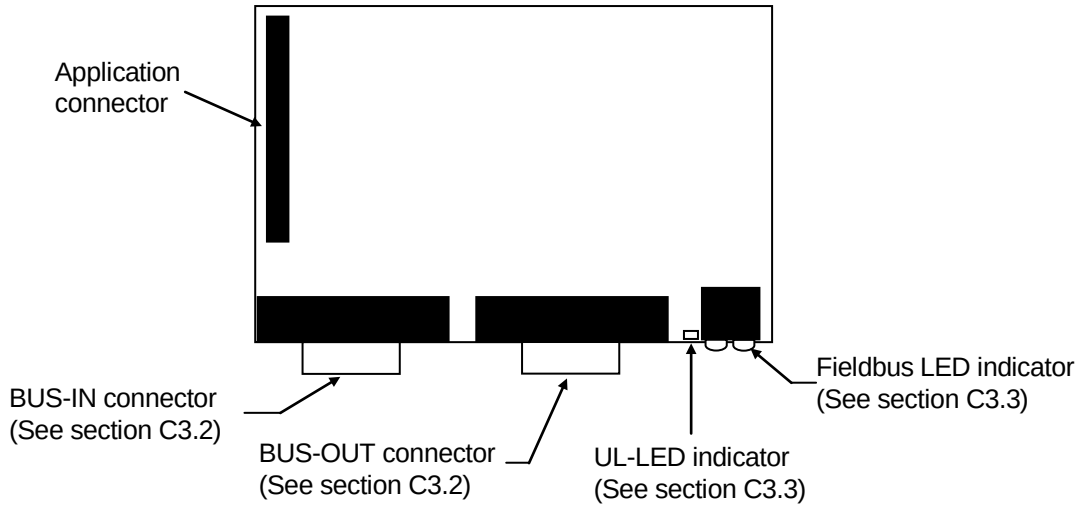


Fig. C1 AnyBus-S INTERBUS card (Plane view)

C3.2 INTERBUS CONNECTOR

The table below shows the pin function of the INTERBUS connectors.

Table C1 INTERBUS connector pins

BUS-IN (9 pin male)

D-SUB	Name
1	DO1
6	/DO1
2	DI1
7	/DI1
3	GND
Housing	PE

BUS-OUT (9 pin female)

D-SUB	Name
1	DO2
6	/DO2
2	DI2
7	/DI2
3, 5	GND
9	RBST
Housing	PE

[NOTE]

1. Always connect the RBST to GND if it is not the last module on the bus.
2. Do not connect to BUS-OUT connector on the last module of the INTERBUS network.

C3.3 LED INDICATOR

AnyBus-S has five LEDs in the front and one LED on the board. The specifications for the LED in the front are below.

LED1: RBDA (**R**emote **B**us **D**is**A**ble)
LED2: TR (**T**ransmit/**R**eceive)
LED3: CC (**C**able **C**heck)
LED4: BA (**B**us **A**ctive)
LED5: UL

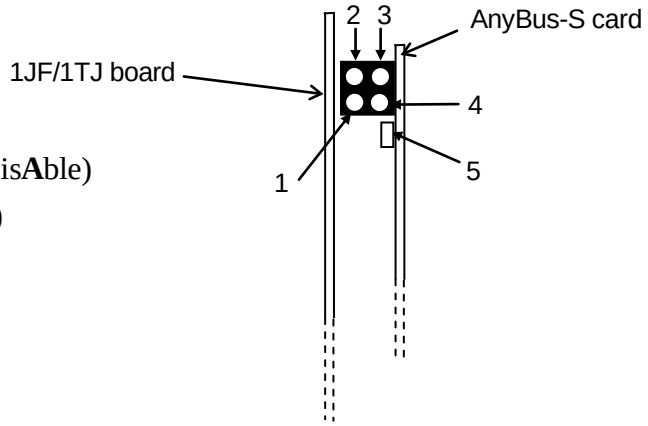


Fig. C2 Front view of LED indicator

Table C2 LED indicator

Name of LED	Status	Description
1. RBDA (Remote bus disable)	Red	Remote bus connected to BUS-OUT switched OFF
2. TR (Transmit/Receive)	Green	PCP communicating via the INTERBUS. ON 0.6 sec. each time triggered.
3. CC (Cable check)	Green	Cable connection is good and INTERBUS master is not in reset mode.
4. BA (Bus active)	Green	Monitoring Layer 2.
5. UL (Voltage check)	Green	Voltage at the bus interface is OK.

Watchdog LED (on AnyBus card)

Table C3 Watchdog

Name	Status	Description
Watchdog	Flashing green (1 Hz)	Module is initialized and running.
	Flashing green (2 Hz)	Module is not initialized.
	Flashing red (1 Hz)	RAM check fault
	Flashing red (2 Hz)	ASIC and Flash ROM check fault
	Flashing red (4 Hz)	DPRAM check fault

C4.0 INTERBUS – MASTER

This section describes the INTERBUS master board used for E controller (produced by Phoenix Contact). Mount the INTERBUS master board on PCI bus adapter (1UQ/1YQ board) board, then insert it into the robot controller. Use RS485 cable as INTERBUS remote bus cable.

C4.1 MECHANICAL OVERVIEW OF MODULE

Fig. C3 is the outline view (plane view) of the master board. Fig. C4 shows the outline view (front view) of the interface board with 1UQ/1YQ board and slave boards.

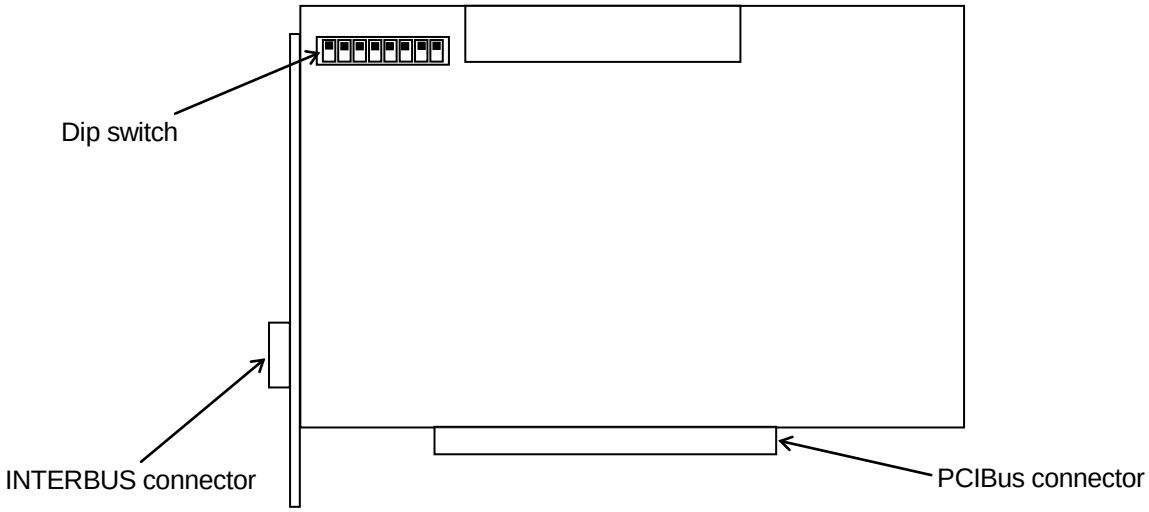


Fig. C3 Master board (Plane view)

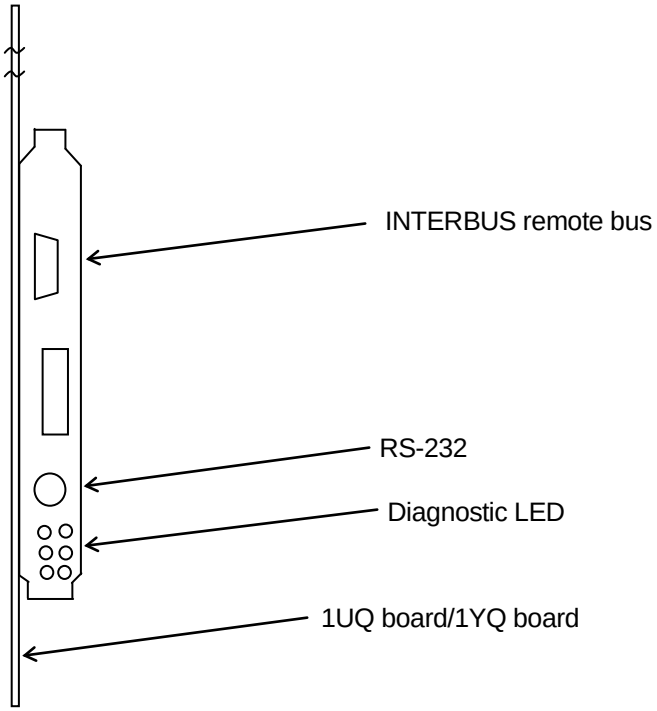


Fig. C4 Interface board. (Front view)

The figure below shows the outline view of the interface board when INTERBUS master and PCI bus adapter (1UQ) board are connected.

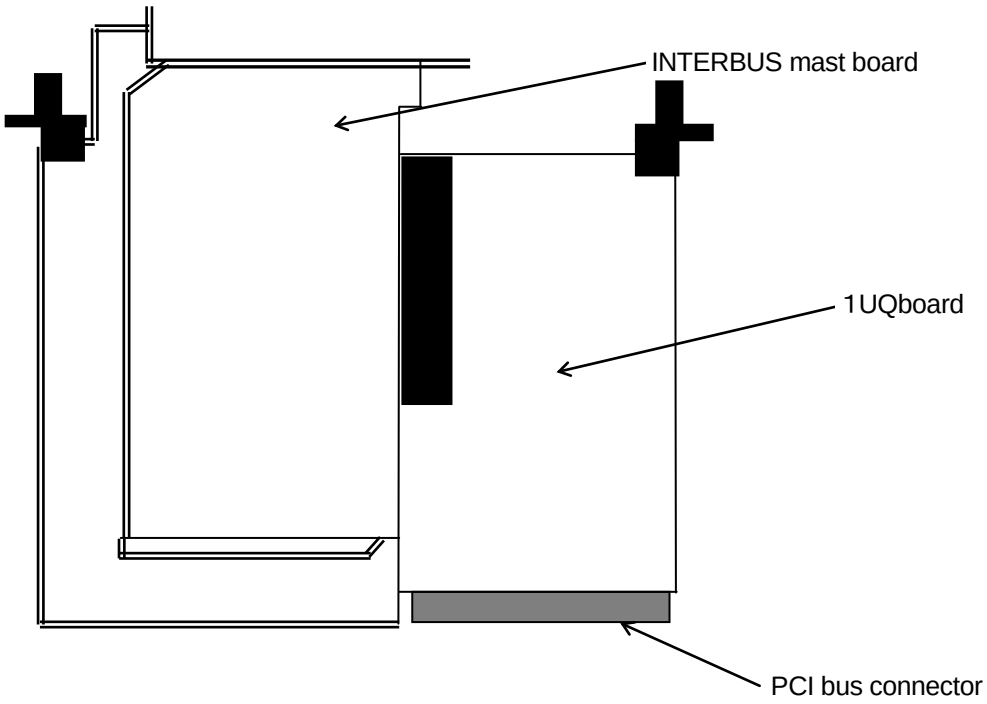


Fig. C5-1 Interface board with INTERBUS master and PCI bus mother board connected (Front view)

The figure below shows the outline view of the interface board when INTERBUS master card and PCI bus adapter board (1YQ board) are connected.

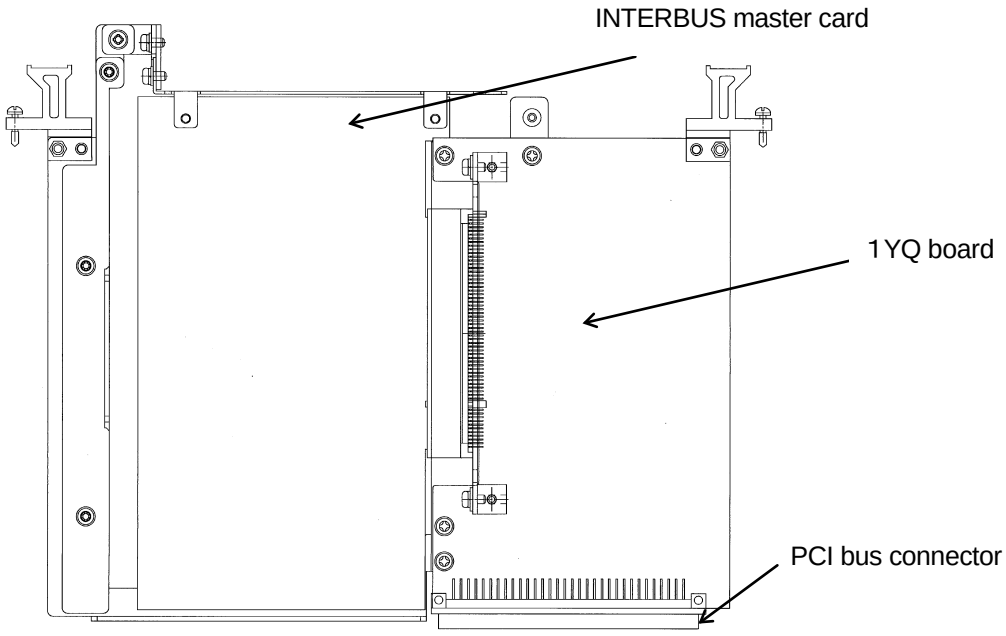


Fig. C5-2 Interface board with IINTERBUS master and 1YQ board connected (Front view)

C4.2 CONNECTOR

C4.2.1 INTERBUS CONNECTOR

The table below shows the pin function of the INTERBUS connectors.

Table C4 INTERBUS connector pins

BUS-IN
(9 pin male)

D-SUB	Name
1	DO
6	$\overline{DO}$
2	DI
7	$\overline{DI}$
3	COM
Strain Relief	Shield

BUS-OUT
(9 pin female)

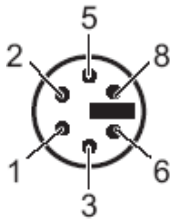
D-SUB	Name
1	DO
6	$\overline{DO}$
2	DI
7	$\overline{DI}$
3	COM
5	(Jumpre)
9	
Strain Relief	Shield

C4.2.2 RS232 CONNECTOR

RS232 is used for configuration. Interface of RS-232 is 6-pos. Mini-DIN female connector (PS/2). Connect between the PC and INTERBUS master with RS-232 cable.

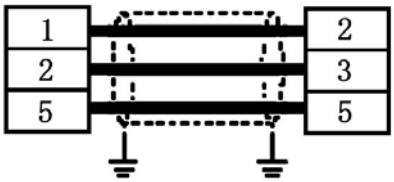
6-pos. Mini-DIN
female connector
(PS/2)

	Name
1	TXD
2	RXD
5	GND
6	RTS
8	CTS



6-pos.Mini-DIN female

RS-232 cable



D-sub 9 pin

	Name
2	RXD
3	TXD
5	GND
7	RTS
8	CTS

Fig. C6 RS232

C4.3 CONFIGURATION

C4.3.1 BOARD SETTING

Set the execution environment by the dip switches when INTERBUS PCI board is used.
500 kbit/s is selected in Fig. C7.

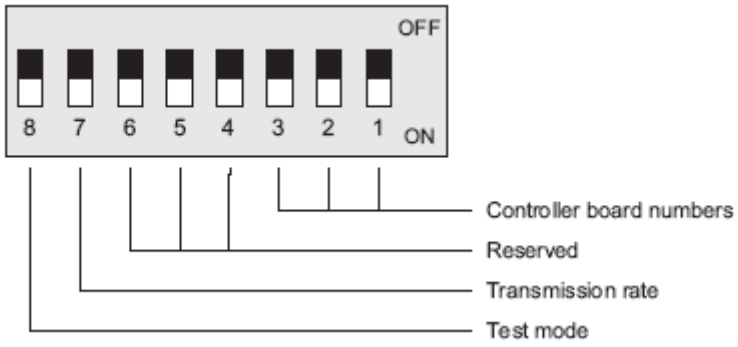


Fig. C7 Dip switch

(1) Controller board numbers (Dip switch from 1 to 3): 1

Board number	Dip switch 1	Dip switch 2	Dip switch 3
1	OFF	OFF	OFF

(2) Transmission rate (Dip switch 7)

OFF 500 kbit/s
ON 2 Mbit/s

(3) Test mode (Dip switch 8)

OFF Test mode is not selected.

C4.3.2 CONFIGURATION TOOL

For INTERBUS master, use IBS CMD SWT G4 (produced by Phoenix Contact) as a configuration tool.

C4.4 LED INDICATOR

Master board has six LEDs at the front. The specifications for the LED are below.

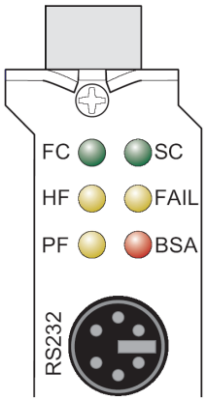


Fig. C8 LED indicator

Table C5 LED indicator

Name of LED	Status	Description
FC	Green	Reserved
SC	Green Flashing Green ON	INTERBUS ready/running The controller board is in READY or ACTIVE state. The controller board and the connected INTERBUS are in the RUN state.
HF	Yellow ON	Host failure Host system failure; driver not yet started
FAIL	Red ON	Failure Error has occurred in the INTERBUS system
PF	Yellow ON	Peripheral failure Peripheral failure of an INTERBUS device
BSA	Yellow ON	Bus segment aborted One or more bus segments are disconnected

APPENDIX D ETHERNET/IP

D1.0 OUTLINE OF ETHERNET/IP FOR ROBOT CONTROLLER

In applications with Kawasaki controller, AnyBus-S EtherNet/IP is used for the EtherNet/IP adapter (slave) and AnyBus-M EtherNet/IP is used for the scanner (master).

Main features of the EtherNet/IP are shown below:

1. Communication speed:	10/100 Mbit/s
2. Cable:	Twisted pair cable (Connector: RJ45)
3. IP configuration:	Auxiliary function, dip switch, DHCP server
4. Protocol	CIP (Common Industrial Protocol)

AnyBus-M Ethernet/ IP can communicate with maximum of 64 slaves.

[NOTE]

1. The Max. IO signal numbers available in the master unit are 960 for input and 960 for output.
2. Depending on the number IO signals used in each connected slave, number of connectable slaves might be reduced to less the max. number (64 slaves).

[NOTE]

The connectivity with all EtherNet/IP products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all EtherNet/IP products.

[NOTE]

Do not use Kawasaki's TCP/IP Communication function via Ethernet and EtherNet/IP on the same network.

D1.1 OUTLINE OF MODBUS TCP FUNCTION FOR ROBOT CONTROLLER

AnyBus-S EtherNet/IP adaptor card supports both EtherNet/IP and Modbus/TCP.

- Communication speed: 10/100 Mbit/s
- Cable: Twisted pair cable (Connector RJ45)
- Address model of Modbus communication is as follows:

Register No.	Coil No	Area	Offset
1	1... 16	Output data	000h... 001h
2	17... 32		002h... 003h
3	33... 48		004h... 005h
4	49... 64		006h... 007h
...	...		...
1024	16369... 16384		7FEh... 7FFh
1025	16385... 16400	Input data	000h... 001h
1026	16401... 16416		002h... 003h
1027	16417... 16432		004h... 005h
1028	16433... 16448		006h... 007h
...	...		...
2048	32753... 32768		7FEh... 7FFh

D2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

↓

2. Set the fieldbus interface card. (Network configuration)

Configure the network (IP address, subnet mask, etc.) via ETNIP monitor command or [Aux.0608-4]. (See Section D3.3 for slave, D4.3 for master.)

↓

3. Turn robot controller power ON.

↓

4. Set the allocation for the fieldbus interface. (Signal allocation setting)

In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via [Aux. 0611]) matches the number allocated in [Aux. 0608-1]. (See Chapter 5, Example 2.)

↓

5. Set the number of external I/O signals. (See Chapter 5.)

↓

6 Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

↓

7. Turn robot controller power OFF then ON.

↓

8. Set the signal allocation data. (See Section 6.2.)

↓

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

↓

10. Network configuration.

For slave: Configure the network following the manuals for the master device such as PLC.

For master: Consult HMS about the network configurator to be used.

Visit HMS's website at: http://www.anybus.com for contact information.

↓

11. Start operation.

D3.0 ETHERNET/IP-ADAPTER (SLAVE) OR MODBUS TCP SERVER

D3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of AnyBus-S EtherNet/IP card (Fig. D1) and 1JF/1TJ board installed with AnyBus-S EtherNet/IP card (Fig. D2) are shown below.

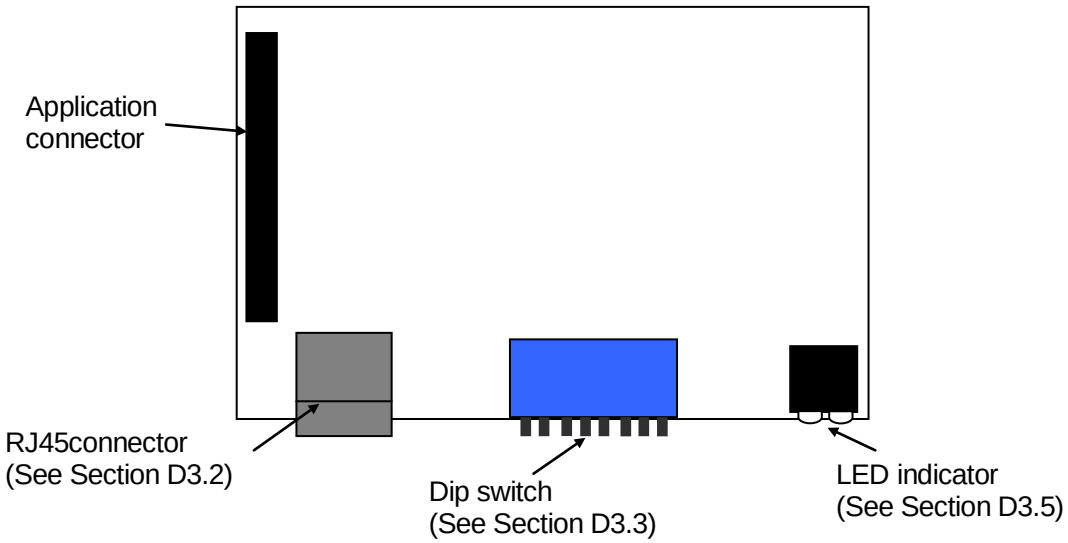


Fig. D1 AnyBus-S EtherNet/IP card (Plane view)

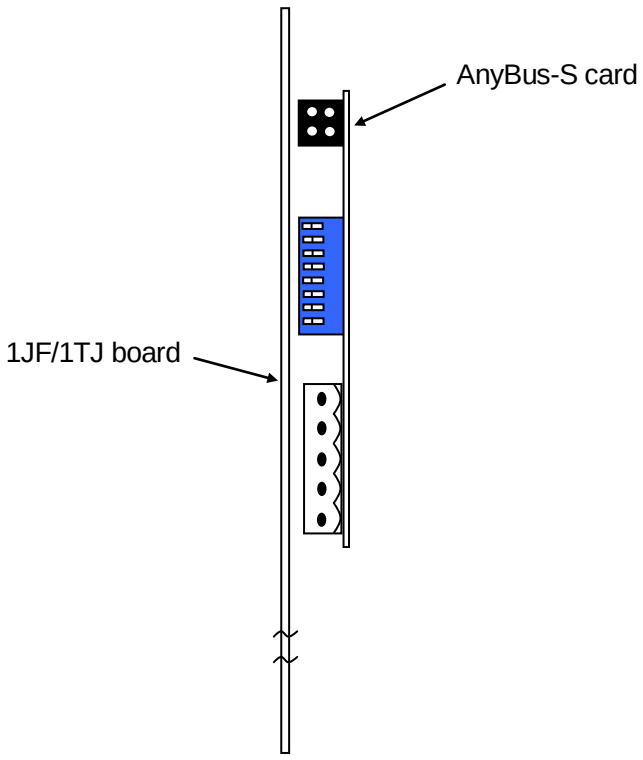


Fig. D2 Interface board (Front view)

D3.2 CONNECTOR

The table below shows the pin functions of RJ45 connectors.

Table D1 RJ45 Connector

Connector Pin	Signal	Description
1	TD	Transmission+
2	TD-	Transmission -
3	RD+	Reception+
4	Not used	
5	Not used	
6	RD-	Reception -
7	Not used	
8	Not used	

D3.3 CONFIGURATION

IP address network is configured in one of the three methods shown below:
1. via [Aux. 0608] – [4. Set Ethernet Configuration] or ETNIP monitor command
2. via dip switches on EtherNet/IP card
3. via address setting by DHCP/BOOTP server

Initial settings for EtherNet/IP card are as follows:
Slave port:

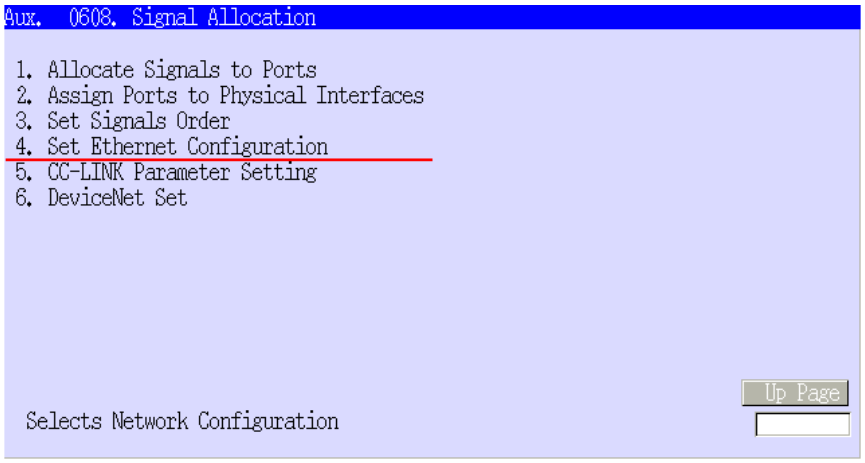
IP address : 192.168.0.2
Subnet mask : 255.255.255.0
Gateway : 0.0.0.0

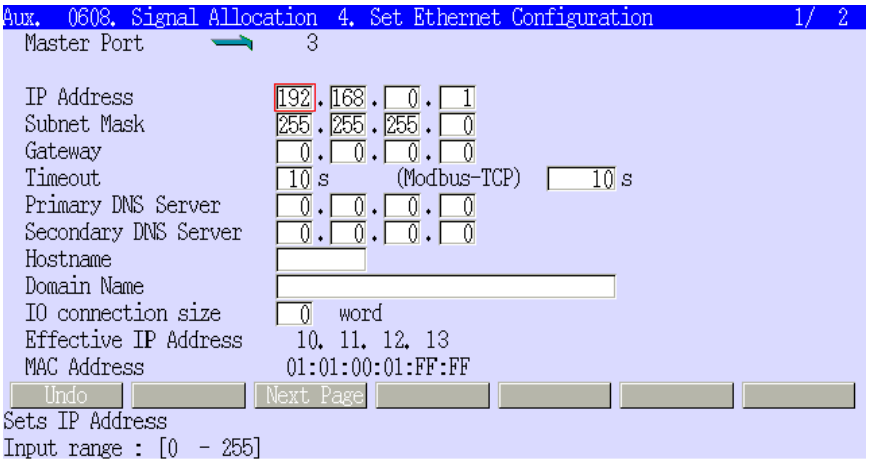
The following IP addresses can not be used:

0.x.x.x.
127.x.x.x.
x.x.x.0
x.x.x.255

D3.3.1 ETHENET CONFIGURATION (AUX. 0608-4)

Selecting [Aux. 0608 Signal Allocation] – [4 Set Ethernet Configuration] displays the screen shown below. Necessary network configuration data such as IP address, subnet mask, gateway address, timeout, etc. are set via this screen.





IP address, subnet mask, gateway

Specify decimal values from 0 to 255. When all IP address fields are set 0 in [Aux. 0608-4], the dip switch values determine the IP address. (See D3.3.2).

Timeout

Specify the timeout value for EtherNet/IP communication in decimal value from 1 to 255. Unit is in seconds.

(Modbus-TCP)

Specify the timeout value for MODBUS-TCP communication in decimal value from 0 or 10 to 32767. Unit is in seconds. Set 0 to disable the timeout function.

Primary/Secondary DNS server
Not valid for slave. (Only for master)

Host name, Domain name
Not valid for slave. (Only for master)

IO connection size
Not valid for slave. (Only for master)

Effective IP address and MAC address are only displayed for reference and cannot be changed here. Effective IP address shows the actual IP address of the AnyBus-S EtherNet/IP card. 0 (zero) is displayed for both IP address and MAC address when AnyBus-S EtherNet/IP card is not installed.

[NOTE]

1. MAC address cannot be changed.
2. IP address for EtherNet/IP (/Modbus TCP) cannot be changed via [Aux. 0812].

When all IP address fields are set to 0 in [Aux. 0608-4], the dip switch values determine the IP address. (See D3.3.2).

When both the IP address in [Aux. 0608-4] and the dip switch values are set to 0, the IP address allocated by DHCP/BOOTP server is configured as the IP address. See the manual for AnyBus-S EtherNet/IP for details.

D3.3.2 CONFIGURATION BY DIP SWITCHES

This setting is valid only in independent (local) network with no connection via router (=gateway) with other networks.

Class C address is used for the IP address. Values for subnet mask and gateway address are fixed. Initial setting values are:

IP address:	192.168.0. X
Subnet mask:	255.255.255.0
Gateway address:	0.0.0.0

The IP address consists of 4 values. The last value X is set via the dip switch in binary number. Settable value for X is from 1 to 255. The first switch on the dip switch is MSB, the eighth is LSB. 1 is assumed when switch is ON.

In the example below, the IP address is 192.168.0.3.

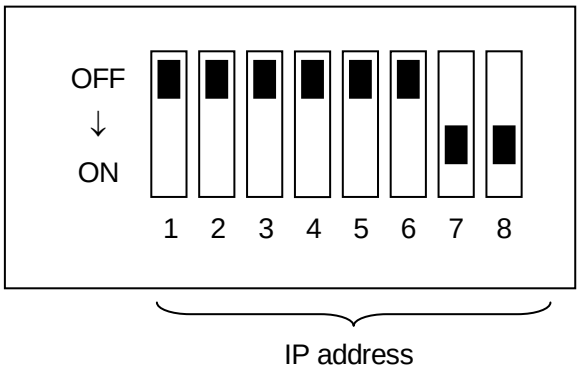


Fig. D3 Dip Switches

[NOTE]

1. IP address cannot be specified by dip switches via the internet.
2. IP address set via ETNIP monitor command or Aux. 0608-4 takes precedence over the IP address set via the dip switches. The latter will be invalid when IP address is set by the monitor command or the auxiliary function.

D3.3.3 EDS FILE

EDS (Electronic Data Sheet) is an ASCII file containing the necessary information for the device. The EDS file is required when using network configuration tools (e.g. RSNetWorx configuration tool software from Rockwell Automation Inc.) to configure the network. In this case, install the EDS file into the personal computer before executing network configuration. Install the EDS file as describe in the manual of the configuration tool.

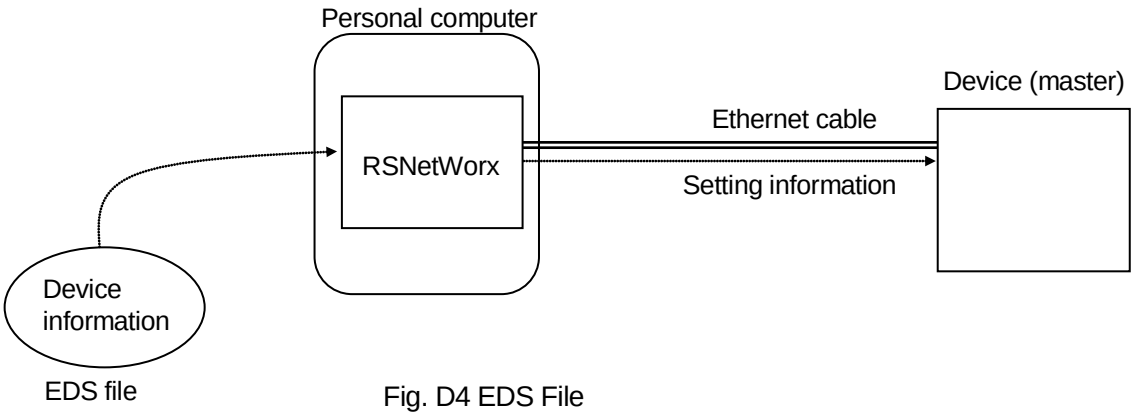


Fig. D4 EDS File

D3.4 ETHERNET/IP MONITOR COMMAND

ETNIP[/MAS or **/SLA] function no.** or **function no. = setting value**

Function

Executes following functions for EtherNet/IP network:

1. Sets configuration data such as IP address, subnet mask, gateway address, etc.
2. Sets EtherNet/IP communication time out (For slave only).

Parameter

1. Port

   Specify either master or slave.

   /MAS: Specifies master port.

   /SLA: Specifies slave port.

   When omitted, slave port is assumed. Primary/ secondary DNS server, host name or domain name can not be specified.

2. Function No.

   Specifies either 1 or 2 below.

   1: Sets the following data:

   IP address, subnet mask, gateway address

   2: Sets EtherNet/IP communication time out.

Explanation 1

Specifying function number 1 displays the currently set IP address, subnet mask, gateway address and makes them available for setting. All values are shown in decimal values.

The settings made here are reset to the default values when the robot controller is initialized. To validate the settings made, turn OFF/ON the controller power.

Example 1

Address confirmation (Port specification omitted)

```
>ETNIP 1↵
IP address = 192.168.0.2
Change? (If not, hit RETURN only)
↵
```

```
Subnet mask = 255.255.255.0
Change? (If not, hit RETURN only)
↵
Gateway address = 0.0.0.0
Change? (If not, hit RETURN only)↵
>
```

Example 2

Address confirmation (Master port specified)

```
>ETNIP/MAS 1↵
IP address = 192.168.0.1
Change? (If not, hit RETURN only)
192.168.0.3↵
IP address = 192.168.0.3
Change? (If not, hit RETURN only)
↵
Subnet mask = 255.255.255.0
Change? (If not, hit RETURN only)
↵
Gateway address = 0.0.0.0
Change? (If not, hit RETURN only)
↵
>
```

Explanation 2

Specifying Function No.2 sets EtherNet/IP communication time out. Unit is second, and the initial set value is 10 seconds. Setting range: 1 to 255. To validate the settings made, turn OFF/ON the controller power.

Example 1

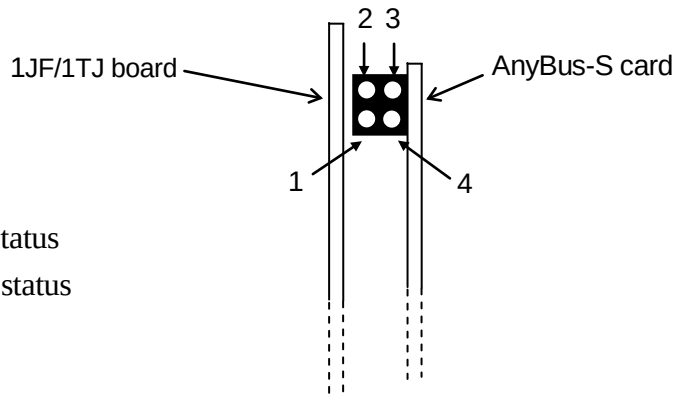
Set 20 seconds for time out

```
>ETNIP 2=20↵
Set value 20
Current value  10
Confirm! (Yes: 1, No: 0)
```

Entering 1 registers the set value. This value is validated when the power to the controller is turned OFF/ON. Entering 0 ignores the set value and no change is made to the setting.

D3.5 LED INDICATOR

AnyBus-S has four LEDs on the front of the board and one on the card. The specifications for the LEDs are as shown below.



LED1: Link
LED2: Module status
LED3: Network status
LED4: Activity

Fig. D4 Front view of LED Indicator

Table D2 LED Indicator

Name of LED	Status	Description
1.Link	Green	Module has a link.
	OFF	Module does not sense a link.
2.Module status	OFF	No power applied to the module.
	Green	Module is operating correctly.
	Flashing Green	Module has not been configured.
	Flashing Red	A minor recoverable fault has been detected.
	Red	A major internal error has been detected.
	Flashing Green/ Red	Module is performing a power ON self test.
3.Network status	OFF	Module has no power or no IP address has been assigned.
	Green	Module has at least one established EtherNet/IP connection.
	Flashing Green	No EtherNet/IP connections established with module.
	Flashing Red	Connection Timeout: One or more of the connections in which this module is the target has timed out. Time out status is released only if all timed out connections are re-established or if the module is reset.
	Red	Duplicate IP: The module has detected that its IP address is already in use.
	Flashing Green/ Red	The module is performing a power ON self-test.
4.Activity	Green	The Activity led flashes green each time a packet is received or transmitted.

Watchdog LED (on AnyBus card)

Table D3 Watchdog

Name of LED	Status	Description
Watchdog	Flashing Green (1 Hz)	Module is initialized and running.
	Flashing Green (2 Hz)	Module is not initialized
	Flashing Red (1 Hz)	RAM check fault
	Flashing Red (2 Hz)	ASIC and Flash ROM check fault
	Flashing Red (4 Hz)	DPRAM check fault
	Red	Internal error or executing in Boot Loader Mode.

D4.0 ETHERNET/IP-SCANNER (MASTER)

D4.1 MECHANICAL OVERVIEW OF MODULE

The outline view of AnyBus-M EtherNet/IP card (Fig. D6) and 1JF/1TJ board installed with AnyBus-M EtherNet/IP card (Fig. D7) are shown below.

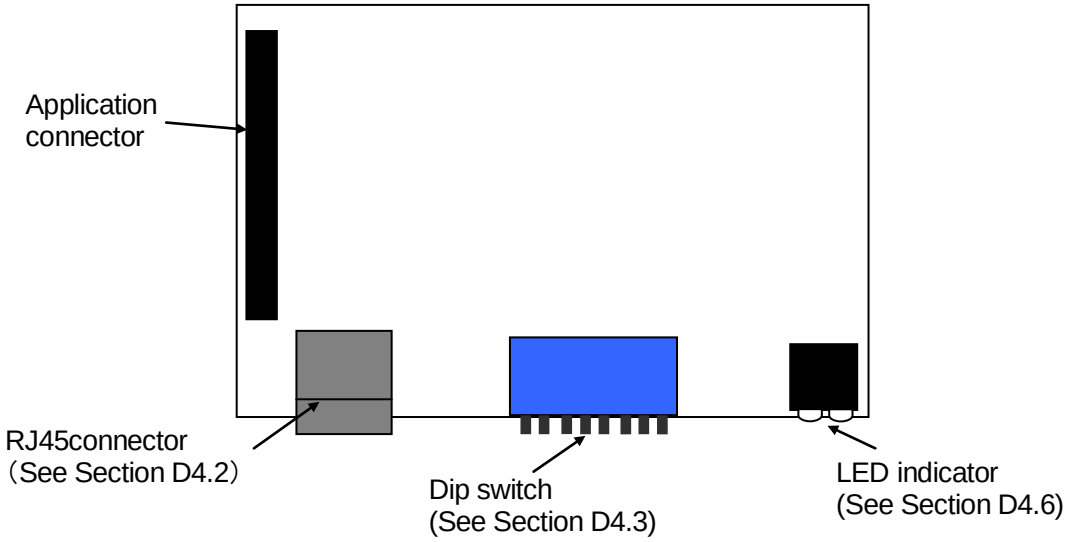


Fig. D6 AnyBus-M EtherNet/IP card (Plane view)

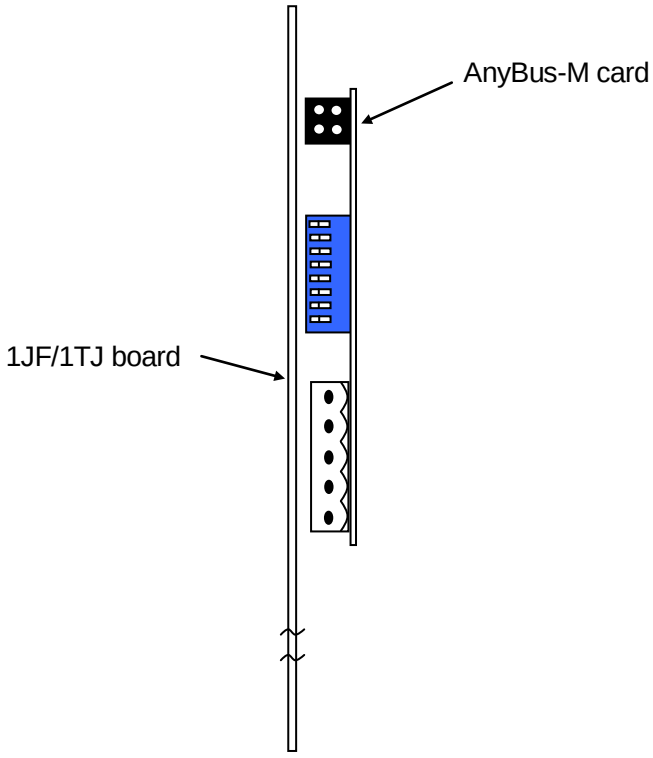


Fig. D7 Interface board (Front view)

D4.2 CONNECTOR

The table below shows the pin functions of RJ45 connectors.

Table D4 RJ45 Connector

Connector Pin	Signal	Description
1	TD	Transmission+
2	TD-	Transmission -
3	RD+	Reception+
4	Not used	
5	Not used	
6	RD-	Reception -
7	Not used	
8	Not used	

D4.3 CONFIGURATION

EtherNet/IP network is configured by one of the three methods shown below:
1. via [Aux. 0608] – [4. Set Ethernet Configuration] or ETNIP monitor command
2. via dip switches on EtherNet/IP card
3. via address setting by DHCP/BOOTP server

Initial settings for EtherNet/IP are as follows:
Master Port:

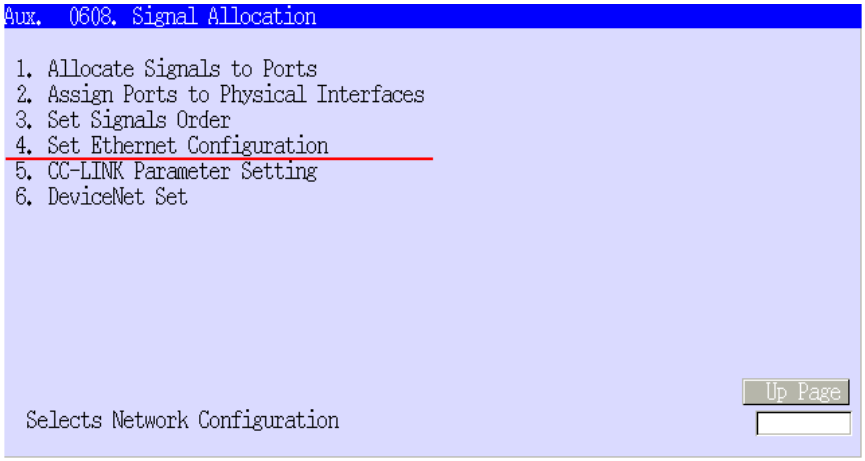
IP address : 192.168.0.1
Subnet mask : 255.255.255.0
Gateway : 0.0.0.0

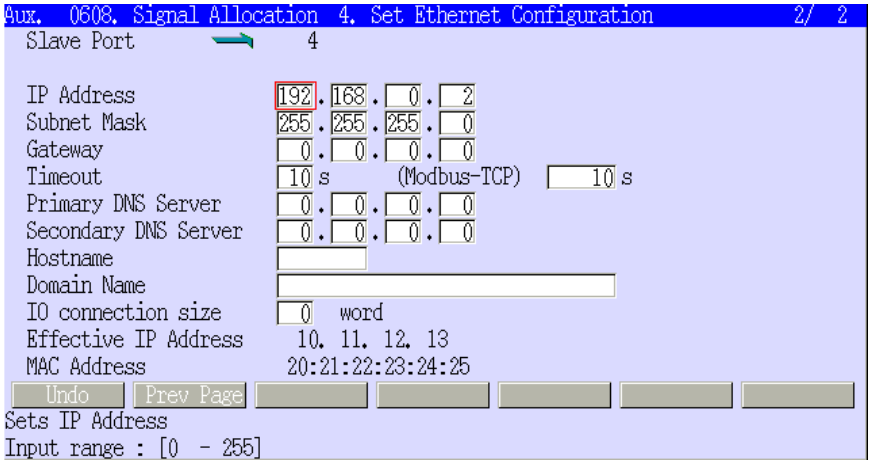
The following IP addresses can not be used as EtherNet/IP address:

0.x.x.x.
127.x.x.x.
x.x.x.0
x.x.x.255

D4.3.1 NETWORK SETTING (AUX. 0608-4)

Selecting [Aux. 0608 Signal Allocation] – [4 Set Ethernet Configuration] displays the screen shown below. Necessary network configuration data such as IP address, subnet mask, gateway address, DNS server, etc. are set via this screen.





IP address, subnet mask, gateway

Specify decimal values from 0 to 255.

Timeout

Not valid for master. (Only for slave)

Primary/Secondary DNS server

Specify decimal values from 0 to 255, when necessary.

Host name, Domain name

Set the names if necessary. Move the cursor to the item to be set and press SELECT. Input the desired name using the keyboard screen that appears.

IO connection size

Set the IO connection size when communicating with PLC (RSLogix, etc.). (Unit: word)
Specifying 1 word for IO connection outputs to PLC, 1 word starting from the top of the signals allocated to the master port (See Fig. D8.)

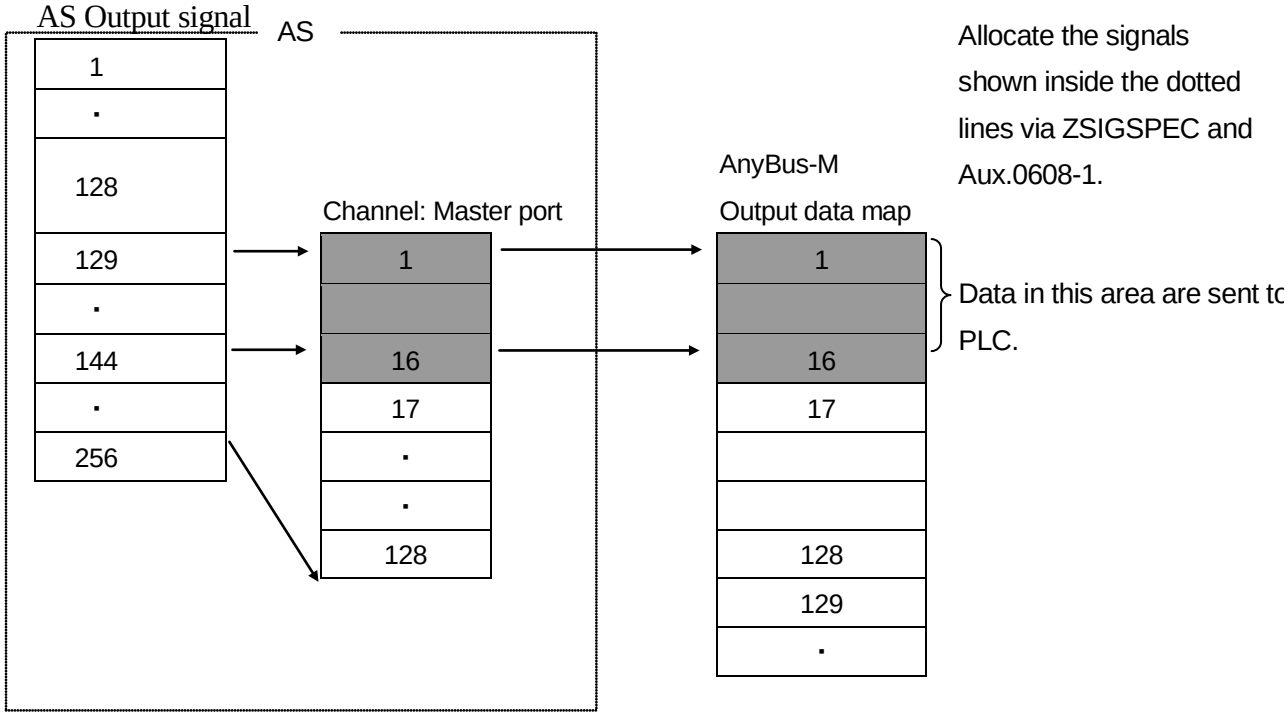


Fig. D8 Example of specifying 1 word for IO connection size

When communicating between slaves only and not with PLC, set the connection size to 0.

Connected IP address and MAC address are only displayed for reference and cannot be changed here. Connected IP address shows the actual IP address of the AnyBus-M EtherNet/IP card. 0 (zero) is displayed for both IP address and MAC address when no card is installed.

[**NOTE**]

1. MAC address cannot be changed.
2. IP address for EtherNet/IP cannot be changed via Aux. 0812.

When IP address is set to 0 in [Aux. 0608-4], the dip switch values are used for the IP address. (See D4.3.2).

When both the IP address in [Aux. 0608-4] and the dip switch values are set to 0, the IP address allocated by DHCP/BOOTP server is configured as the IP address. See the manual for AnyBus-M EtherNet/IP for details.

D4.3.2 CONFIGURATION BY DIP SWITCHES

This setting is valid only with independent (local) network with no connection via router (=gateway) with other networks.

Class C address is used for the IP address. Values for subnet mask and gateway address are fixed. The initial set values are as follows:

IP address : 192.168.0. X
Subnet mask: 255.255.255.0
Gateway address: 0.0.0.0

The IP address consists of 4 values. The last value X is set via the dip switch in binary number. Settable value for X is from 1 to 255. The first switch on the dip switch is MSB, the eighth is LSB. 1 is assumed when the switch is ON.

In the example below, the IP address is 192.168.0.3.

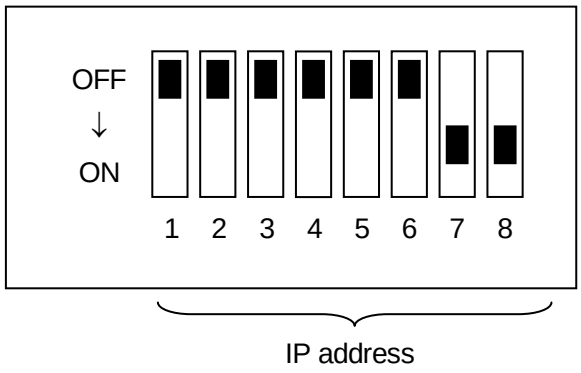


Fig. D9 Dip Switches

[NOTE]

1. IP address cannot be specified by dip switches via the internet.
2. IP address set via ETNIP monitor command or Aux. 0608-4 takes precedence over the IP address set via the dip switches. The latter will be invalid when IP address is set by the monitor command or the auxiliary function.

D4.3.3 NETWORK CONFIGURATION

When the number of I/O signals is changed by ZSIGSPEC monitor command, the network must be reconfigured. AnyBus-M EtherNet/IP card is configured using RSNetWorx configuration tool from Rockwell Software. Use this tool to set the communication partner and I/O size.

[NOTE]

Note that AS applications do not control or recognize which signal is communicating with which slave.

The chart below (Fig. D10) shows the operation procedures for robot controller and RSNetWorx when configuring the network.

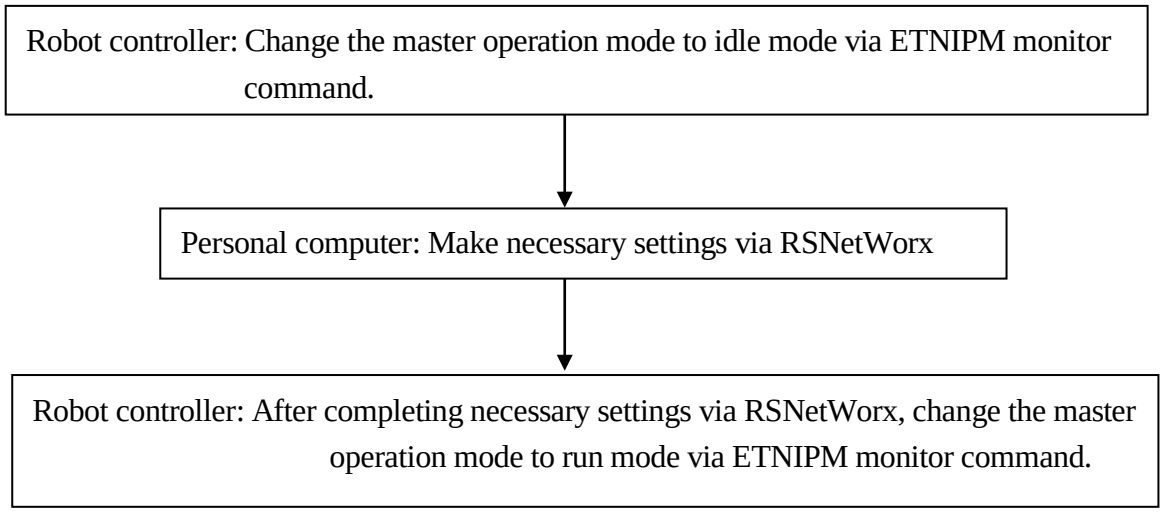


Fig. D10 Operation procedures for robot controller and RSNetWorx

Table D5 on the next page shows the procedures for configuring the network via RSNetWork. The scanlist created by RSNetWorx includes information for each node (I/O data size, etc.) on the EtherNet/IP. Refer to the RSNetWorx manual for more details on this operation.

Table A10 Outline procedure for RSNetWorx

Step	Robot controller	Operations in RSNetWorx
1	>ETNIPM 1 (Set to Idle mode)	
2		Start up RSNetWorx (Upload EDS file for the connected slave beforehand.)
3	Start up all slaves.	
4		Click on Online button. All nodes on EtherNet/IP network are displayed.
5		Click on [Master] icon.
6		Select [Scanlist configuration] form the pull-down menu.
7		Double click on the desired slave in the [Scanlist Configuration] window that is displayed.
8		[Connection Properties] windows is displayed. Set Input size and Output size. Enter the size in units of words (16 bits). Press <Apply> and close the window.
9		Select the master and select [Download to Device]
10		When the network configuration is changed, a message asking if the file is to be saved appears. Select [YES].
13		Confirmation message for download appears. Select [YES] and wait until download is completed.
14	>ETNIPM 2 (Set to Run mode)	
15	Start communication	

D4.3.4 EDS FILE

EDS (Electronic Data Sheet) is an ASCII file containing all necessary information about the specified device type. In this system, RSNetWorx (network configuration tool) configures the network based on the EDS files for the master and slave(s). For EDS file for slave, please use those provided by the vendor.

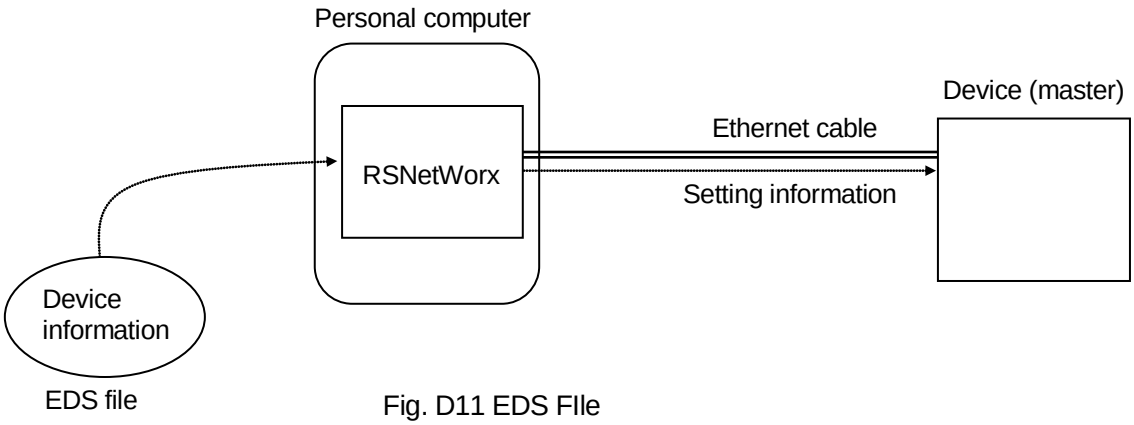


Fig. D11 EDS FIle

D4.4 ETHERNET/IP MONITOR COMMAND

ETNIP[/MAS or **/SLA] function number** or **function number = set value**

Function

Executes following functions for EtherNet/IP network:

1. Sets configuration data such as IP address, subnet mask, gateway address, etc.
2. Sets EtherNet/IP communication time out. (For slave only).

Parameter

1. Port

   Specifies master or slave.

   /MAS: Specifies master port. /SLA: Specifies slave port.

   When omitted, slave port is assumed. Primary/ secondary DNS server, host name or domain name can not be specified.

2. Function No.

   Specifies 1 or 2.

   1: Sets the following data: IP address, subnet mask, gateway address

   2: Sets EtherNet/IP communication time out. (For slave only).

Explanation

Specifying function number 1displays the currently set IP address, subnet mask, gateway address and makes them available for setting. All values are shown in decimal values. The settings made here are reset to the default values when the robot controller is initialized. To validate the settings made, turn OFF/ON the control power.

Example

Address confirmation (Master port specified)

```
>ETNIP/MAS 1 ↵
IP address = 192.168.0.1
192.168.0.3 ↵
IP address = 192.168.0.3
Change? (If not, hit RETURN only)↵
Subnet mask = 255.255.255.0
Change? (If not, hit RETURN only)↵
Gateway address = 0.0.0.0
Change? (If not, hit RETURN only)↵
>
```

D4.5 ETHERNET/IP MASTER MONITOR COMMAND

ETNIPM function number

Function

Sets operation mode settings for master.

Parameter

Function No.

Specifies 1 or 2.

1: Sets operation mode for master to idle (Only for master)

2: Sets operation mode for master to RUN (Only for master)

Explanation

Operation mode setting function: ETNIPM function number (1 or 2)

Master's operation mode must be set to idle mode while the network is configured. To change the operation mode, use function numbers 1 and 2 with this monitor command. After finishing configuring the network, change the operation mode to RUN mode, and then start communication.

Example

Master is changed to idle mode.

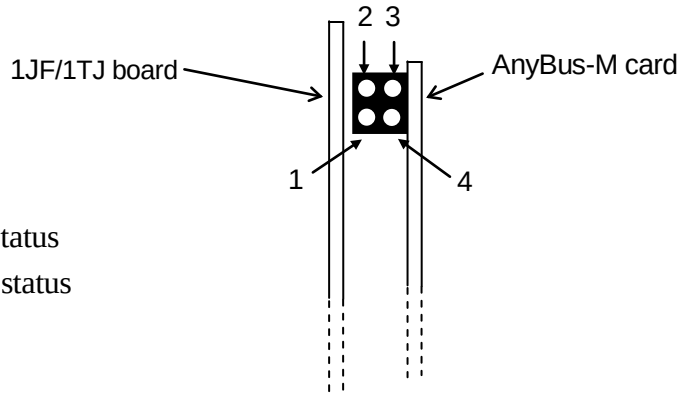
```
>ETNIPM 1
```

[NOTE]

This command might not execute when there is a fatal error in the specified slave or master.

D4.6 LED INDICATOR

AnyBus-M has four LEDs on the front of the board and one on the card. The specifications for the LEDs are as shown below.



LED1: Link
LED2: Module status
LED3: Network status
LED4: Activity

Fig. D12 Front view of LED Indicator

Table D6 LED Indicator

Name of LED	Status	Description
1.Link/ Activity	Green	Link established
	Flashing Green	Activity; receiving/ transmitting data
	OFF	No link or power off
2.Module status	Green	Device operational-Module is operating correctly in Run-state
	Flashing Green	Standby-Module has not been configured-Scanner in Idle-state
	Red	Major fault-Major unrecoverable fault
	Flashing Red	Minor fault-Minor recoverable fault (originated on timeout)-An originated connection could not be opened.
	Alternating Red/ Green	Self test-Module is performing power up test procedures.
	OFF	No power
3.Network status	Green	Connected The module has at least one established EtherNet/IP connection (target or originated)
	Flashing Green	No connections-There are no EtherNet/IP connections established to the module.
	Red	Duplicate IP-configured IP address already in use
	Flashing Red	Connection timeout-One or several EtherNet/IP target connections have timed out. Time out status is released only if all timed out connections are re-established or if the module is reset
	OFF	Module has no power or no IP address has been assigned.

Watchdog LED (on AnyBus card)

Table D7 Watchdog

Name of	Status	Description
Watchdog	Flashing Green (1 Hz)	Module is initialized and running.
	Flashing Green (2 Hz)	Module is not initialized
	Flashing Red (1 Hz)	RAM check fault
	Flashing Red (2 Hz)	ASIC and Flash ROM check fault
	Flashing Red (4 Hz)	DPRAM check fault
	Red	Internal error or executing in Boot Loader Mode.

APPENDIX E CC-LINK

E1.0 OUTLINE OF CC-LINK FOR ROBOT CONTROLLER

1PS board is used as a daughter board for CC-Link slave communication. 1PS board is a board that functions as CC-Link Remote device station. CC-Link Ver.2 built-in interface board (MITSUBISHI) is used as a daughter board for master communication.

In the CC-Link object-oriented model, robot controller supports the following communication specifications. Transient transmission is not supported.

Table E1 Communication specification

Device type	Slave (Remote IO device)	Master
Baud rate	Selectable 156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, or 10 Mbps	Selectable 156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, or 10 Mbps
Number of I/O signals	Maximum bit points Input: 896 Output: 896 Last 16 points are reserved for system. Max. number of word data Input: 128 Output: 128	Maximum bit points Input: 960 Output: 960 Max. number of word data Input: 256 Output: 256
Version	Version 1.0/ 1.1/ 2.0	Version 2.0/1.10
Communication service	Polling	Polling
Transmission medium	CC-Link dedicated cable	CC-Link dedicated cable
Connector	Open type connector	Open type connector
Number of slave stations	Max. 64	Max. 64 (Remote IO station)
Available Station number	1 to 64	0
Hardware configuration	1PS board and 1JF/1TJ board (or 1QK/1UK board)	Mitsubishi's interface board and 1QK/1UK board
Others		Inputs from abnormal data link stations are cleared.

[**NOTE**]

Note that the installation method for CC-Link communication boards differs from that for Kawasaki's 1HS board.

Maximum number of signals available for 1PS board is the number shown in the table below minus 16. The last 16 points are assigned to the system, therefore, they are unavailable. The setting for Version 1 is the same as one time setting.

Table E2 Bit points

Extended cyclic setting / No. of Occupied station	One time setting		2 times setting		4 times setting		8 times setting	
	Input	Output	Input	Output	Input	Output	Input	Output
1 station	32	32	32	32	64	64	128	128
2 stations	64	64	96	96	192	192	384	384
3 stations	96	96	160	160	320	320	640	640
4 stations	128	128	224	224	448	448	896	896

One word point is equal to 16 bits.

Table E3 Word points

Extended cyclic setting / No. of Occupied station	One time setting		2 times setting		4 times setting		8 times setting	
	Input	Output	Input	Output	Input	Output	Input	Output
1 station	4	4	8	8	16	16	32	32
2 stations	8	8	16	16	32	32	64	64
3 stations	12	12	24	24	48	48	96	96
4 stations	16	16	32	32	64	64	128	128

[NOTE]

1. The Max. IO signal numbers available in the master unit are 960 for input and 960 for output.
2. Depending on the IO signals used in each connected slave, number of slaves connected may be limited below the connectable slave number (64 slaves).

[NOTE]

The connectivity with all CC-Link products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all CC-Link products.

E2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

2. Set the fieldbus interface card.
Set the baud rate, unit address and selector switches (for master) via dip switches. (See section E3.3 for slave, E4.3 for master.)

3. Turn robot controller power ON.

4. Set the allocation for the fieldbus interface. (Signal allocation setting)
In step 5 below, before resetting the number of external I/O signals lower than the current setting ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See chapter 5, Example 2.)

5. Set the number of external I/O signals. (See Chapter 5.)

6 Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

7. Set number of remote register. (See Section E3.0.)

For slave

8. Turn robot controller power OFF then ON.

9. Set the signal allocation data. (See Section 6.2.)

10. Set the order of signals for the master/slave ports. (See Section 6.3.)

11. Network configuration.
Make network parameter setting according to the manual for master device (PLC, etc.).

For master

8. Network configuration
Make network configuration by [Aux.0608]-[5 CC-Link Parameter Setting].

9. Turn robot controller power OFF then ON.

10. Set the signal allocation data.
(See Section 6.2.)

11. Set the order of signals for the master/slave ports. (See Section 6.3.)

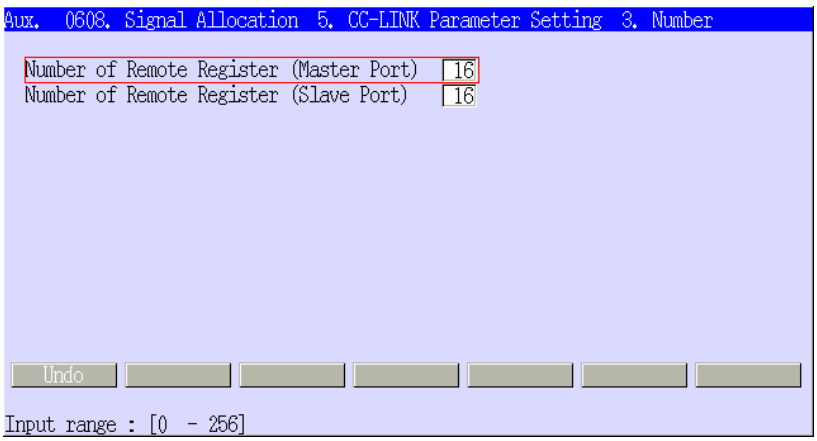
12. Start operation.

E3.0 SETTING NUMBER OF REMOTE REGISTER (AUX. 0608-05-03)

Sets number of remote register used in CC-Link communication. (Setting necessary for both master and slave port.)

The number of registers set here determines the number of integer data that can be used by AS. The number of data displayed on the integer data monitor will also be the same as the number of the remote register.

Selecting [Aux. 0608 Signal Allocation] – [5 CC-LINK Parameter Setting] – [3 Number of Remote Register] displays the screen shown below.



Number of Remote Register (Master Port/Slave Port)
Set the number of remote register for master port and slave port. The number set will be valid for the CC-Link card allocated to each of the ports.

Default value for each port is 16. Settable range: 0 to 256.
Setting 0 disables integer (word) data communication. Hardware setting will be valid over the value set here when the set value larger than the number of ports available by the CC-Link card allocated to the port.

For example, when using CC-Link slave (1PS) Ver.1 with 4 occupied stations, only 16 points each of integer (word) data for input and output will be available even when 256 is set for the number of remote register for the slave port.

Turn controller power OFF/ON after changing the settings. The set values become valid only after rebooting the controller.

E4.0 CC-LINK - SLAVE

E4.1 MECHANICAL OVERVIEW OF MODULE

The outline view of 1PS board (Fig. E1) and interface board (1JF/1TJ board (or 1QK/1UK board) with 1PS card) (Fig. E2) are shown below.

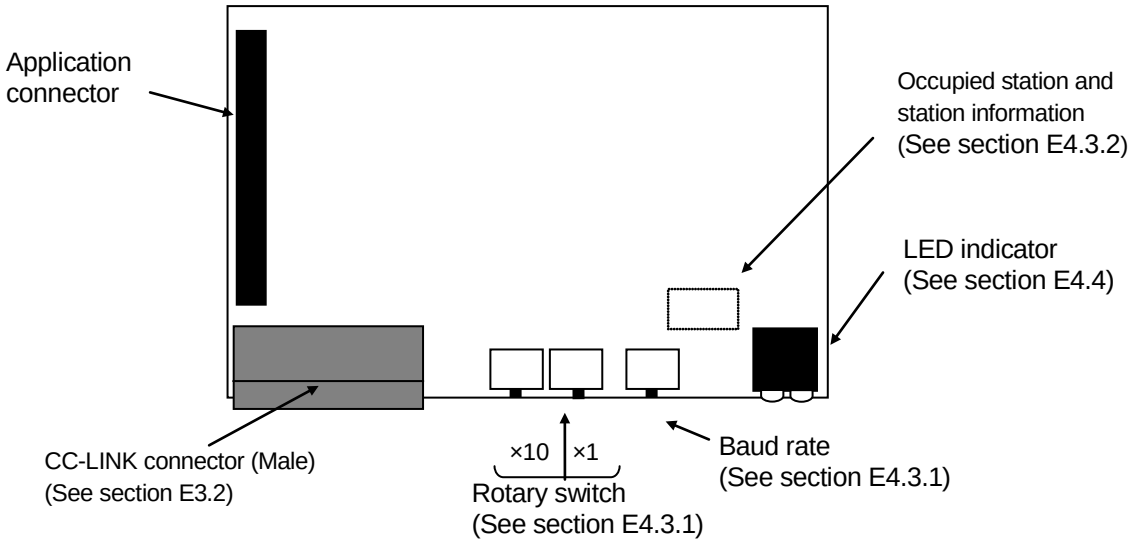


Fig. E1 1PS board (Plane view)

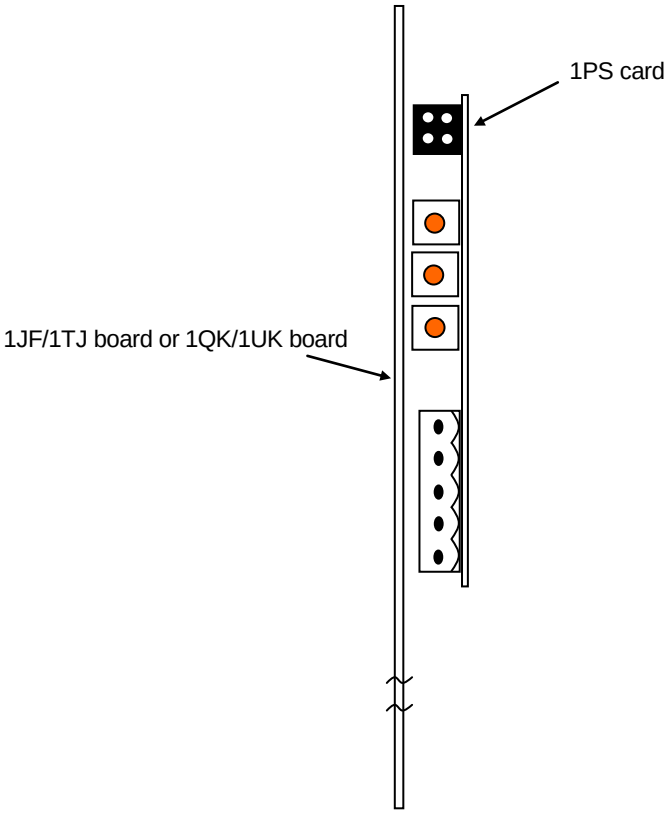


Fig. E2 Interface board (Front view)

E4.2 CABLE CONNECTION

The connection with cables, terminating resistor and connector (female) are shown in Fig.E3 below.

Pin	Signal
1	Communication line (DA)
2	Communication line (DB)
3	Digital GND (DG)
4	Shield
5	Frame Ground (FG / PE)

Attach terminating resistors to both ends of the connection. Connect to line DA and DB. Do not attach to the end of droplines.

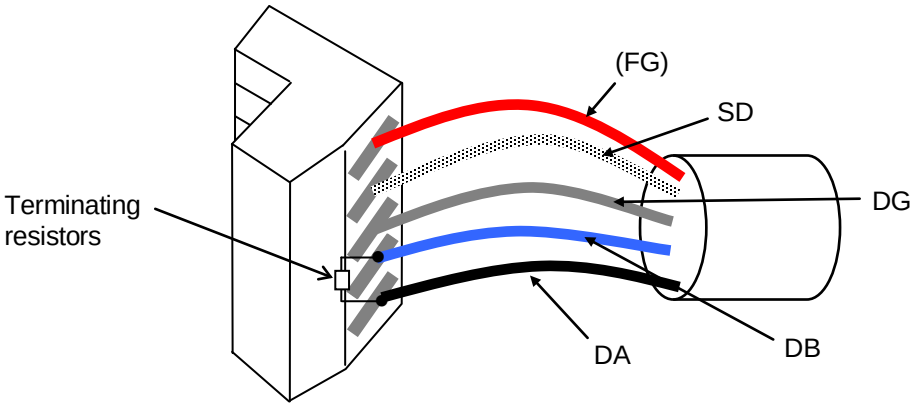


Fig. E3 Connector and cable

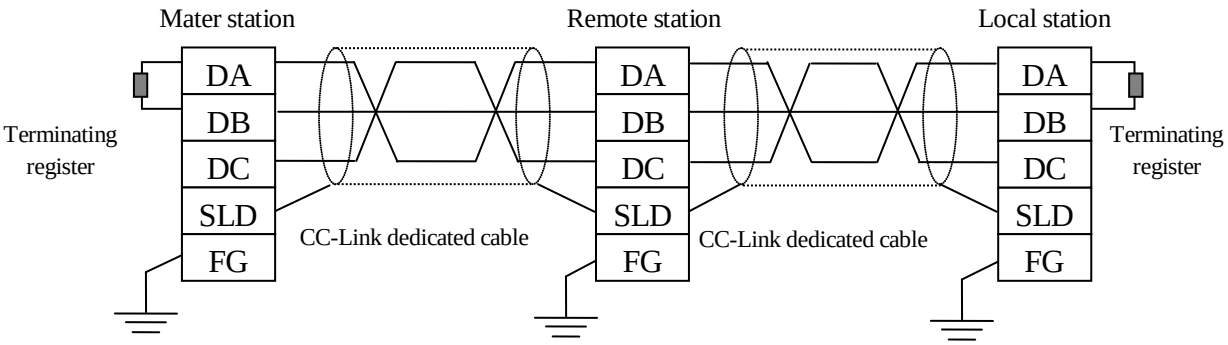


Fig. E4 Connection of Terminating Register

E4.3 CONFIGURATION

E4.3.1 BAUD RATE AND ADDRESS SETTING

When configuring CC-Link network, information for the baud rate and address are necessary.

1. Baud rate (S5) is selectable from 156 kbit/s, 625 kbit/s, 2.5 Mbit/s, 5 Mbit/s, and 10 Mbit/s. All devices on the network must have the same baud rate.

Table E4 Baud rate

Baud rate [kbit/s]	Rotary switch
156 kbit/s	0
625 kbit/s	1
2.5 Mbit/s	2
5 Mbit/s	3
10 Mbit/s	4

2. Before configuration, set the robot controller's address on the network via the two rotary switches on 1PS card. Settable range for the address is 1 to 64. The station number is used as the address on the network, so be careful the station numbers are not used more than once in the same network. The figure below shows the front view of the interface board with 1PS card set on 1JF/1TJ board (Fig. E5).

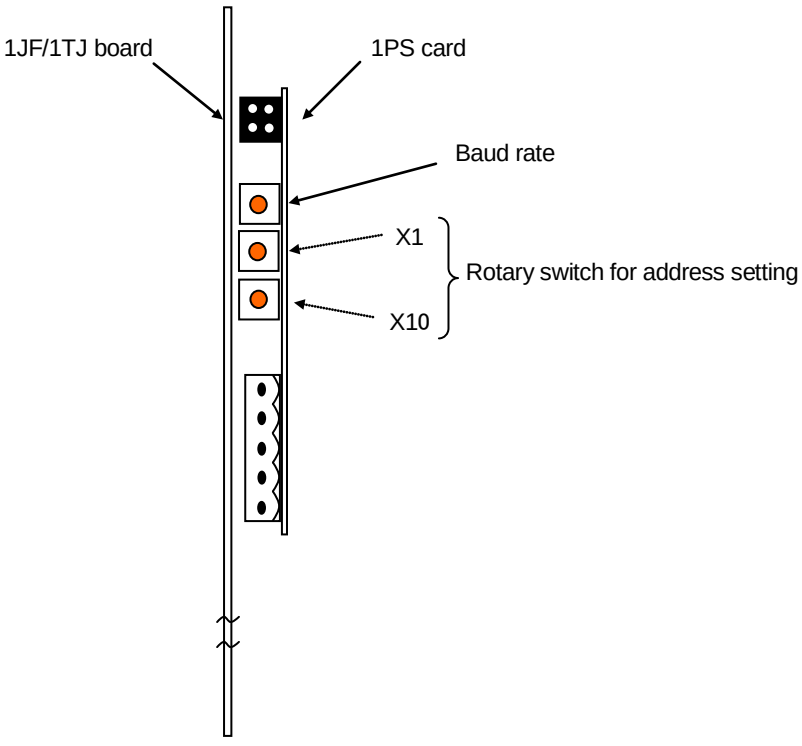


Fig. E5 Interface board (Front view)

Address is expressed in two digits number using the two rotary switches. The lower switch sets the tens place, and the upper switch sets the ones place.

Address = (Value of lower switch×10) + (Value of upper switch×1)

[NOTE]

Address cannot be changed during operation.

E4.3.2 OCCUPIED STATION AND STATION INFORMATION SETTINGS

Set the number of occupied stations and station information using switch S2 on the back side of 1PS board.

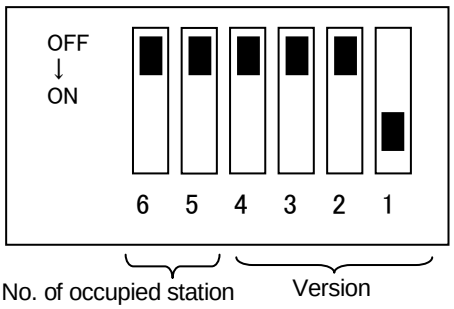


Fig. E6 Dip switches

Table E5 Version and number of extended cyclic

Version	Dip switch 4-1
Version 1.0	0 0 0 1
Version 2.0 1 time extended cyclic	0 0 1 0
Version 2.0 2 times extended cyclic	0 0 1 1
Version 2.0 4 times extended cyclic	0 1 0 0
Version 2.0 8 times extended cyclic	0 1 0 1

0: OFF, 1: ON

Table E6 No. of occupied stations

No. of occupied stations	Dip switch 6-5
1	1 1
2	1 0
3	0 1
4	0 0

0:OFF, 1:ON

The example in Fig. E5 shows Version1.0 with 4 stations occupied.

E4.4 LED INDICATOR

1PS board has four LEDs on the front and one LED on the card. The specifications for the front LEDs are below.

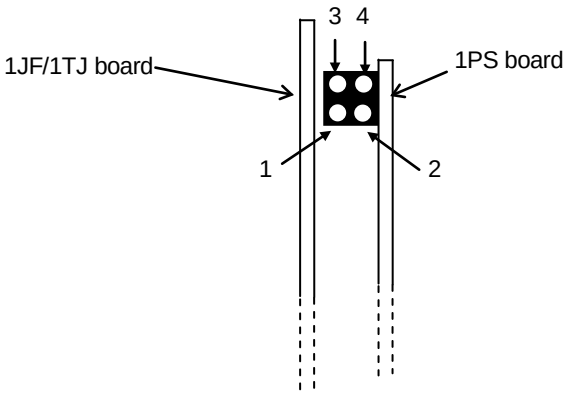


Fig. E7 Front view of LED Indicator

Table E7 LED indicator

No	Status	Description
LD2	Green	Normal CC-Link communication (Network link status)
LD4	Green	Receiving CC-Link data
LD3	Green	Sending CC-Link data
LD1	Red	CC-Link communication error

E5.0 CC-LINK MASTER

E5.1 MECHANICAL OVERVIEW OF MODULE

The outline view of CC-Link master card (Fig. E8) and 1QK/1UK board installed with CC-Link master card (Fig. E9) are shown below.

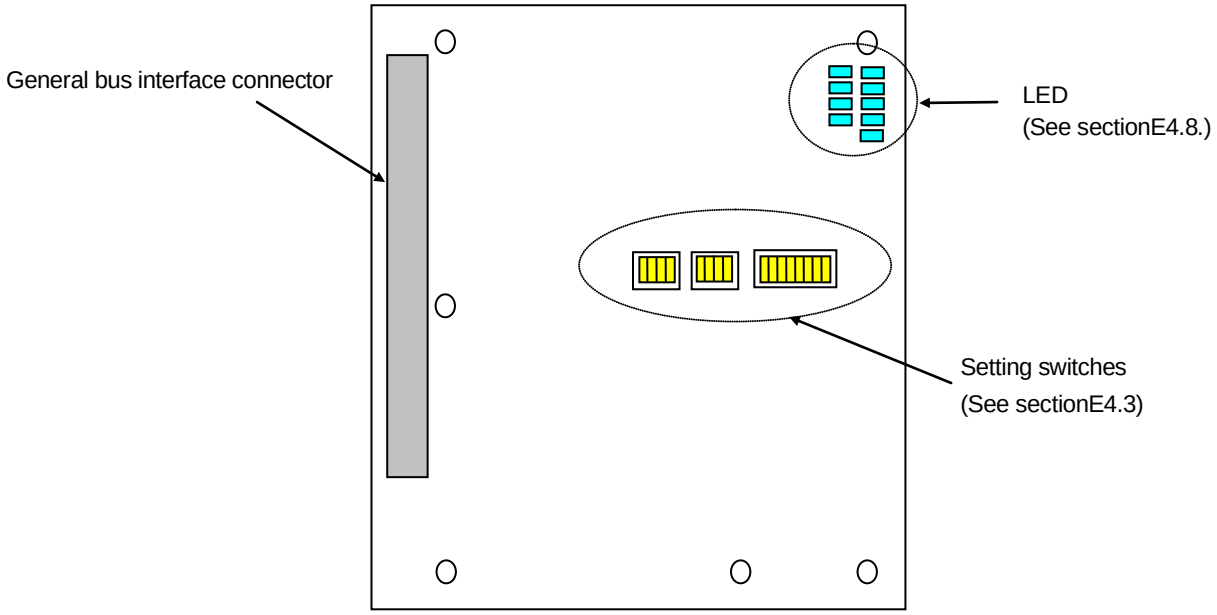


Fig. E8 CC-LINK master card (S side)

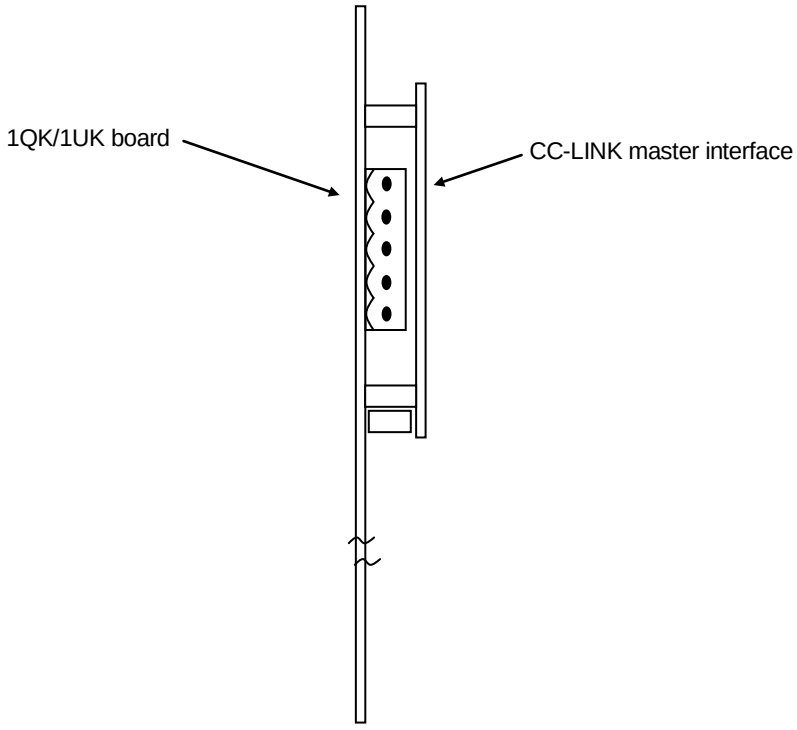


Fig. E9 Interface board (Front view)

E5.2 CABLE CONNECTION

The connection with cables, terminating resistor and connector (female) are shown in Fig.E10 below.

Pin	Signal
1	Communication line (DA)
2	Communication line (DB)
3	Digital GND (DG)
4	Shield
5	Frame Ground (FG/PE)

Attach terminating resistor to both ends of the lines of DA and DB. Do not attach to the end of the other lines.

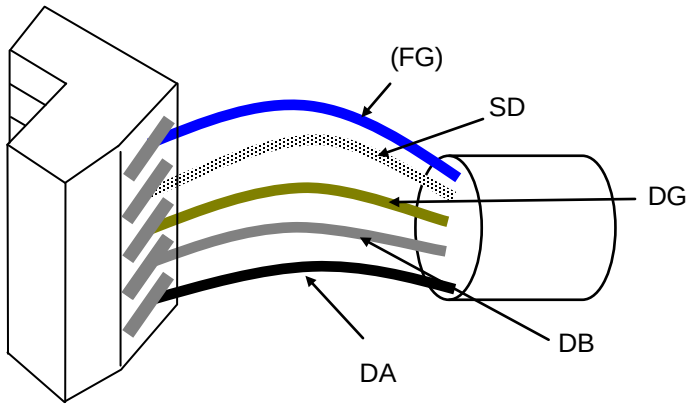


Fig. E 10 Connectors and cables

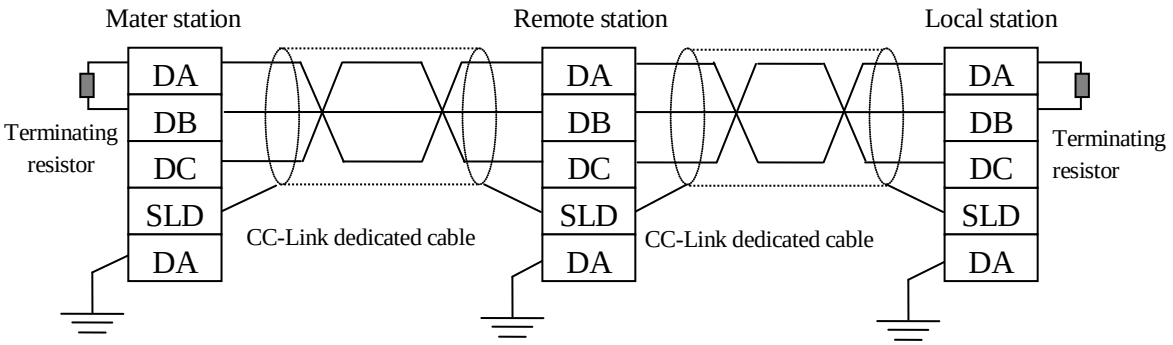


Fig. E11 Connection of Terminating Register

E5.3 CC-LINK MASTER BOARD SETTING

Set unit address, transmission speed, mode setting and selector switch via the setting switches. The switches are positioned as shown in figure below.

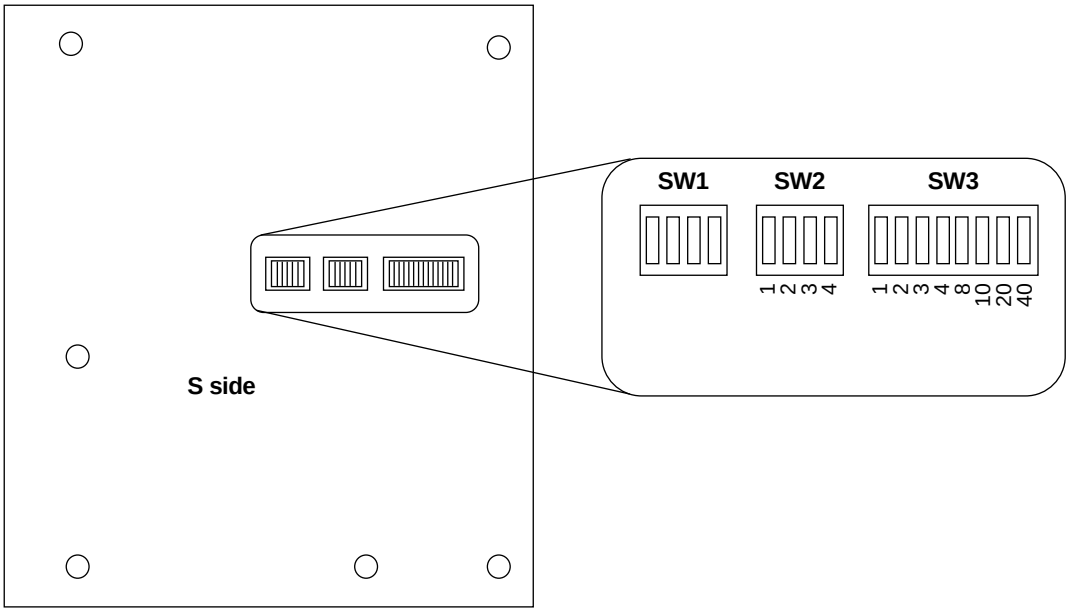


Fig. E12 Switch Positions

E5.3.1 UNIT SETTING

Use SW3 station number setting. The station number is set to 0.

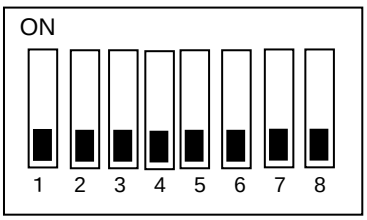


Table E8 Switch (SW3)

	1	2	3	4	5	6	7	8
Station number	X1				X10			
	1	2	4	8	1	2	4	8
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

E5.3.2 TRANSMISSION SPEED AND OPERATION MODE SETTING

Set transmission speed and operation mode via SW2. Select on-line for operation mode.

Example When 10 Mbps is selected.

Table E9 Switch (SW2)

	1	2	3	4	Transmission speed (bps)	Mode
0	OFF	OFF	OFF	OFF	156 k	Online
1	ON	OFF	OFF	OFF	625 k	
2	OFF	ON	OFF	OFF	2.5 M	
3	ON	ON	OFF	OFF	5 M	
4	OFF	OFF	ON	OFF	10 M	

E5.3.3 SELECTOR SWITCH SETTING

The H/W switch setting takes precedence for interface station number setting, transmission speed and mode setting. Set also CC-Link Version.

Example When Version2 is selected.

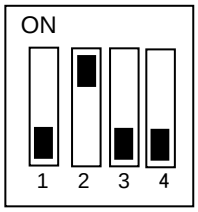


Table E10 Selector switch setting (SW1)

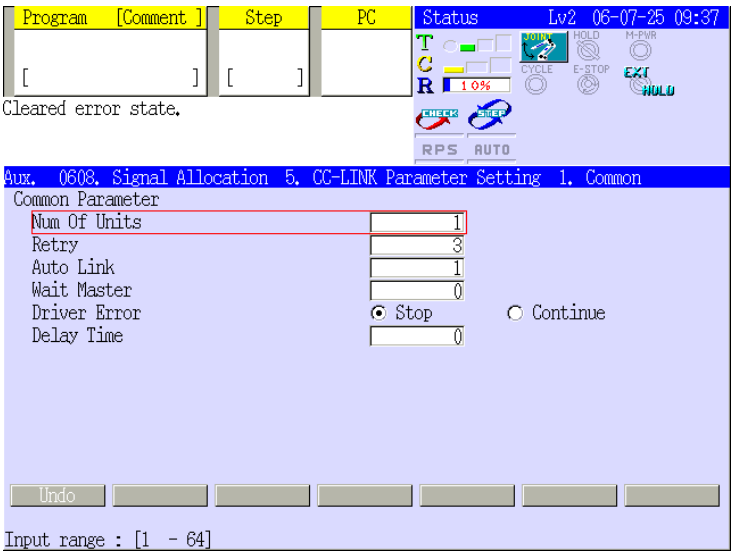
		Setting	
Switch (SW 1)	1	OFF (H/W has precedence)	
	2	OFF (Ver.1 mode)	ON (Ver.2 mode)
	3	Fixed to OFF	
	4	Fixed to OFF	

E5.4 PARAMETER SETTING

Parameters to set CC-Link communication environment are set via [Aux 0608 Signal allocation]–[5 CC-LINK Parameter Setting]. After changing the parameters, turn OFF/ON the power on the controller. Note that changing the parameters only on screen does not validate the changes.

E5.4.1 COMMON PARAMETER

Select [Aux 0608 Signal allocation] – [5 CC-Link Parameter setting] – [1 Common Parameter] to display the screen below. Select the item to set via ⇓ or ⇑ key and enter or select the necessary values/ setting via Number or SELECT key.



Num(ber) of units

Sets the number of modules connected. Setting range: 1 to 64

Bit data size varies depending on the module type, so connection of 64 modules is not always guaranteed. Since the maximum signal number for the robot controller is 960 for input and 960 for output, there might be cases where signals are not transmitted to/ from the robot controller with 64 modules connected.

Retry

Sets how many times to retry polling when there is no response from the target station. Setting range: 1 to 7

Auto Link

Sets how many modules are set as targets when restoring link with a station that communication error occurred. Setting range: 1 to 10

Wait Master

Sets the station number for the standby master station. Setting range: 0: No standby master

Driver Error

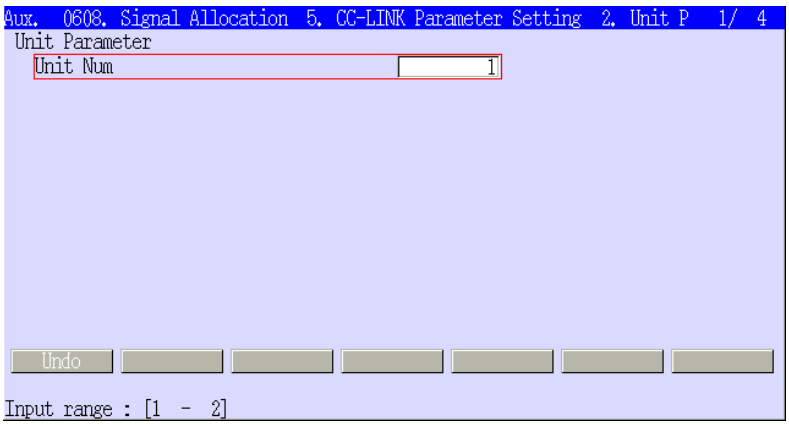
Sets if data link is continued or not when an error occurs while checking driver operation data and checking if the driver is alive. Setting range: 0: Stop 1: Continue.

Delay Time

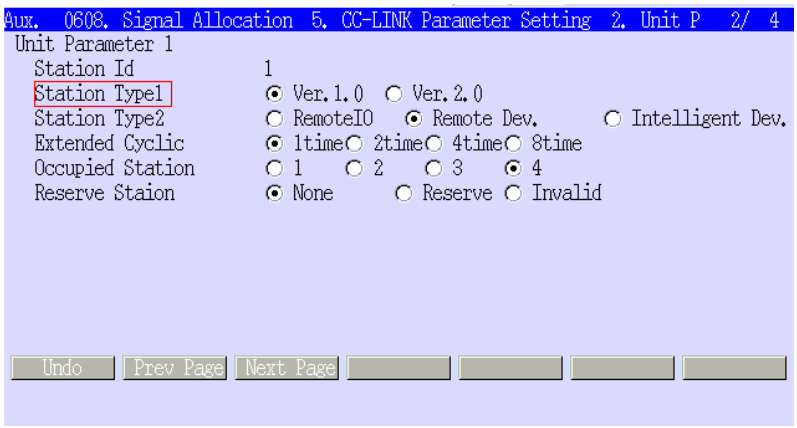
Set 0 for the delay time.

E5.4.2 STATION INFORMATION

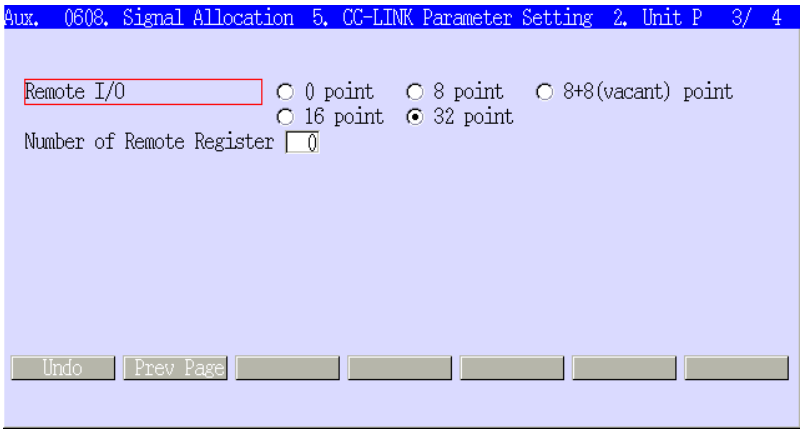
This screen sets the individual data for the modules connected via CC-Link. Set necessary data for all modules that are connected. Select [Aux.0608 Signal allocation]–[5 CC-Link Parameter setting] – [2 Unit Parameter] to display the screen shown below.



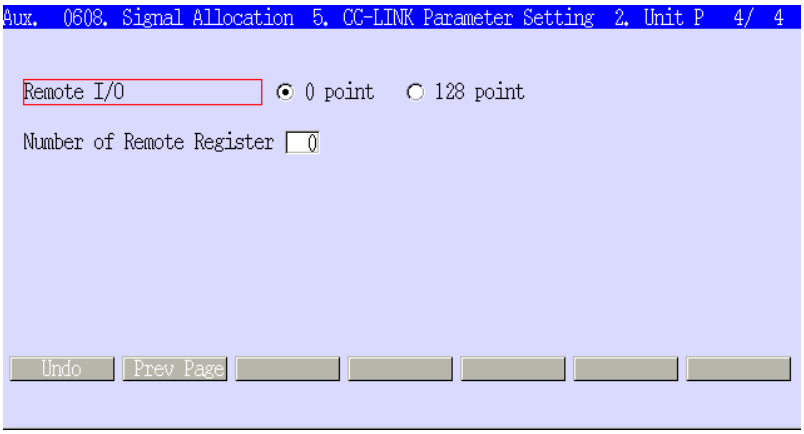
1. When multiple modules are connected, enter the number of the module unit to set the data. Press ↵ to display the setting screen for the selected unit, as shown below.



2. Enter the necessary data for the selected unit. Press <Next Page> or S + ⇩ to scroll to the next page. The content displayed on the next page will differ according to the selection made for [Station Type2].



When [Remote I/O] is selected, this screen is shown.



When [Remote Device] or [Intelligent Device]is selected, this screen is shown.

Station Type1

Setting range: Ver.1.0, Ver.2.0 Default setting: Ver.1

Station Type 2

Select from: Remote I/O, Remote dev(ice), Intelligent dev(ice)

Default setting: For first module: Remote device, For second + module: Remote I/O

Extended Cyclic

Select from either of the following: 1 time, 2 times, 4 times, 8 times.

Occupied station

Select from 1 station to 4 stations. Default setting: For first module: 4 stations occupied, for second + module: 1 station occupied.

Reserved Station

Select from: None, Reserve(d) or Error Invalid.

Reserved: Select when not connecting in the data link.

Error Invalid: Select when not turning ON the corresponding bit between SW0080 to 83 when error is detected.

Remote I/O

Remote I/O setting differs between remote IO station and remote device station:

1. The following numbers of signals can be set for remote IO (1 Station)
   0 point / 8 points / 8 points + 8 points / 16 points / 32 points
2. The following numbers of signals can be set for remote device and intelligent device:
   0 point / Available number of points according to the station type set

[**NOTE**]

1. Check the number of remote stations when changing station type, extended cyclic and occupied station.
2. In AS application, the signals and the target slave are not managed nor recognized.
3. The last two bits of the signal area used for master-local communication cannot be used.

Number of Remote Register

Remote register number setting differs between remote IO station and remote device station. Number of remote register need to be set when remote device or intelligent device is selected. The number of remote register set here determines the number of integer (word) data that can be transmitted with CC-Link master device. This setting is not necessary when Remote IO station is selected.

Setting range; 0 to 128
Default setting: 0
Specifying 0 (zero) disables transmission of integer (word) data.

When the specified number exceeds the maximum the number settable for the slave device, the setting for the slave device takes precedence. For example, when using slave device Ver. 1 with 4 occupied station, the available number of integer (word) data is 16 each for input and output, even if 128 is specified for the remote register number.

If the total number of remote register for the slave device is larger than the number of remote registers set in [Aux. 0608-05-03 Number of Remote Registers], then the number of integer (word) data that can be used by the controller will be the number set in [Aux. 0608-05-03 Number of Remote Registers].

E5.4.3 RELATION BETWEEN IO SIGNAL ASSIGNMENT AND PARAMETERS

In this section, the relation between signal assignment and I/O data map setting made in CC-Link Parameter setting is explained based on the examples below.

Example 1 uses Version 1.0 as master and communicates with 3 slaves. Signals are assigned via [Aux.0608-1 Signal allocation] so that output signals 49 to 144 are output from the master port.

In Ver. 1.0, 32 bits area is reserved even when 8 remote stations are set. When output signal 113 is turned ON, the first input signal for slave 3 (station number 3) turns ON.

Example 1: Master Version 1

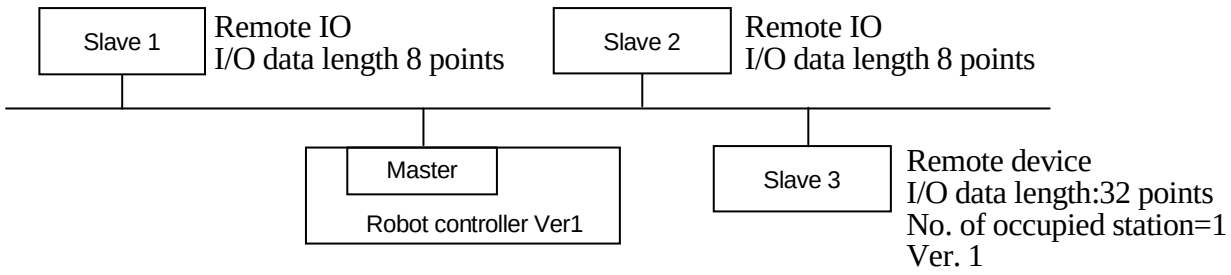


Fig. E13 Link Configuration

```
>ZSIGSPEC↵
DO,     DI,     INT,    MAS,    SLA
 48      48      32     96      64
Change?(If not, press RETURN only.)
```

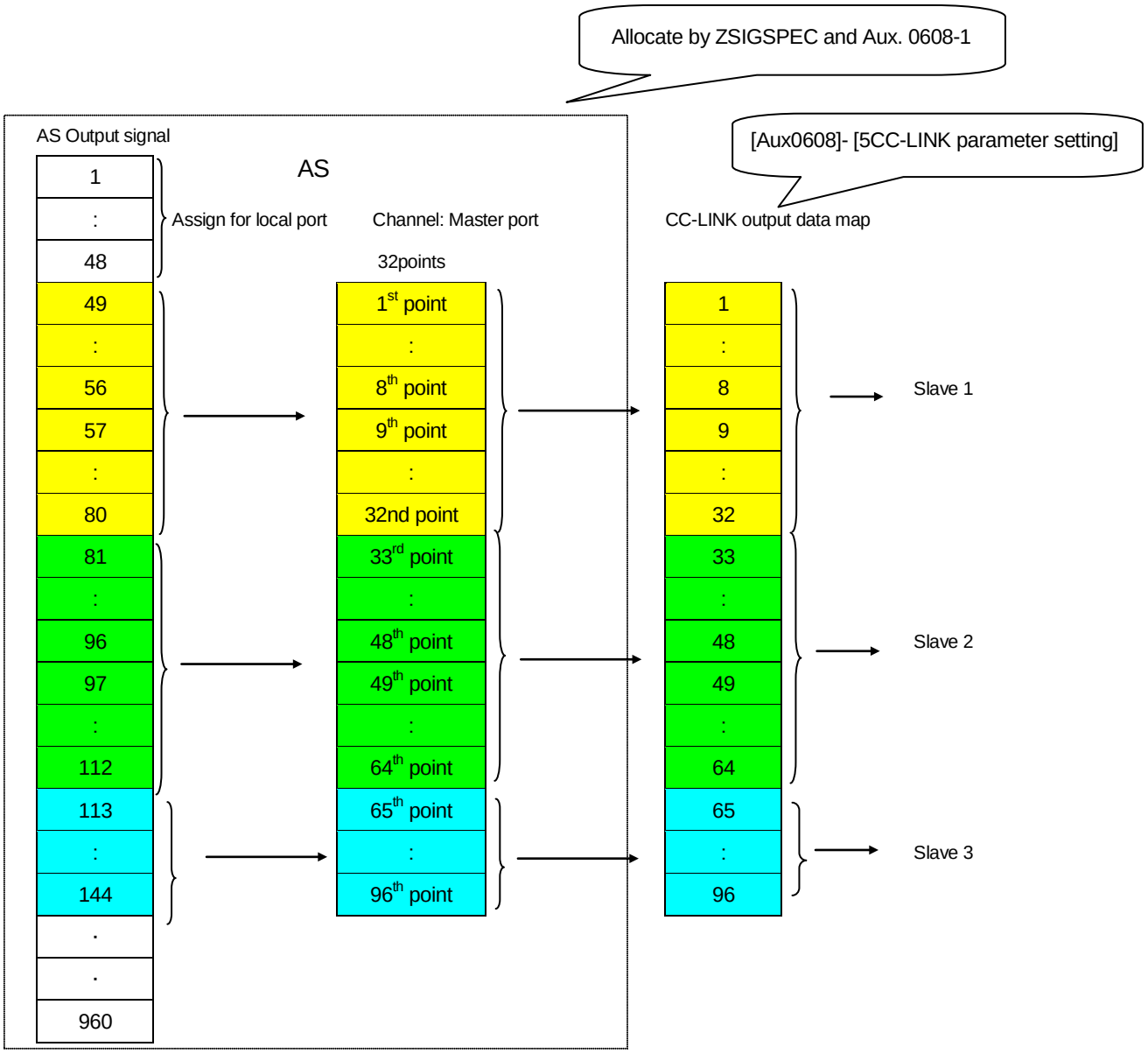


Fig. E14 Relation between ZSIGSPEC command, [Aux.0608-1 Signal allocation] and [Aux.0608-5 CC-LINK Parameter setting]

Example 2 uses Version 2 as master and communicates with 3 slaves. Output signals 49 to 80 are assigned via [Aux.0608-1 Signal allocation] to be output from the master port.

In Version 2, 8 bits are reserved for each slave when 8 remote station is set for slave 1 (station number 1) and also for slave 2 (station number 2). Even if Slave 3 is set in [Aux. 0608-5 CC-Link Parameter setting], output area for slave 3 is not reserved in [Aux. 0608-1 Signal allocation]. Therefore signals number 81 and after cannot be output to slave 3. Turning ON output signal number 65 turns ON the first input signal for slave 3 (station number 3).

Example 2: When master is version 2 (Number of master port I/O signal is 32)

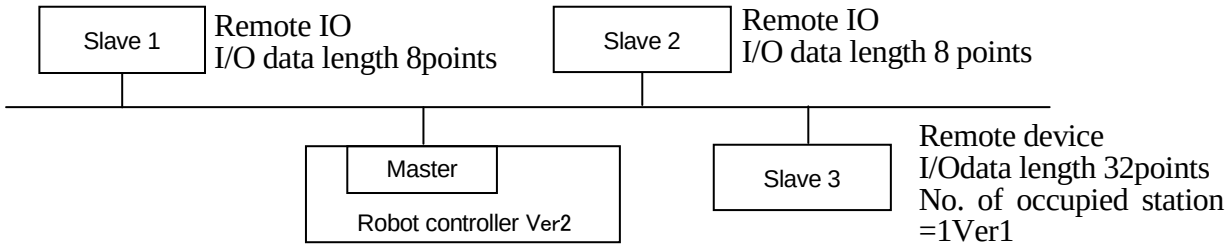


Fig. E15 Link configuration

```
>ZSIGSPEC↵
   DO,      DI,      INT,     MAS,     SLA
   48       48       32       32       64
   Change? (If not, press RETURN only.)
```

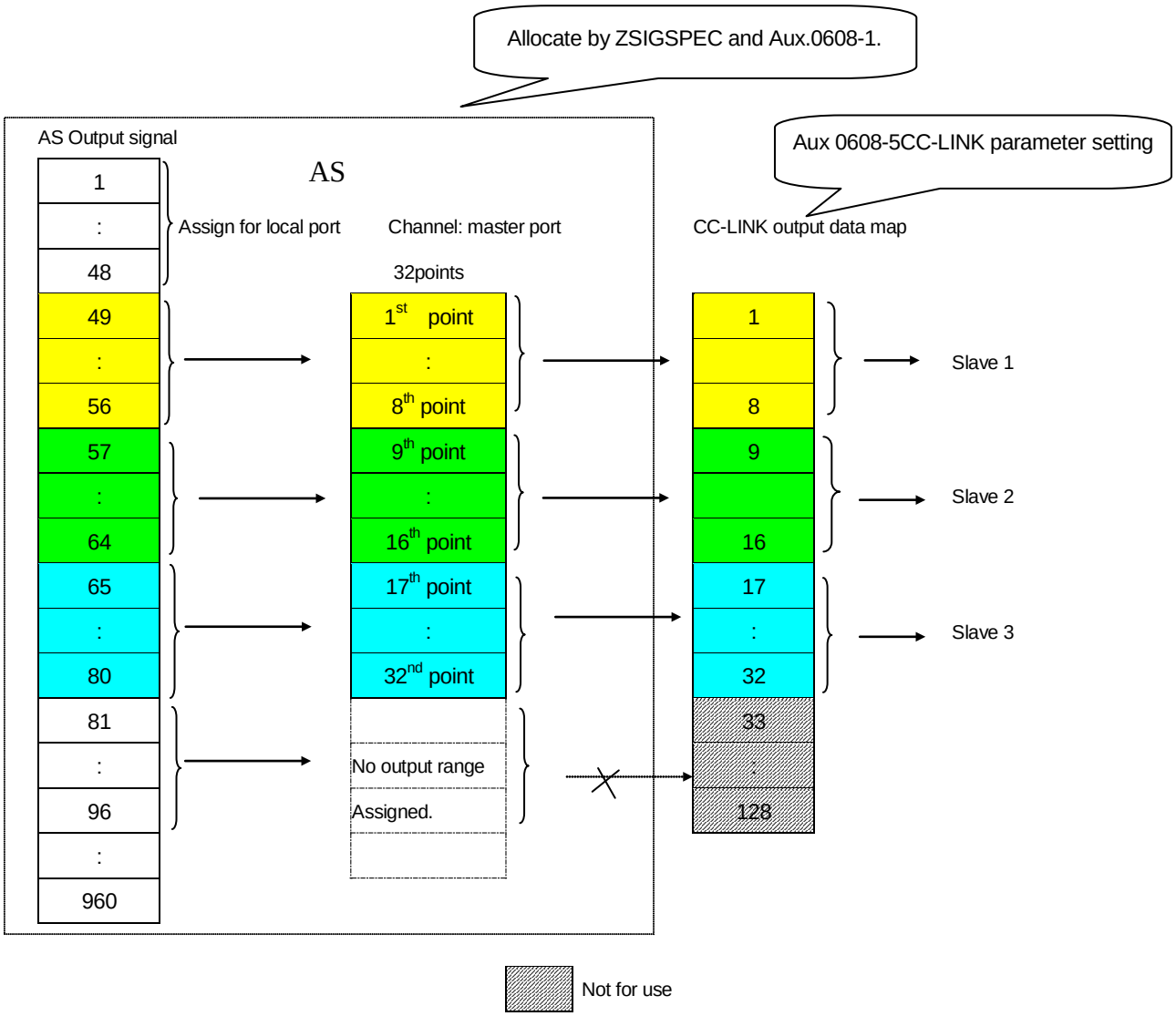


Fig. E16 Relation between ZSIGSPEC command, [Aux.0608-1 Signal allocation] and [Aux.0608-5 CC-LINK Parameter setting]

E5.5 MONITOR COMMAND FOR CC-LINK

CCLINK station number = module name or **function number**

Function

Performs following functions for the CC-Link network:

1. Names the selected module
2. Acquires slave module information (diagnostic function)

Parameter

1. Station number

   Sets the station number of the target module. Settable range: integers from 0 to 64.
   0:Master, 1 to 64: Slave

2. Module name

   Sets the specified name to the selected module. Specify the name in maximum of 7 alphanumeric characters. The name must begin with an alphabet.

3. Function number

   1: Diagnose

Explanation

1. Module name setting function

   Names the selected module. This name is displayed on node status screen on the teach pendant. The module is named Nodenn as default when no name is assigned to a module that exists on the network. “nn” indicates the station number. For example, if the station number is 7, the module will be named Node7. The specified module name is written into the file as an auxiliary data when the data is saved. It is read from the file when loaded and then the name is set.

2. Diagnostic function

   Setting 1: as the function number diagnoses the selected station and acquires its information. The items diagnosed are as below:

When 1-64 (slave) is specified

- Reserved station
- Error invalid station
- Station type: Version 1/Version 2
- Number of occupied stations

- Link status: Normal/ abnormal
- Extended cyclic setting
- Remote IO points

When 0 (master) is specified
- Master board error information

Example

Station 1 is named “sensor 1”.

```
>CCLink 1=sensor 1
```

Station number 3 is diagnosed.

```
>CCLink 3 = 1
```

[NOTE]

This command might not execute when there is a fatal error in the specified slave or master.

E5.6 CC-LINK NODE STATUS DISPLAY

This function displays on the teach pendant, the status of each node connected to the master. There are four types of the node status: Active, Fault, Reserved, and Error invalid. If the node is not registered in the network parameter for the master, its status is not displayed.

1. How to start

Starting from the teach pendant:

1)Activate C Area and display the pull-down menu.

2)Select [Signal Monitor].

3)Select [Fieldbus Node Status] from the list that is displayed.

When network status other than that for CC-Link is displayed:

4)Scroll the display screen via S + ← or S + →.

2. Screen display

Fig. E17 shows that only CC-Link master is supported. CC-Link Node Status covers two pages. Scroll by using S + ⇓ or S + ⇑.

Page 1: Node address 0 and slaves with node addresses 1 to 35.

Page 2: Node address 36 to 64.

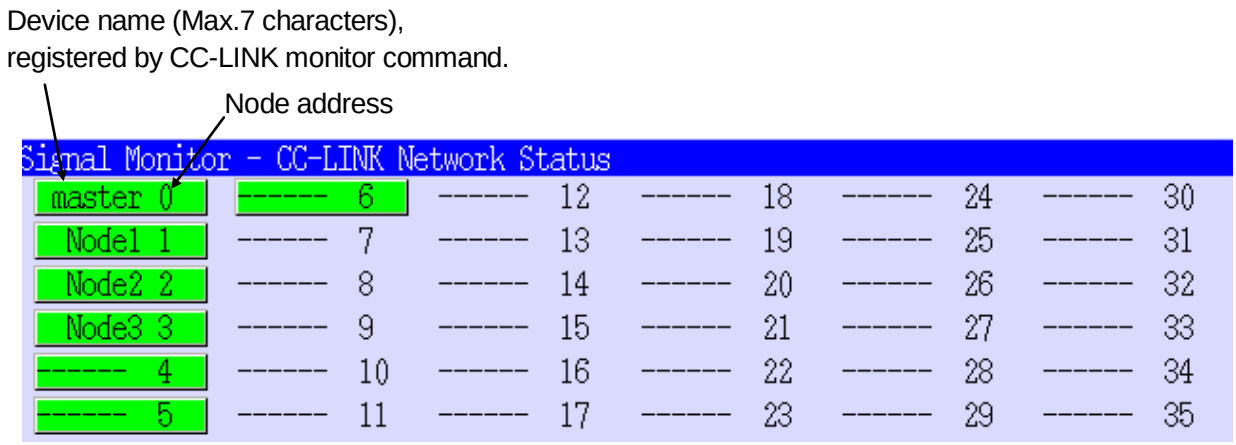


Fig. E17 Example of screen display (1/2 page)

When the applicable node address (station number) does not exist on the network, the node status is displayed as "------".

The character background colors show the following status:

Green: Active Gray: Reserved

Red: Inactive Light blue: Error

No character background color: Not configured (Not registered as network parameter)

Example

Table E11 shows the node status when the network is configured as shown in Fig. E18 and the node status is displayed as in Fig. E19. If the device with the specified node address is not connected to the network, and has no device name, "------" is displayed.

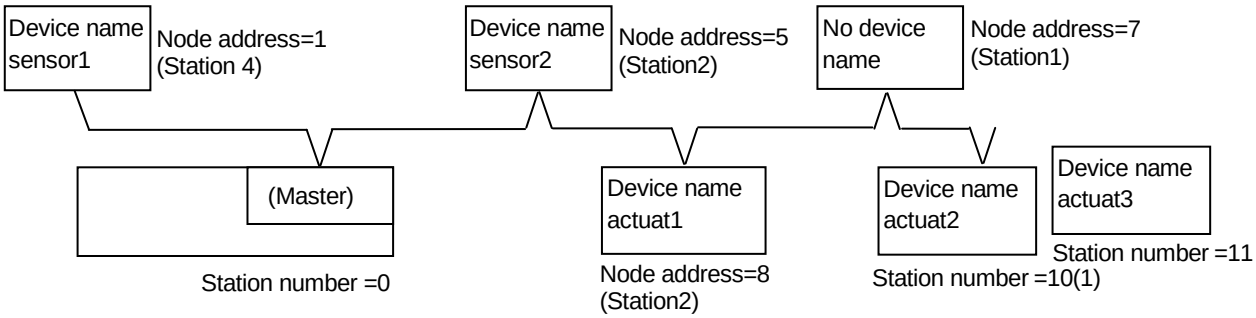


Fig. E18 Example of network configuration

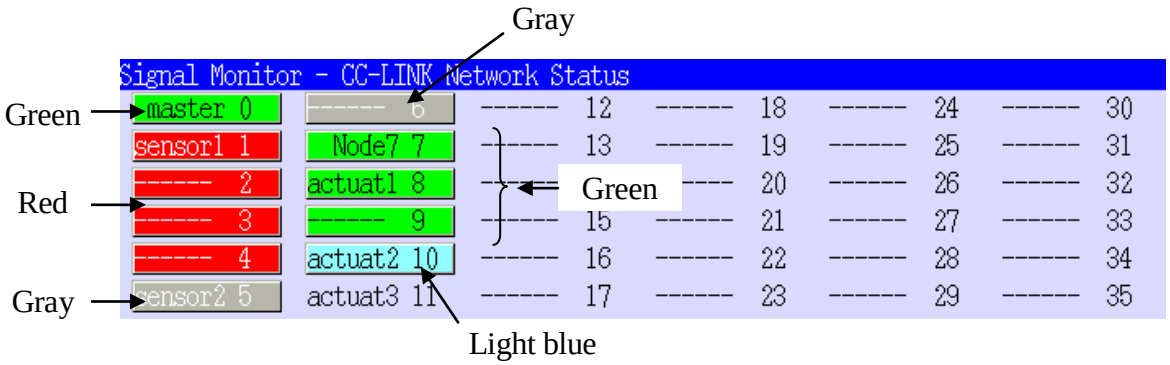


Fig. E19 Example of screen display

Table E11 Node status

Station number	Device name	Status
1	sensor 1	Fault status
5	sensor 2	Reserved status
7	Node 7	Run-status, but no device name is set
8	actuat 1	Run-state.
10	actuat 2	Error invalid status
11	actuat 3	Not connected (Device name is registered, but the device was not registered as registered station.)

[NOTE]

The CC-Link device names are valid only in AS applications.

E5.7 LED INDICATOR

CC-Link master card has six LEDs mounted at the front. The functions of the LEDs mounted at the front are shown below.

Fig. E20 LED Layout

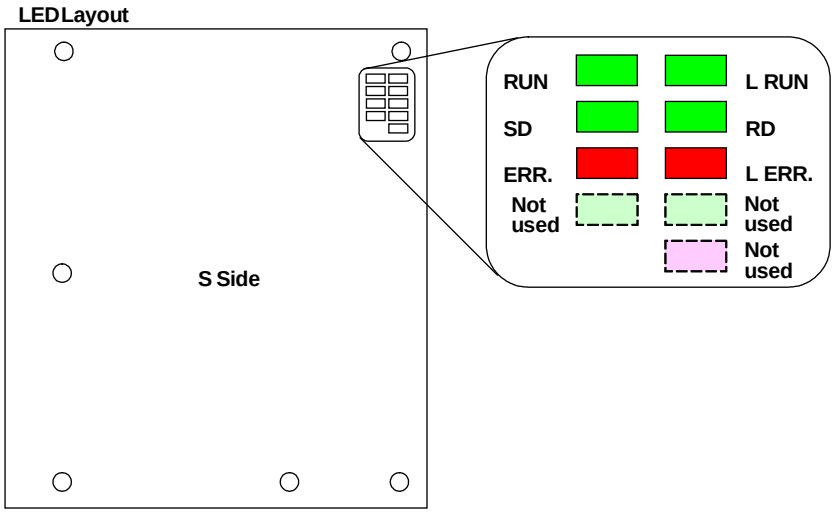


Table E12 LED display

Status	Description
RUN (Green)	ON: Interface board is normal OFF: Watchdog timer error
L RUN (Green)	ON: Data link processing.
L ERR. (Red)	ON: Data link communication error Flashing: Station in operation, mode change
SD (Green)	ON: Sending data
RD (Green)	ON: Receiving data
ERR. (Red)	ON: Switch setting error (L ERR. is also ON) master duplicated
	Parameter error
	Communication error
	Flashing: Data link error in other stations (for master station)

E5.8 WORD DATA ACCESS

This section explains about function, monitor command and program instruction to access word data.

Function

PLCAIN (Integer input data number)

Function

Returns the value of the specified integer input data number.

Parameter

Integer input data number

Specifies input data number in integer. Setting range: 1 - 128

Example

aa=PLCAIN (12) Returns the value set for 12th integer input data.

Monitor command

PLCAOUT Integer output data number = Real numbers

Function

Set real numbers for specified integer output data number.

Parameter

1. Integer output data number

   Specifies output data number in integer. Setting range: 1 - 128

2. Real numbers

   Specifies real numbers for output data number in decimal. Variable name is also acceptable.
   Setting range: 0 - 65535

Example

>PLCAOUT 13=120 ↵ Specifies 120 (decimal) for 13th integer output data.

Program instruction

PLCAOUT Integer output data number = Real numbers

Function

Sets real numbers to the specified integer output data number.

Parameter

1. Integer output data number
   Specifies output data number in integer. Setting range: 1 - 128

2. Real numbers
   Specifies real numbers for output data number in decimal. Setting range: 0 - 65535

APPENDIX F CANOPEN (E CONTROLLER)

F1.0 OUTLINE OF CANOPEN FOR ROBOT CONTROLLER

For CANopen slave interface card, AnyBus-S CANopen slave card is used. The features of CANopen interface are shown below:

a. Protocol & Supported Functions

Protocol : CAN Application Layer (CAL) protocol
Baud rate range : 10 kbit/s-1Mbit/s

b. Physical Interface

Topology : Master-Slave communication
Fieldbus connectors : 9 pin male DSUB.
Isolation : The bus is galvanically separated from the other electronics with an on board DC/DC converter.

c. Configuration & Indications

Address range : 1 ~ 99.
Maximum cyclic I/O data size : max. 32 bytes in, max 32 bytes out (256 points for each).
LED-indications : Status indication, Run indication and Power

d. Data Exchange

I/O data transmission : The module supports unscheduled data exchange.

[NOTE]

The connectivity with all CANopen products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all CANopen products.

[NOTE]

The IO communication with CANopen is possible up to 256 points for both input and output.

F2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

↓

2. Set the fieldbus interface card.

   Set the baud rate and node address (slave). (See F3.3.1 and F3.3.2.)

↓

3. Turn robot controller power ON.

↓

4. Set the allocation for the fieldbus interface. (Signal allocation setting)

   In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)

↓

5. Set the number of external I/O signals. (See Chapter 5.)

↓

6. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

↓

7. Turn robot controller power OFF then ON.

↓

8. Set the signal allocation data. (See Section 6.2.)

↓

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

↓

10. Network configuration.

    Please follow a manual of a master device like PLC to configure a CANopen network. If you use the network configuration tool (ex. Sycon: Configuration software, Hilscher GmbH.), you should install EDS file into the designated area by the tool. (See F3.3.)

↓

11. Start operation.

F3.0 CANOPEN - SLAVE

F3.1 MECHANICAL OVERVIEW OF MODULE

Figure F1 is top view of AnyBus-S CANopen card appearance.

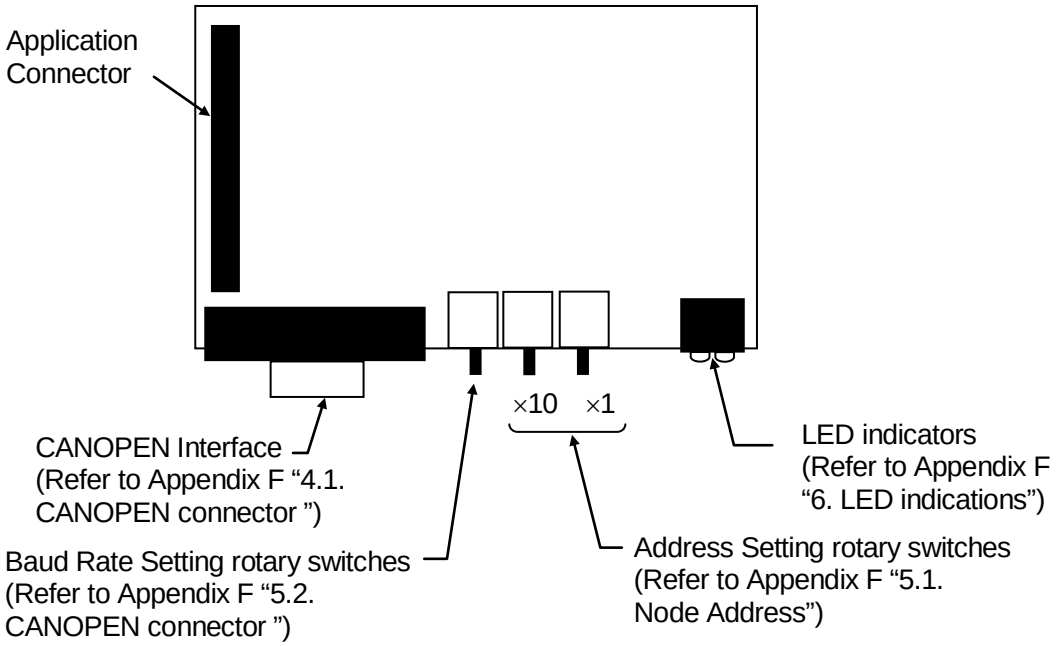


Fig. F1 Overview of AnyBus-S CANopen Card (Top view)

F3.2 CANOPEN CONNECTOR

It is recommended to use a 9-pin D-Sub connector (DIN 41652 or corresponding international standard) with the pinning according to CiA DS-102, Version 2.0.

In Kawasaki robot controller application, Kawasaki recommends that this D-sub connector shall be used. If you use the other type of connectors, Kawasaki will not be responsible for it.

The connector of the cable is a female type: it is a male connector on the AnyBus-S card. Table F1 shows the Assignment of Signals.

Pin	Name	Function
1	-	Reserved
2	CAN_L	CAN_L Bus line (dominant low)
3	CAN_GND	CAN ground
4	-	Reserved
5	CAN_SHLD	Optional CAN Shield
6	GND	Optional ground
7	CAN_H	CAN_H Bus line (dominant high)
8	-	Reserved
9	-	Reserved

Table F1 9-Pin D-Sub Connectors

F3.3 CONFIGURATION

F3.3.1 BAUD RATE

The baudrate is configured with the lowermost one decimal rotary switch. Baud rates supported by the AnyBus-S CANopen module are :

No.	Baud rate
0	Not available
1	10 kbit/s
2	20 kbit/s
3	50 kbit/s
4	125 kbit/s
5	250 kbit/s
6	500 kbit/s
7	800 kbit/s
8	1 Mbit/s
9	Not available

F3.3.2 NODE ADDRESS

Before using the fieldbus system, set up the address with two rotary switches on the module. This enables address settings from 1-99 in decimal format. Look at the front of the assembled set of ANYBUS-S-card and 1TJ board as Figure F2.

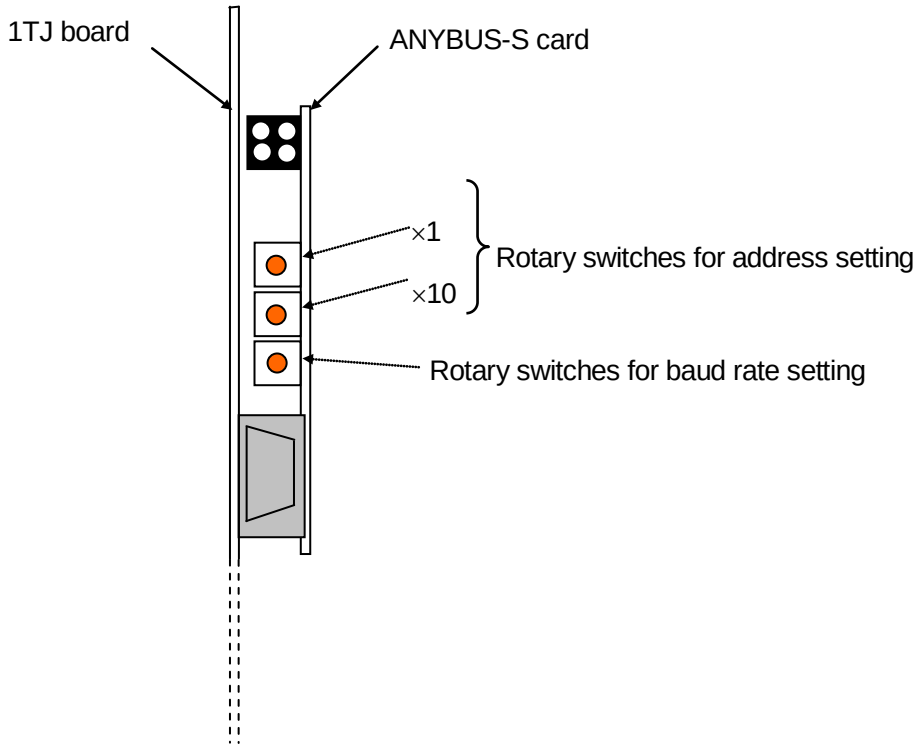


Fig. F2 Interface Board (Front View)

In the above figure, the middle switch is used for the ten setting and the uppermost switch is used d for the setting of the integers.

Address=(Middle Switch Setting×10)+(Upper Switch Setting×1)

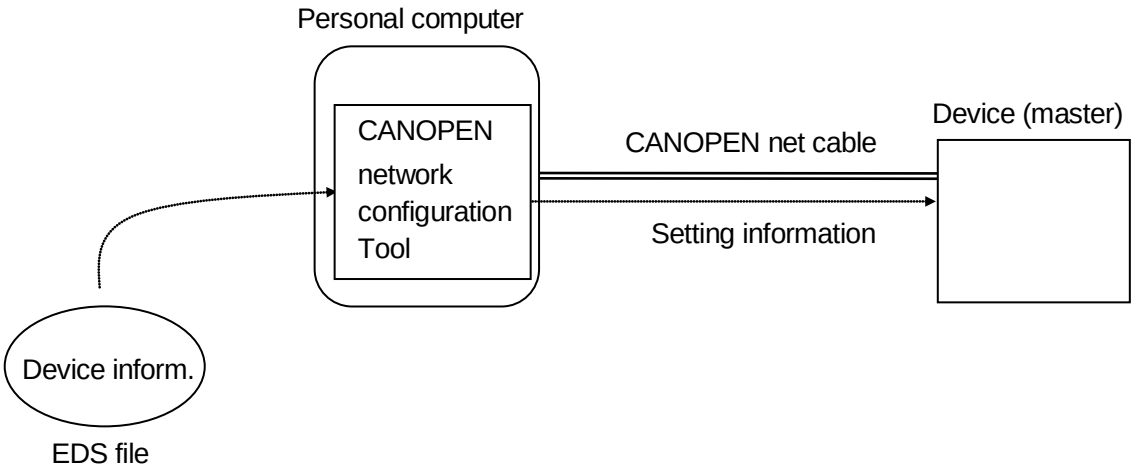
[**NOTE**]

The address cannot be changed during operations.

F3.3.3 EDS FILE

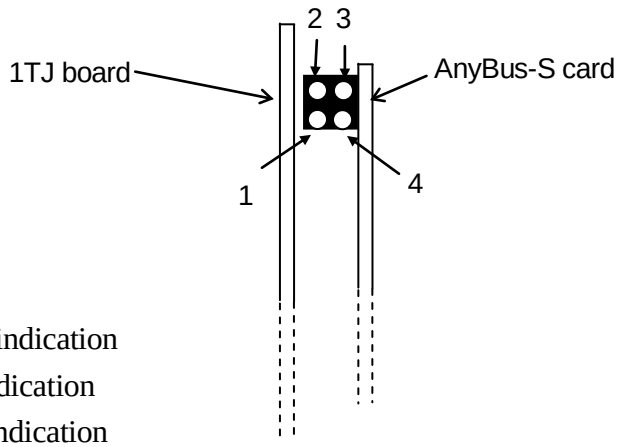
EDS (Electronic Data Sheet) is an ASCII file, including information of the device.
The Network Configuration tool refers to the EDS file when the network is configured.
(Example : Sycon ("Configuration Tool Software" composed by Hilscher GmbH.))
Before the network configuration, install the EDS file into a personal computer which executes the Configuration. Please follow a manual of the configuration tool to install EDS file into the designated area by the tool.

Kawasaki supplies the EDS file for this ANYBUS-S-CANopen.



F3.4 LED INDICATOR

The AnyBus-S is equipped with four LEDs and one LED on the board in the front section. The specification of the LED is as follows:



LED1 : Status indication
LED2 : Run indication
LED3 : Error indication
LED4 : Power indication

Fig. F3 Indicator Front View

Table F2 State indication

Name of LED	Status	Description
1.Status indication	Off	Normal operation
	Red	Unrecoverable fault detected

Table F3 Run indication

Name of LED	Status	Description
2. Run indication	Off	Module not powered
	Green	Module is in the OPERATIONAL state
	Green, single flash	Module is in the STOPPED state
	Green, blinking	Module is in the PRE-OPERATIONAL stat
	Red, blinking	Bus initialisation fault

Table F4 Error indication

Name of LED	Status	Description
3. Error indication	Off	No error
	Red	Bus off
	Red, single flash	Warning limit reached
	Red, double flash	Error Control Event
	Red, triple flash	Sync Error

Table F5 Power

Name of LED	Status	Description
4.Power indication	Off	Module not powered
	Green	Module powered

Watchdog LED (on AnyBus card)

Table F6 Watchdog

Name	Status	Description
Watchdog	Flashing green (1 Hz)	Module is initialized and running.
	Flashing green (2 Hz)	Module is not initialized
	Flashing red (1 Hz)	RAM check fault
	Flashing red (2 Hz)	ASIC and Flash ROM check fault
	Flashing red (4 Hz)	DPRAM check fault

APPENDIX G PROFINET (E CONTROLLER)

G1.0 OUTLINE OF PROFINET FOR ROBOT CONTROLLER

As PROFInet IO device interface card, AnyBus-S PROFInet adapter card is used. Available PROFInet board supports real-time communication in IO device. Use CP1616 (SIEMENS) as the interface card for PROFInet IO controller. CP1616 can be used as IO controller, as well as IO device.

[NOTE]

The connectivity with all PROFInet products has not been confirmed. It is generally possible; however, Kawasaki does not guarantee the connection with all PROFInet products.

G2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)

2. Configure the fieldbus interface card.(Network configuration)
   (Anybus) Set the IP address, subnet mask etc. for the network configuration via Aux. 060804.
   (Anybus) Register the device name via Aux. 060807. (See Section G3.3.)

3. Turn controller power ON.

4. Set the allocation for the fieldbus interface. (Signal allocation setting)
   In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals (Aux. 0611 Number of I/O Signals) matches the signal allocation to the ports (Aux. 060801). (See Chapter 5, Example 2.)

5. Set the number of external I/O signals. (See Chapter 5.)

6. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)

7. Turn controller power OFF then ON.

8. Set the signal allocation data. (See Section 6.2.)

9. Set the order of signals for the master/slave ports. (See Section 6.3.)

10. Network configuration.
    (Anybus) Follow the manual for the master device (PLC etc.) and configure the network.
    (CP1616) Use configuration software (See Section G4.3) and configure the network.
    After completing the configuration, turn the controller power OFF and then ON.

11. Start operation.

G3.0 PROFINET – IO DEVICE (ANYBUS)

G3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of AnyBus-S PROFInet card (plane view) and the interface board with 1JF/1TJ board and AnyBus-S PROFInet card (plane view) are shown below in Figres G1 and G2 respectively.

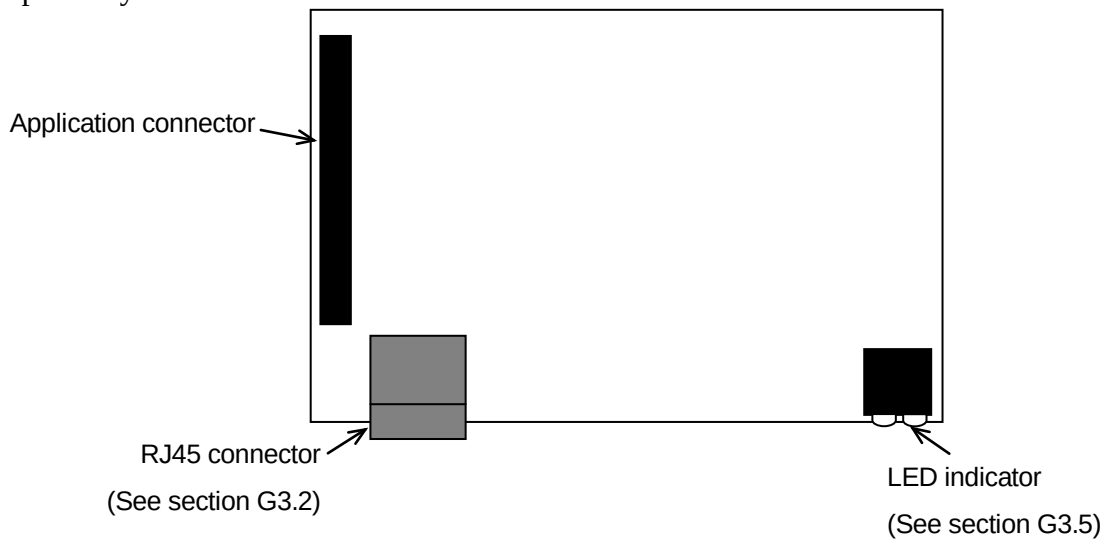


Fig. G1 AnyBus-S PROFInet card (Top view)

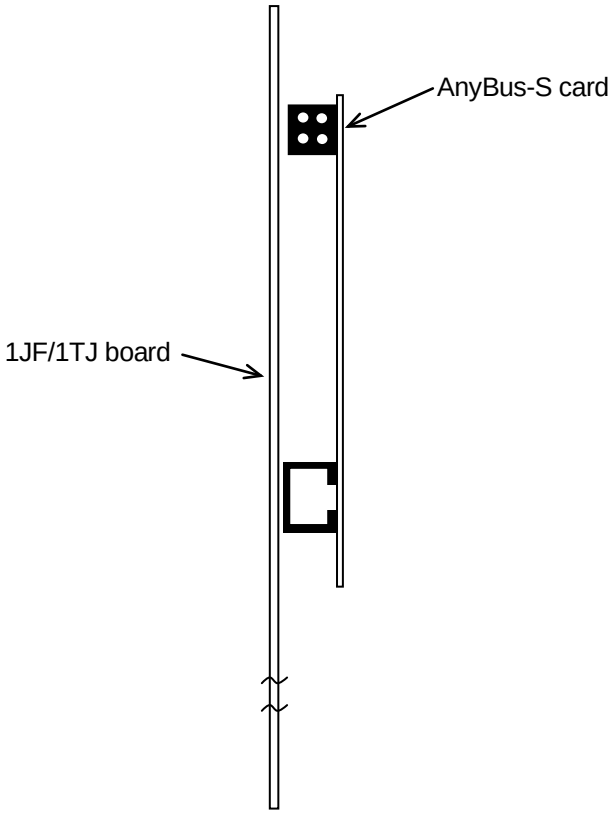


Fig. G2 Interface board (Front view)

G3.2 CONNECTOR

G3.2.1 PROFINET-DP CONNECTOR

Table G1 shows RJ45 connector pins.

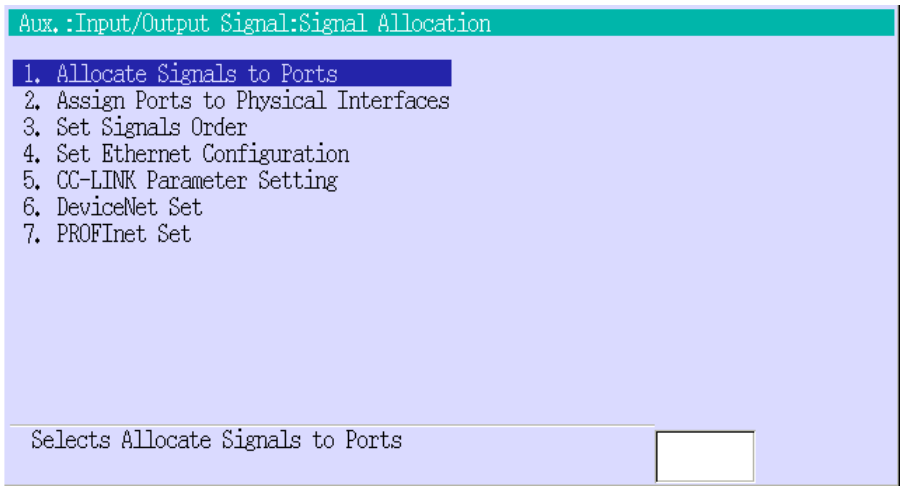
Table G1 RJ45 connector

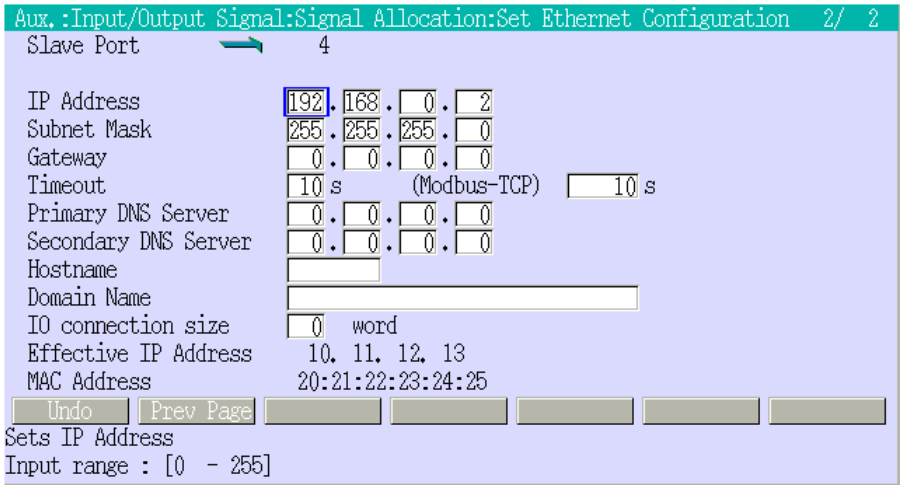
Pin	Signal	Function
1	TD	Send+
2	TD-	Send-
3	RD+	Receive+
4	Not used	
5	Not used	
6	RD-	Receive-
7	Not used	
8	Not used	

G3.3 CONFIGURATION

G3.3.1 NETWORK SETTING

Set IP address, Subnet Mask, Gateway address on [Aux.0608 Signal Allocation] – [4. Set Ethernet Configuration].





IP Address, Subnet Mask, Gateway

Specify the value of each item in decimal format by inputting numbers between 0 and 255.
Inputting 0 for entire IP address, the values of dip switch on the card is used as IP address.

The default settings of PROFInet IO card are as follows.
Slave port:

IP address	: 192.168.0.2
Subnet Mask	: 255.255.255.0
Gateway	: 0.0.0.0

The following IP addresses cannot be used.

0.x.x.x.
127.x.x.x.
x.x.x.0
x.x.x.255

Timeout

The set value is invalid.

(Modbus-TPC)

The set value is invalid.

Primary/ Secondary DNS Server

The set value is invalid.

Hostname, Domain Name

The set value is invalid.

IO connection size

The set value is invalid.

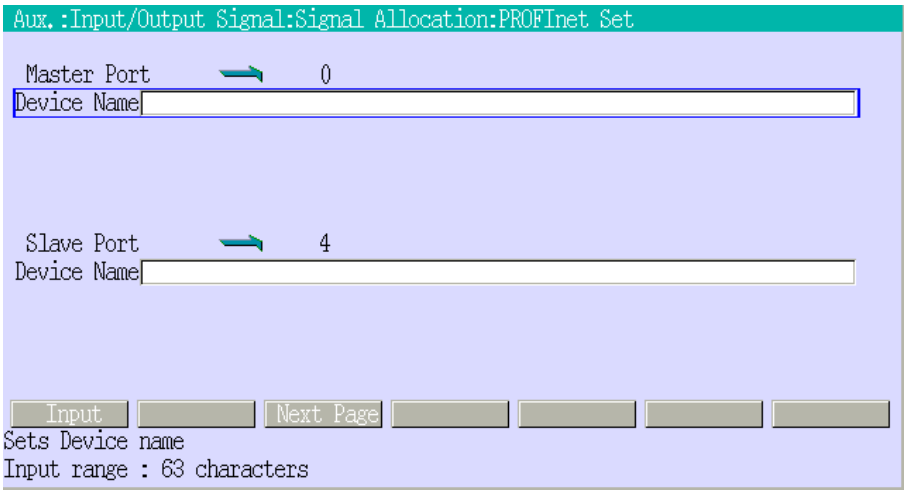
The displayed Effective IP and MAC addresses cannot be changed. The actual IP address of AnyBus-S PROFInet card is displayed as the Effective IP address. Effective IP and MAC addressed are displayed by 0 if AnyBus-S PROFInet card is not mounted.

[NOTE]

1. MAC address cannot be changed.
2. IP address cannot be changed on [Aux.0812].

G3.3.2 DEVICE NAME SETTING (AUX. 060807)

Set the device name on [Aux.0608 Signal Allocation] – [7. PROFInet Set] so PLC can identify each IO device.



G3.3.3 GSD FILE

GSD file is a data sheet containing all necessary information about each device. Each device in PROFInet network field is associated with a GSD file which is used for network configuration. Therefore, install the GSD file into the personal computer that executes the network configuration. The IO board for GSD is provided by Kawasaki.

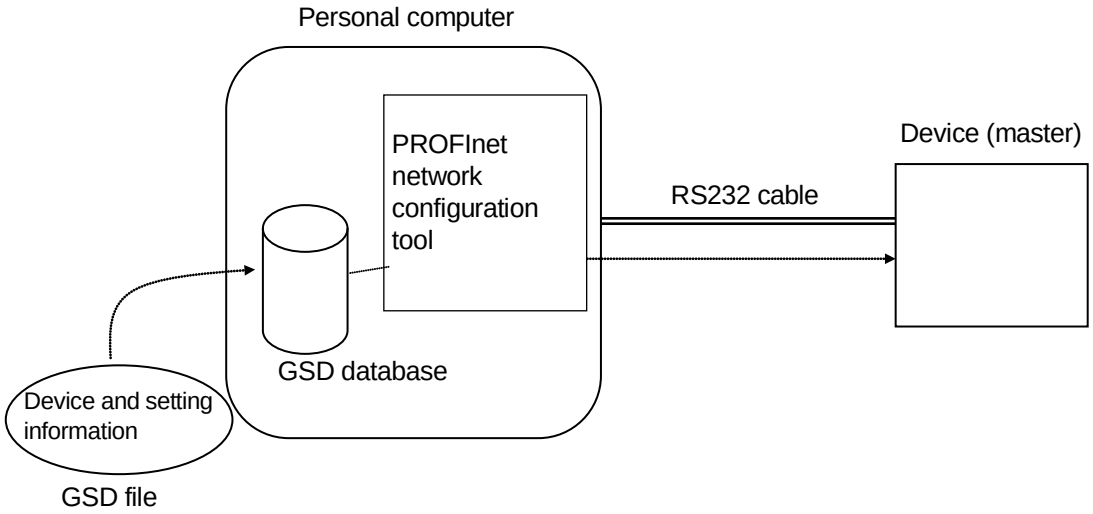
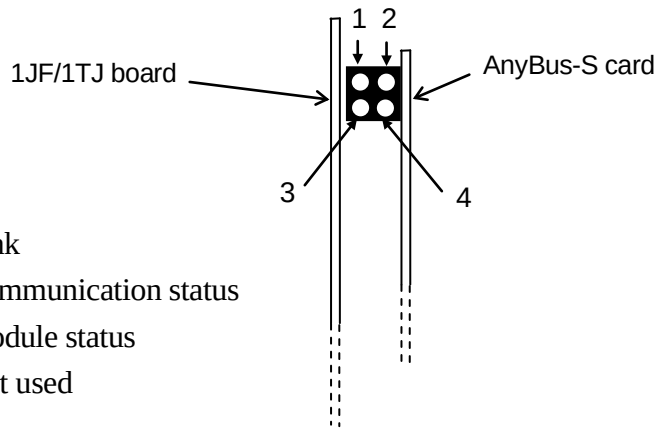


Fig. G3 GSD File

G3.4 LED INDICATOR

AnyBus-S PROFInet IO board has four LEDs mounted at the front and one LED on the board. The functions of the LEDs mounted at the front are shown below.



LED1: Link
LED2: Communication status
LED3: Module status
LED4: Not used

Fig. G4 Front view of LED indicator

Table G2 LED indicator

Name of LED	Status	Description
1. Link	Green	Linked
	Green flashing	Sending data
	OFF	Not linked, or power is not supplied.
2. Communication status	Green	Connected to IO controller. IO controller is in operation.
	Green flashing (once)	Connected to IO controller. IO controller is not in operation.
	OFF	Unconnected to IO controller
3. Module status	Green	Initialization is complete. Normal state.
	Green flashing (once)	Available diagnostic data
	Green flashing (twice)	Used by the engineering tool for identifying the Anybus module.
	Red flashing (once)	Error in configuration: 1. Too many modules/sub-modules. 2. Too may IO channels. 3. Configuration failure. (No module or wrong module)
	Red flashing (three times)	Allocated station name or IP address is not existed.
	Red flashing (four times)	Internal error.
	OFF	Power is not supplied or initialization is not complete.

G4.0 PROFINET - IO CONTROLLER, IO DEVICE (CP1616)

This chapter expalins CP1616 card (SIEMENS) used for E controller. Mount CP1616 card on PCI adapter board (1UQ board/1YQ board) and install it into the robot controller.

G4.1 MECHANICAL OVERVIEW OF MODULE

Top and front views of CP1616 card are shown below in Figres G5 and G6.

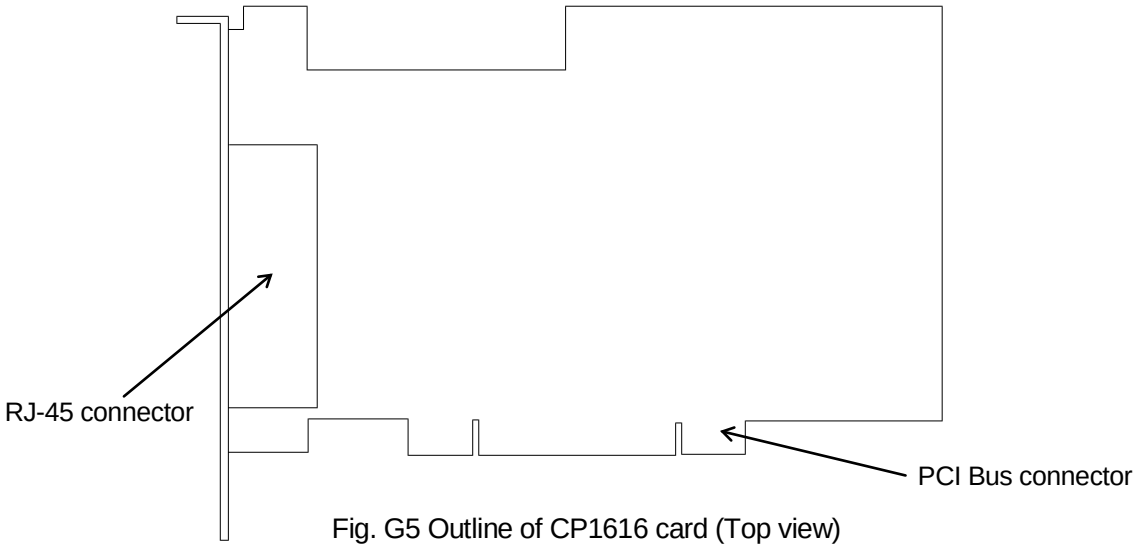


Fig. G5 Outline of CP1616 card (Top view)

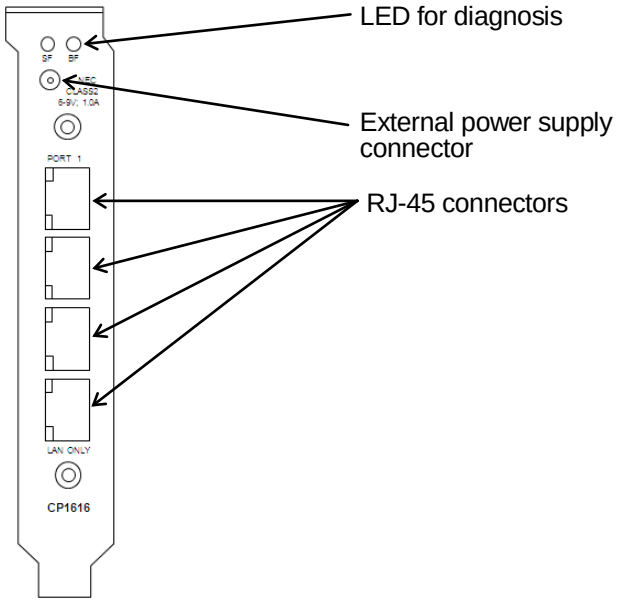


Fig. G6 Outline of CP1616 card (Front view)

Outline view of the interface board with CP1616 mounted on PCI adapter board (1UQ board) is shown in Figure G7-1.

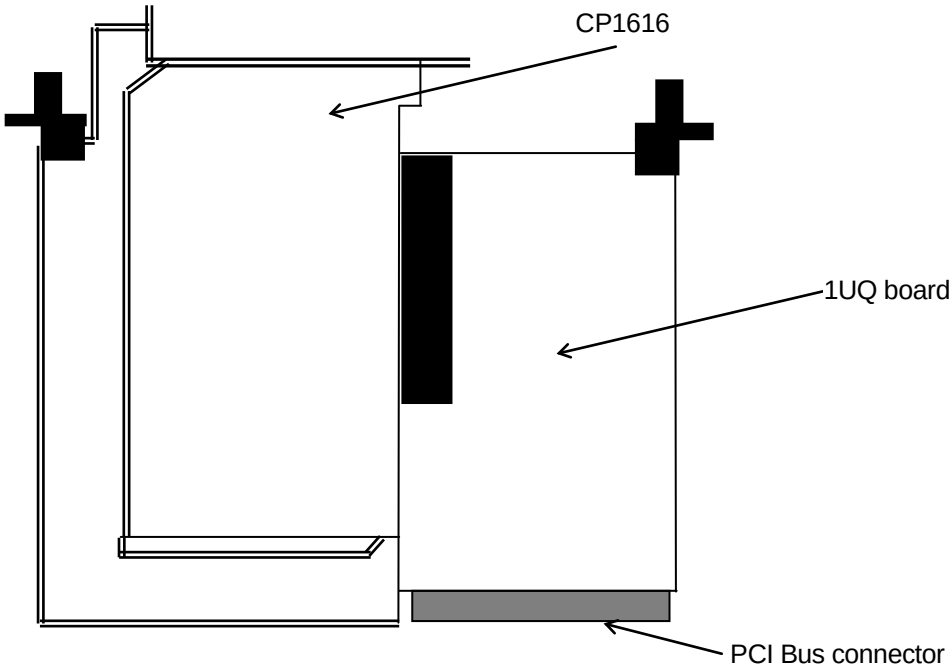


Fig. G7-1 Outline view of interface board when CP1616 card and 1UQ board are connected (Top view)

Outline view of the interface board with CP1616 card mounted on PCI adapter board (1YQ board) is shown in Figure G7-2.

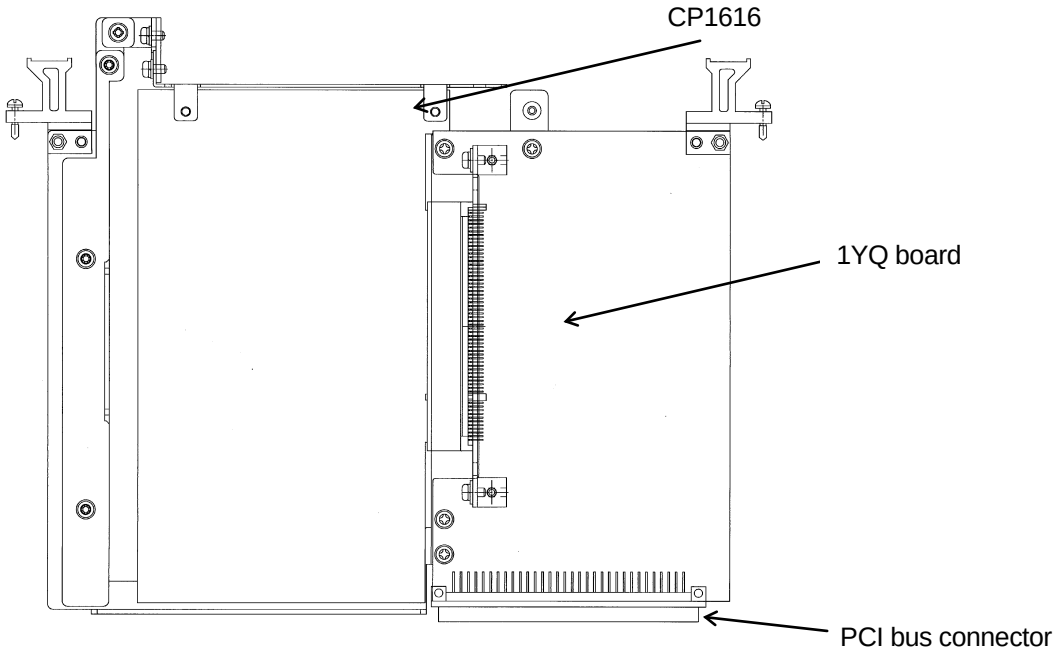


Fig. G7-2 Outline view of interface board when CP1616 card and 1YQ board are connected (Top view)

G4.2 CONNECTOR

G4.2.1 RJ-45 CONNECTOR

CP1616 card has four RJ-45 connectors. Personal computer or PFOFINET IO device is connected to RJ-45 connector. Table G3 shows RJ45 connector pins.

Table G3 RJ45 connector

Connector pin	Signal	Function
1	TD	Send+
2	TD-	Send-
3	RD+	Receive+
4	Not used	
5	Not used	
6	RD-	Receive-
7	Not used	
8	Not used	

G4.2.2 EXTERNAL POWER SUPPLY CONNECTOR

This connector supplies external power to Ethernet switch built in the card. Table G4 shows specifications of the external power.

Table G4 Specification of external power

Power specification	
Electrical insulation	Needed
Rated voltage	6 – 9 V DC
Consumption current	Approx. 0.8 A
Connector specification	
DC plug	External diameter 3.5 mm (-)
	Inside diameter 1.35 mm (+)

G4.3 CONFIGURATION

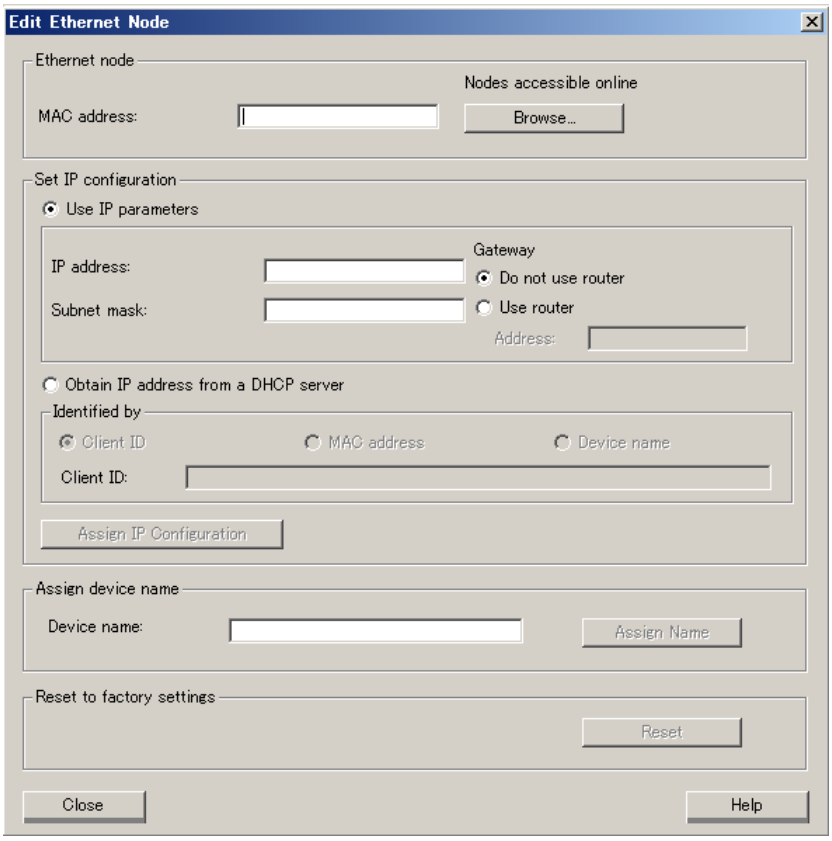
For CP1616 card, use SIMATIC Manager STEP 7 (SIEMENS) to set the communication environment and configure the networks. Install STEP 7 on personal computer and connect it to the RJ-45 connector on the CP1616 card and set the environment and configure the networks.

G4.3.1 CATALOG FILE (GSDML)

GSDML is ASCII file containing information about specific device type. Configure the networks based on GSDML via STEP7 (network configuration tool). Use the GSDML provided by Kawasaki.

G4.3.2 ENVIRONMENT SETTINGS

For CP1616 card, set IP address, Subnet mask, Gateway, Device name via Edit Ethernet Node function of SIMATIC STEP7.

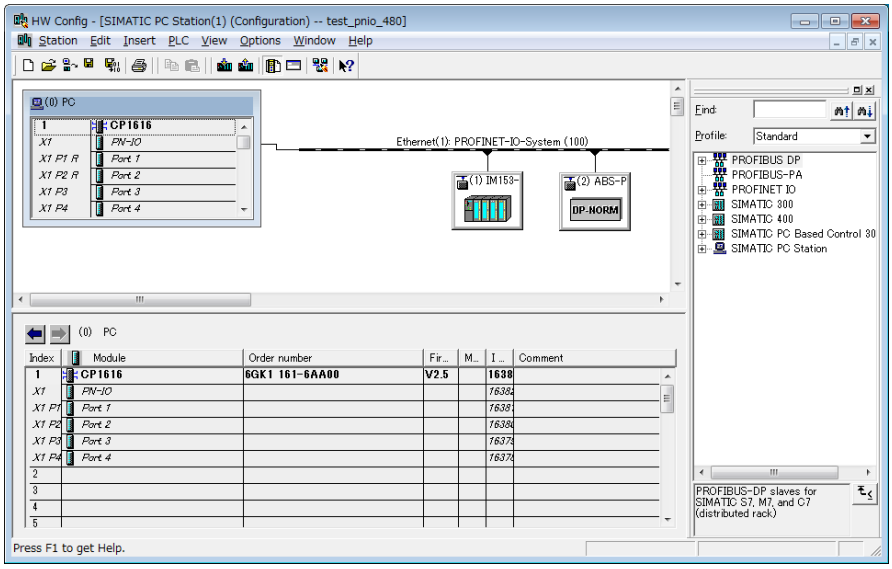


G4.3.3 NETWORK - CONFIGURATION

Configure the networks for PROFINET via hardware configuration of STEP 7. After downloading the network configuration data to CP1616 card, turn the robot controller power OFF and then ON.

For details about STEP 7, refer to the manual of SIEMENS below and manual for STEP 7.

“SIMAIC NET Industrial Communication Commissioning PC Stations - Manual and Quick Start Configuration Manual, Release 06/2008 C79000-G8976-C156-11”



[NOTE]

AS application does not control and recognize each signal and the slave communicating with each signal.

G4.4 LED INDICATOR

There are ten LEDs on the board. Two red LEDs shows "BF" (Bus fault) and "SF" (Group fault), and green and yellow LEDs are provided to each RJ-45 connector. The functions of the LEDs are shown below.

Table G5 BF/SF LED indicator

"BF" status	"SF" status	Function
OFF	—	Communication connection established
ON	—	Link status error occurred
Slow blinking	—	Unconnected IO device exists
—	OFF	No errors, or Download in progress
	ON	Diagnosis data exists
	Blinking every 2 seconds	Firmware error Contact the vendor.
Alternate slow blinking		Flash test in progress
Alternate fast blinking		Card error Contact the vendor.

Table G6 RJ-45 port LED indicator

LED	Function
Green LED (Link LED)	Linked
Yellow LED (Activity LED)	Sending/ Receiving data

G4.5 PROFINET IO CONTROLLER, DEVICE DEDICATED AS LANGUAGE

Function

PNIOSTATUS (Device number)

Function

Returns communication status of CP1616 device or CP1616 controller.
Setting 0 for device number returns communication status of CP1616 device.
Setting 1- 256 for device number returns communication status of the corresponding device connected to CP1616 controller. Unset is returned when corresponding device doesn't exist.

Example

```
>TYPE PNIOSTATUS (1)
-1              ONLINE
>TYPE PNIOSTATUS (2)
0               ONLINE
>TYPE PNIOSTATUS (256)
-2              UNSET
```

Monitor command

PNIOSTATUS [Device number]

Function

Returns communication status of CP1616 device or CP1616 controller.
Setting 0 for device number returns communication status of CP1616 device.
Setting 1- 256 for device number returns communication status of the corresponding device connected to CP1616 controller. Unset is returned when corresponding device doesn't exist.
If device number is omitted, communication status of all devices in use connected to CP1616 controller in use is displayed.

Example

```
>PNIOSTATUS 0
 DEVICE:0        ONLINE
>PNIOSTATUS 1
 DEVICE:1        OFFLINE
>PNIOSTATUS 256
 DEVICE:256      NOT USED
```

```
>PNIOSTATUS
 DEVICE:0       ONLINE
 DEVICE:1       OFFLINE
```

Monitor command

PROFINETM [Function number]

Function

Operates CP1616 controller board and device board.

Function number

1: Opens controller board and restarts communication.
2: Closes controller board and ends communication.

11: Opens device board and restarts communication.
12: Closes device board and ends communication.

APPENDIX H CONTROLNET (E CONTROLLER)

H1.0 OUTLINE OF CONTROLNET FOR ROBOT CONTROLLER

As ControlNet slave (adapter) for robot controller, AnyBus-S ControlNet card is used.

1. Physical Interface
   Connector: CoaxialBNC connector

2. Configuration & Indications
   Address: 1 - 99

3. Supported Functions
   Transmission speed: 5 Mbit/s
   Network Access Port (NAP)

[NOTE]

The connectivity with all ControlNet products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all ControlNet products.

H2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board. (See Chapter 3.)
2. Set the fieldbus interface card.
   Set MAC_ID with rotary switches. (See H3.3.)
3. Turn robot controller power ON.
4. Set the allocation for the fieldbus interface. (Signal allocation setting)
   In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)
5. Set the number of external I/O signals. (See Chapter 5.)
6. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)
7. Turn robot controller power OFF then ON.
8. Set the signal allocation data. (See Section 6.2.)
9. Set the order of signals for the master/slave ports. (See Section 6.3.)
10. Network configuration.
    Follow a manual of a master device like PLC to configure a network. If using the network configuration tool (ex. RSNetWorks configuration tool software from Rockwell Automation Inc.), install EDS file into the area designated by the tool.
11. Start operation.

H3.0 CONTROLNET - SLAVE

H3.1 MECHANICAL OVERVIEW OF MODULE

Figure H1 is outline view of the slave board (plain view).

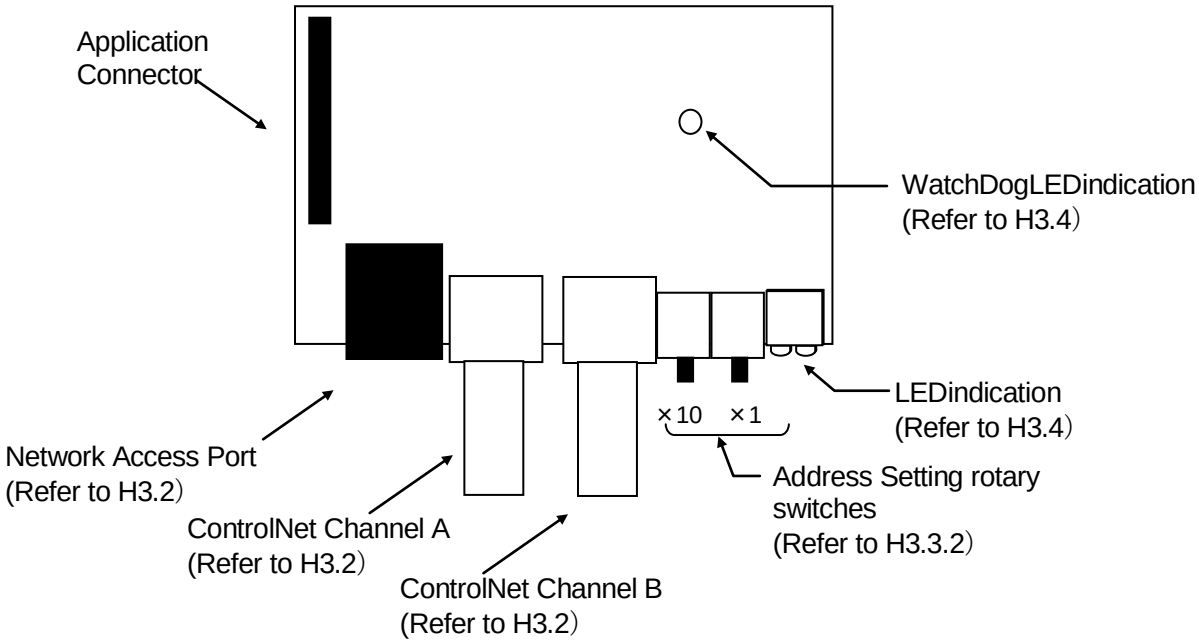


Fig. H1 Outline view of slave board (Plain view)

H3.2 CONTROLNET CONNECTOR

(1) ControlNet connector channel A/ B (BNC)

For ControlNet, channel A/ B and two BNC connectors are provided.

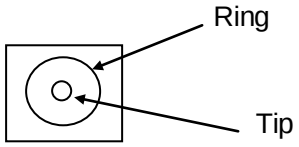


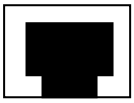
Fig. H2 BNC connector

Table H1 BNC connector pin

	Signal name
Tip	ControlNet
Ring	Shield

(2) Network Access Port (NAP) connector

Use RJ45.



1 8

Fig. H3 RJ45 connector

Table H2 RJ45 connector pin

No.	Signal	Function
1	GND	Signal Ground
2	-	Not used
3	Tx_H	Transmit Data, positive
4	Tx_L	Transmit Data, neg
5	Rx_L	Receive Data, negative ative
6	Rx_H	Receive Data positive
7	-	Not used
8	Shield	Connected to PE

H3.3 CONFIGURATION

H3.3.1 MAC_ID (ADDRESS)

Before configuration, set the robot controller's address on the network via the two rotary switches on AnyBus-S card. Settable range for the address is 1 to 99. The figure below shows the front view of the interface board with ANYBUS-S card set on 1JF/1TJ board. (Fig. H2）

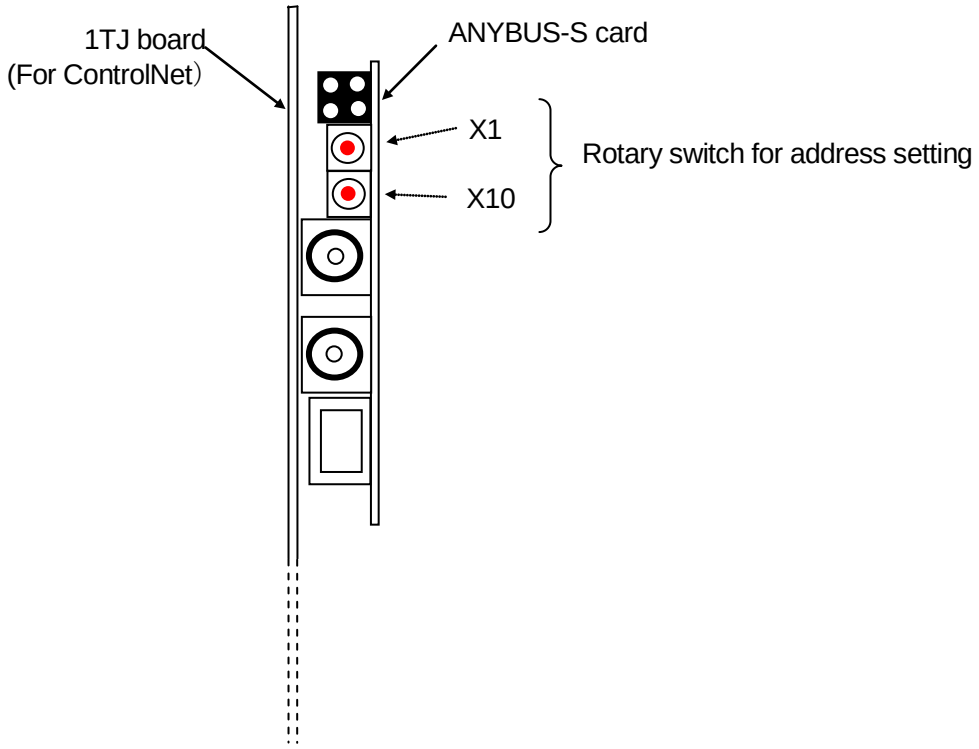


Fig. H4 Interface board (Front view)

Address is expressed in two digits number using the two rotary switches. The lower switch sets the tens place, and the upper switch sets the ones place.

Address = (Value of lower switch×10) + (Value of upper switch×1)

[NOTE]

Address cannot be changed during operation.

H3.3.2 EDS FILE

EDS (Electronic Data Sheet) is an ASCII file containing the necessary information for the device. The EDS file is required when using network configuration tools (e.g. RSNetWorks configuration tool software from Rockwell Automation Inc.) to configure the network. In this case, install the EDS file into the personal computer before executing network configuration. When installing EDS file, follow the manual of the configuration tool. The EDS file for the slave board is provided by Kawasaki.

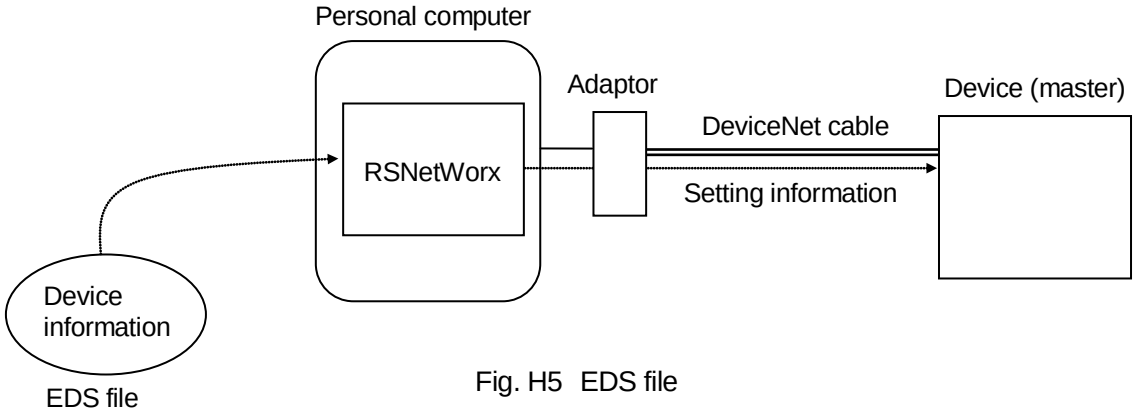
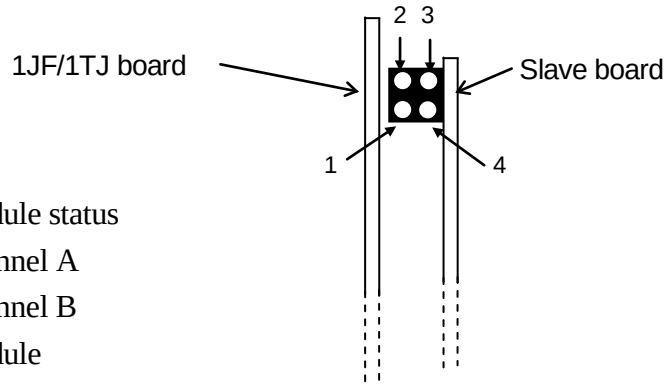


Fig. H5 EDS file

H3.4 LED INDICATOR

The slave board has four LEDs on the front of the board and one on the card. The specifications for the LEDs are as shown below.



LED1: Module status
LED2: Channel A
LED3: Channel B
LED4: Module

Fig. H6 Front view of LED Indicator

Table H3 LED indicator

Name of LED	Status	Description
1 Module status	Green ON	Run status
	Green flashing	Idle status
	Red ON	Major fault
	Red flashing	Minor fault
2 Channel A and 3 Channel. B	OFF	Not initialized
	Red ON	Unrecoverable fault
	Red & green, flashing	Self testing
	Red flashing	Configuration error; duplicate MAC ID etc.
2 Channel A or 3 Channel. B	OFF	Channel invalid status
	Green ON	Channel normal status
	Green flashing	Temporary error (node is normalt), or not configured
	Red flashing	No nodes, or media fault
	Red & green, flashing	Network configuration error
4 Module	OFF	Not connected
	Green ON	Connected

Watchdog LED (on slave board)

Table H4 Watchdog

Name	Status	Description
Watchdog	Green flashing (1 Hz)	Module is initialized and running.
	Green flashing (2 Hz)	Module is not initialized
	Red flashing (1 Hz)	RAM check fault
	Red flashing (2 Hz)	ASIC and Flash ROM check fault
	Red flashing (4 Hz)	DPRAM check fault

APPENDIX I SOFTWARE ETHERNET/IP (E CONTROLLER)

I1.0 OUTLINE OF SOFTWARE ETHERNET/IP

EtherNet/IP communication is executed by using Ethernet port (port 2) on main CPU bord.

Main features of the software EtherNet/IP are shown below:

1. Communication speed:	10/100 Mbit/s
2. Cable:	Twisted pair cable (Connector: RJ45)
3. IP configuration:	Execution by using robot controller teach pendant
4. Protocol:	EtherNet/IP

Software EtherNet/ IP scanner can communicate with up to 3 adapters.

[NOTE]

1. The max. number of IO signals in the port is 960 for input and 960 for output.
2. Depending on the number of IO signals used in each connected adapter, the number of connectable adapters might become less than 3 (max. number).

[NOTE]

The connectivity with all EtherNet/IP products has not been confirmed. We assume that connection is generally possible; however, we do not guarantee the connection with all EtherNet/IP products.

[NOTE]

When using Kawasaki's TCP/IP Communication function via Ethernet and EtherNet/IP at the same time, create individual network for each communication.

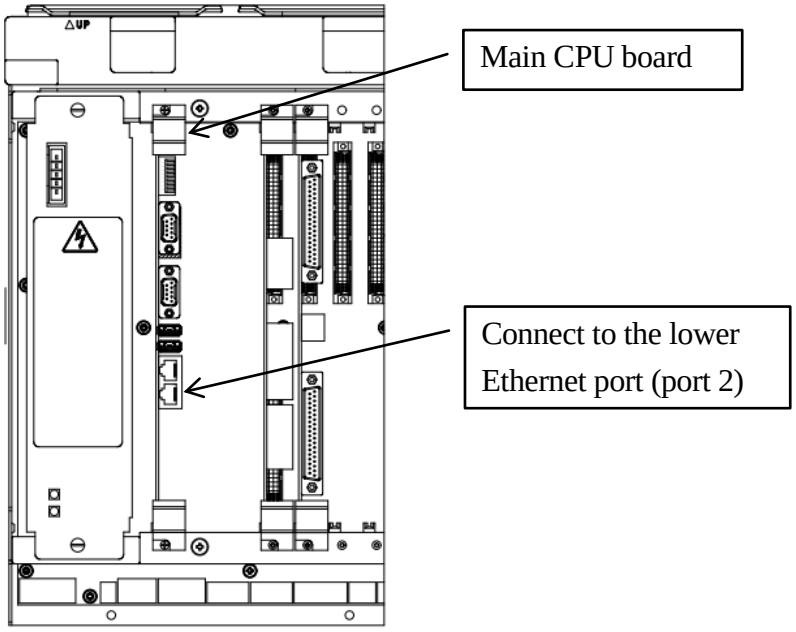
I2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Execute wiring. (See Chapter I3.0.)
↓
2. Turn robot controller power ON.
↓
3. Set relation between physical I/O interface and master/slave ports. (See Section 6.1.)
↓
[4. Network configuration.]
Set the IP address, subnet mask etc. for the network configuration via Aux. function0608-9-1. (See Chapter I4.0.)
↓
5. Set the allocation for the fieldbus interface. (Signal allocation setting)
In step 6 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. function 0611) matches the number allocated in Aux. function 0608-1. (See Chapter 5, Example 2.)
↓
6. Set the number of external I/O signals. (See Chapter 5.)
↓
7. Turn robot controller power OFF then ON.
↓
8. Set the signal allocation data. (See Section 6.2.)
↓
9. Set the order of signals for the master/slave ports. (See Section 6.3.)
↓
[10. EtherNet/IP configuration] (See Chapter I5.0.)
(Adapter) Set the number of signals and offset via Aux. function 0608-9-3 and then register devices by using PLC
(Scanner). Set the data for adapters to be connected via Aux. function 0608-9-4.
↓
11. Turn robot controller power OFF then ON.
↓
12. Start operation.

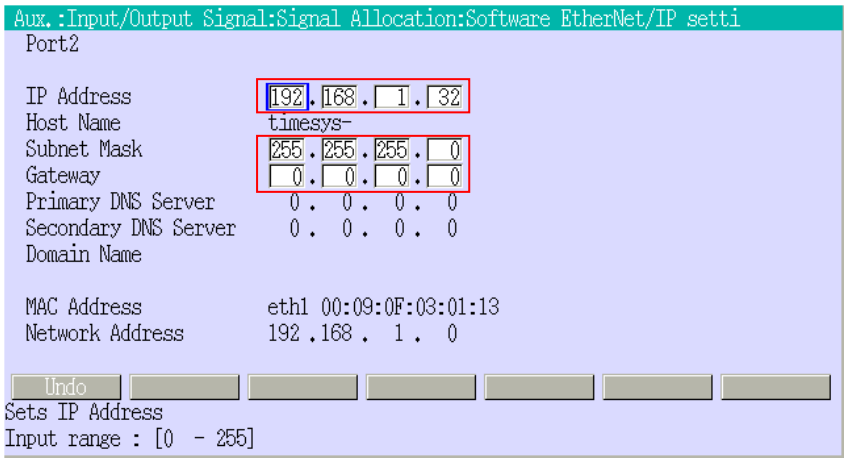
I3.0 WIRING PROCEDURE (CONNECTION OF ETHERNET CABLES)

For EtherNet/IP communication, use the shielded cable of category 5e or more and connect it to Ethernet port 2 on main CPU board.



I4.0 NETWORK CONFIGURATION

Set the network configuration data (IP address etc.) for Ethernet port via Aux. function 0608-9-1.



After registrating IP address, turn the robot controller power OFF then ON to restart.

[NOTE]

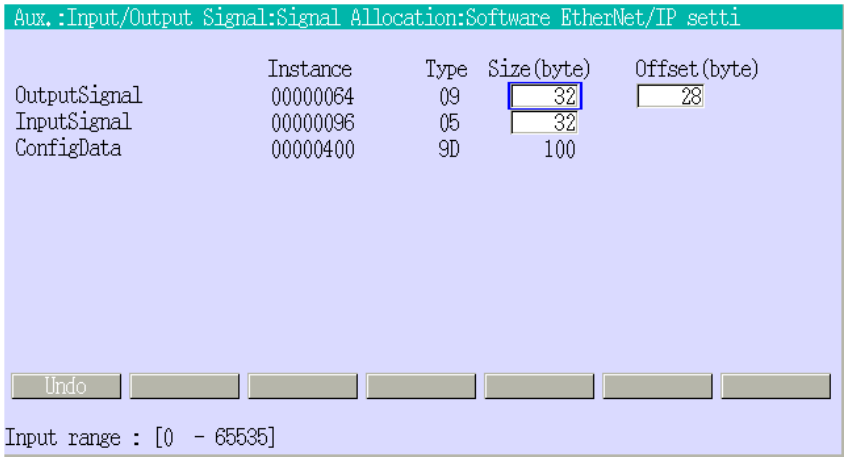
The same network address can not be set to both Port1 and Port2.

I5.0 ETHERNET/IP CONFIGURATION

I5.1 ETHERNET/IP ADAPTER SETTING

I5.1.1 SETTING FOR ROBOT CONTROLLER

Set data for robot controller used as EtherNet/IP adapter via Aux. function 0608-9-3.



Set the offset values and sizes for output and input signals in unit of byte.

Example) Enter 256/8=32 (bytes) to register 256 points.
Enter 960/8=120 (bytes) to register 960 points.

For [Offset], set the offset values of signal start position for the master or slave port where the interface is set. (See Section I5.3. for details)

I5.1.2 ADDING ADAPTER MODULE TO PLC

I5.1.2.1 ADDING TO ROCKWELL AUTOMATION PLC

This section explains how to add the adapter module to ControlLogix controller system of Rockwell Automation.

For ControlLogix controller system, refer to the manual below.

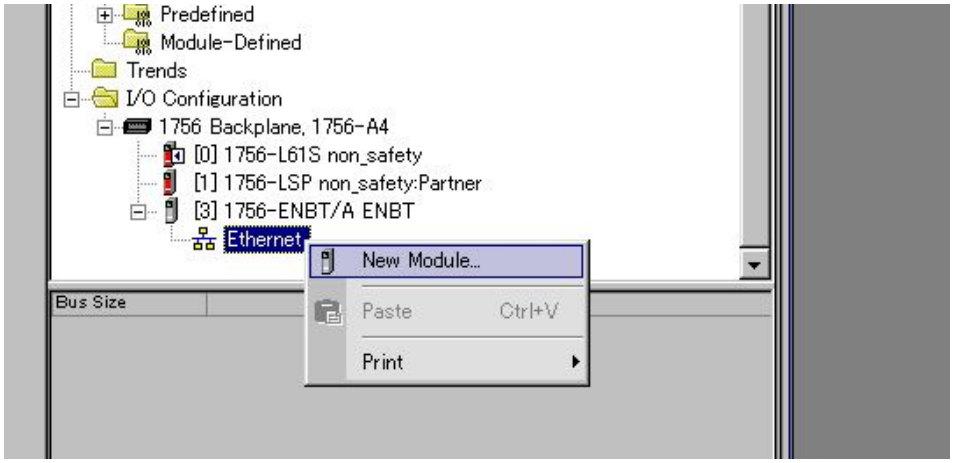
- ControlLogix system user‘s manual 1756-UM001M-JA-P

I5.1.2.2 ADDING MODULE TO I/O CONFIGURATION TREE

This section explains how to configure module on RSLogix 5000 software.

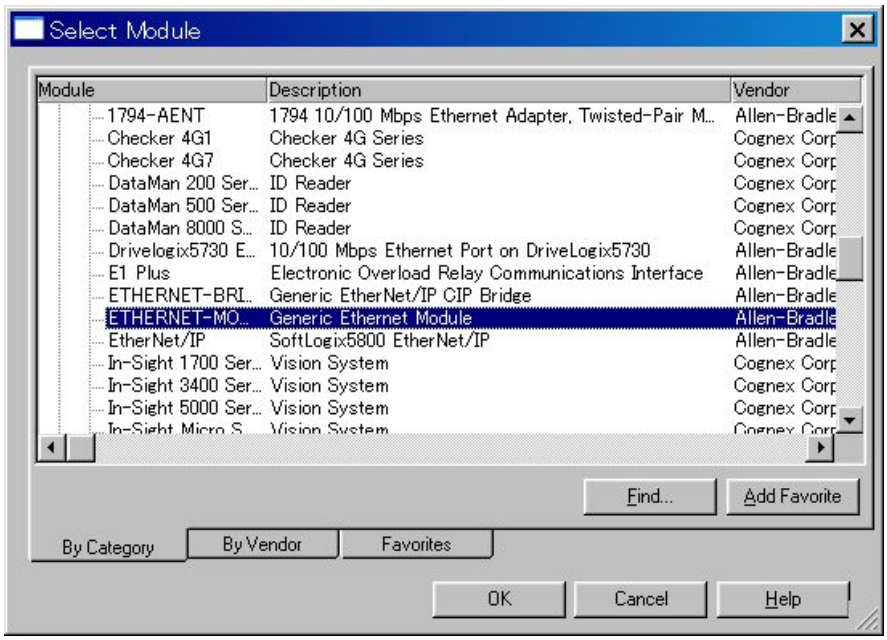
Follow the procedures below to add the module to I/O Configuration tree.

1. Right click on [Ethernet Bridge] module to select [New Module] from I/O Configuration tree as shown below.



2. [Select Module] dialogue box appears.
   Click on [+] of Select Module dialogue box to display the module list.

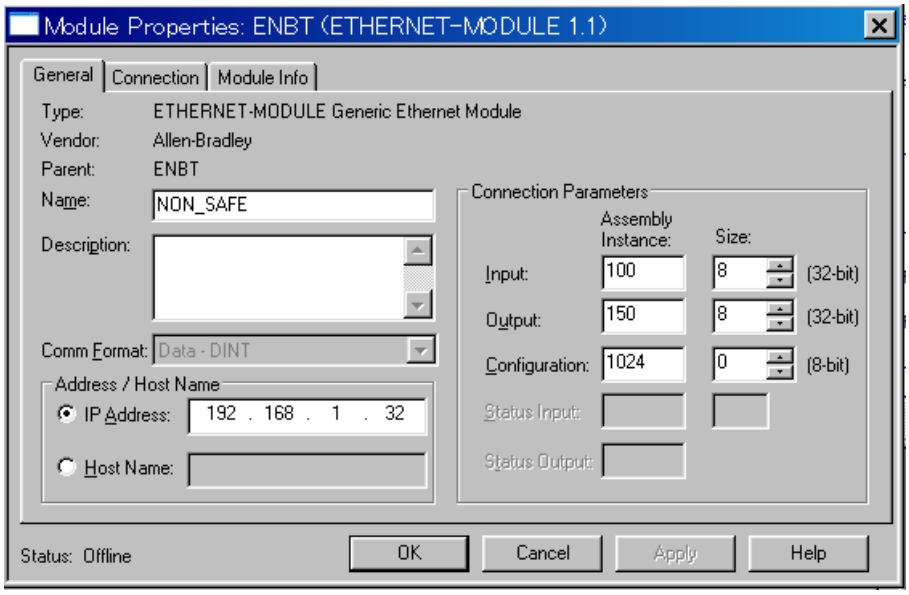
3. Click on [ETHERNET-MODULE] and then click on [OK] on the dialogue box.



I5.1.2.3 MODULE PROPERTIES AND GENERAL DIALOG BOXES

Follow the procedures below to configure module via Module Properties and General dialogue boxes.

1. Duble click on [Generic EtherNet/IP Safety Module] on I/O Configuration tree to display [Module Properties] dialogue box below.



Name

Enter a specific name.

IP Address

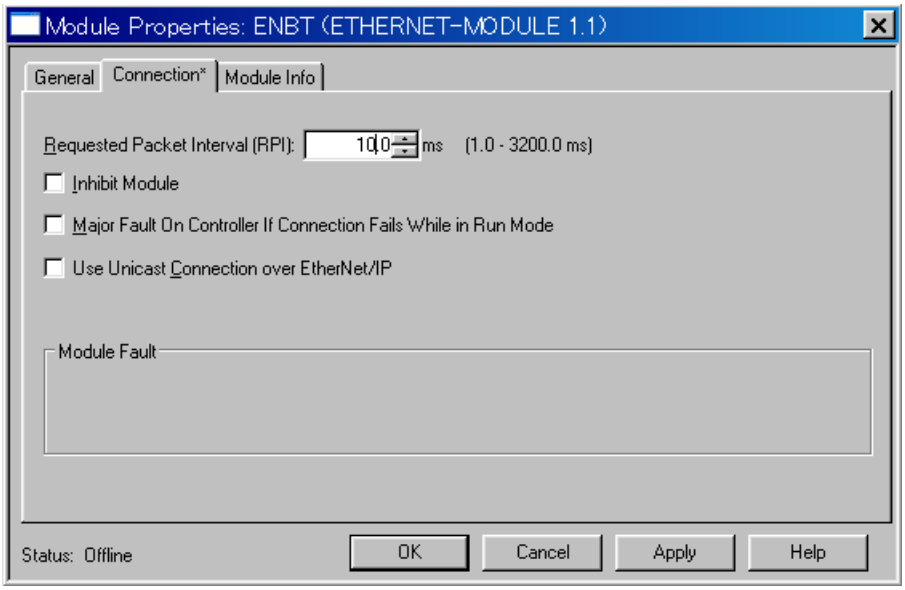
Enter the IP address set in I4.0.

Description

Enter description if necessary.

Connection Parameters

Enter 100 for Assembly Instance of Input.
Enter 150 for Assembly Instance of Output.
Enter 1024 for Assembly Instance of Configuration.
Enter input signal number in long word (4 bytes) for Size of Input.
Enter output signal number in long word (4 bytes) for Size of Output.
Enter 0 for Size of Configuration.

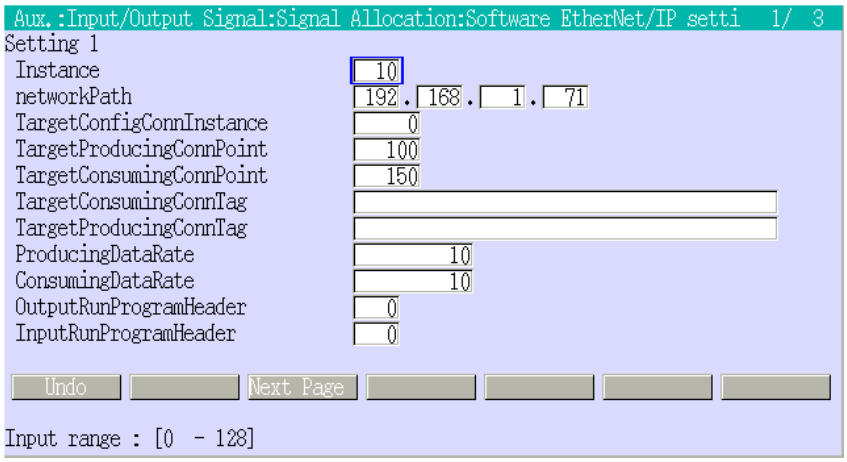


Requested Packet Interval (RPI)

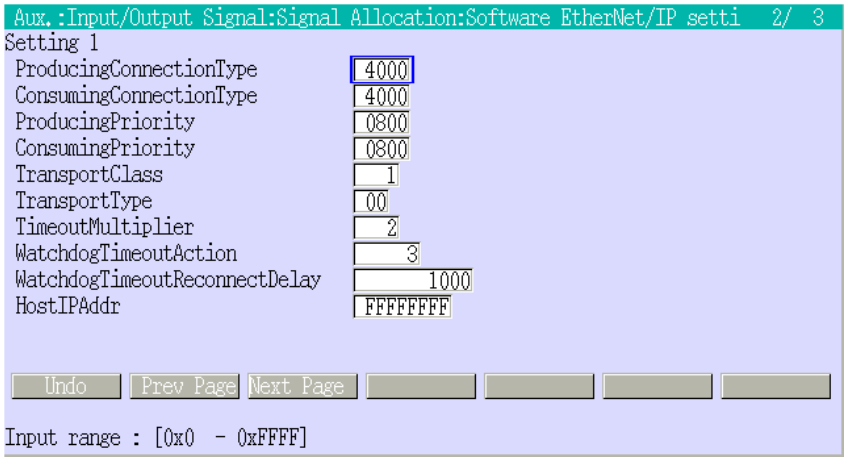
Enter RPI. Min. RPI is 10.0 ms.

I5.2 ETHERNET/IP SCANNER SETTING

Robot controller has scanner function of EtherNet/IP and can control up to 3 adapters. Use Aux. function 0608-9-4 to set data for adapters to be controlled by robot controller.

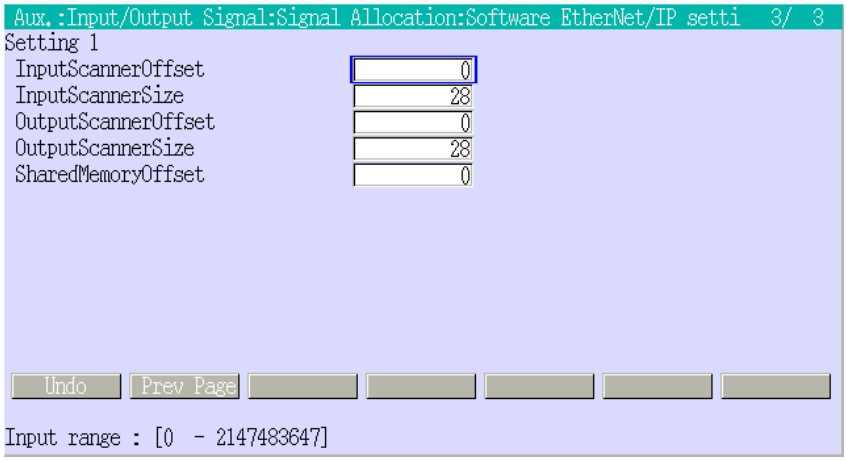


Parameters	Type	Unit	Description
Instance	DEC	-	Set Instance number of adapter (1 - 128)
Network Path	DEC	-	Set IP address of adapter. Set all IP address fields to 0 for non-use.
Target Configration Connection Instance	DEC	-	Set Instance number of set data based on EDS of the adapter to be connected.
Target Producing Connection Point	DEC	-	Set Instance number of output data based on EDS of the adapter to be connected.
Target Consuming Connection Point	DEC	-	Set Instance number of input data based on EDS.
Target Consuming Connection Tag	CHR	-	Enter Tag name (Input). (Up to 256 characters)
Target Producing Connection Tag	CHR	-	Enter Tag name (Output). (Up to 256 characters)
Producing Data Rate	DEC	ms	Set RPI of output data. (Min. 10 ms)
Consuming Data Rate	DEC	ms	Set RPI of input data. (Min. 10 ms)
Output Run Program Header	DEC	-	Set header (Output) Entering 1 sends output data with a header added to the first 4 bytes of output data. Normally input 0.
Input Run Program Header	DEC	-	Set header (Input) Entering 1 considers the first 4 bytes of input data as a header. Normally input 0.



Parameters	Type	Unit	Description
Producing Connection Type	HEX	-	Set output connection type. 0x4000: Point to Point 0x2000: Multicast
Consuming Connection Type	HEX	-	Set input connection type. 0x4000: Point to Point 0x2000: Multicast
Producing Priority	HEX	-	Set priority of output data. Normally set 0x800 (Schedule priority). 0x000: Low priority 0x400: High priority 0x800: Schedule priority 0xC00: Emergency priority
Consuming Priority	HEX	-	Set priority of input data . Normally set 0x800 (Schedule priority). 0x000: Low priority 0x400: High priority 0x800: Schedule priority 0xC00: Emergency priority
Transport Class	DEC	-	Set communication (Transport) class. Set 1 (Class 1) or 3 (Class 3). Normally set 1.
Transport Type	HEX	-	Set sending trigger type. Normally set 0 (sending after time is up). 0x00: Sending after time up 0x20: Sending after trigger of Application object
Timeout Multiplier	DEC	-	Set timeout coefficient. Normally set 2.

Watchdog Timeout Action	DEC	-	Set action to be takenwhen connection is timeout. Normally set 3 (Reconnect after delay time). 0: Delete connection 1: Delete connection after Watch dog timeout 2: Reconnect 3: Reconnect after delay time 4: Wait for scanner reset connection
Watchdog Timeout Reconnecttion Delay	DEC	ms	Set delay time when connection timeout occurred.
Host IP Address	HEX	-	Set IP address of connecting source. Normally set 0xFFFFFFFF.

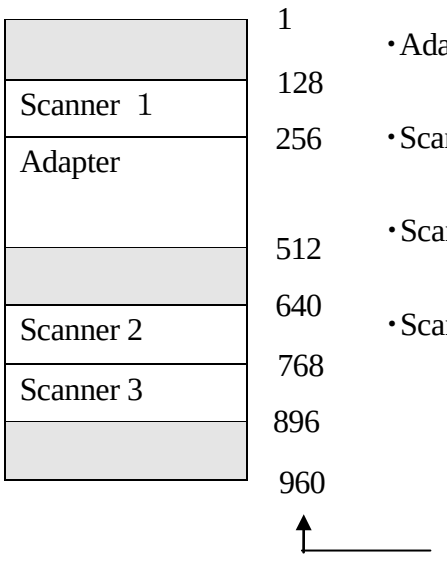


Parameters	Type	Unit	Description
Input Scanner Offset	DEC	Byte	Specify the data position to acquire input data. Normally set 0.
Input Scanner Size	DEC	Byte	Input data size
Output Scanner Offset	DEC	Byte	Specify the data position to acquire output data. Normally set 0.
Output Scanner Size	DEC	Byte	Set output data size
Shared Memory Offset	DEC	Byte	Set the offset values of signal start position for the master or slave port where the interface is set.

I5.3 SIGNAL ALLOCATION FOR ADAPTER AND SCANNER

Signals for adapter and scanner are allocated based on each offset value for maseter or slave port where the interface is set. Up to 960 signals are available in total.

Example） The following screens show setting example of Aug. function corresponding to the signal allocation below.



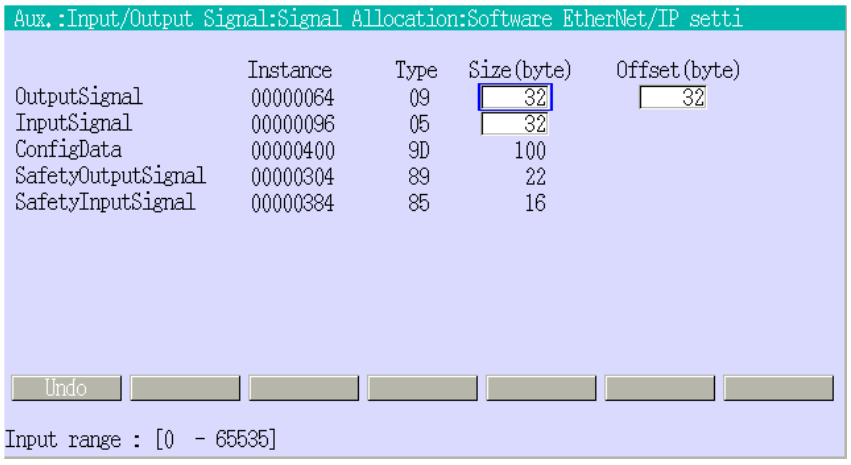
・Adapter Number of signals 256 (32 bytes), Offset 256 (32 bytes)
Start sig. No.: 257, End sig. No.: 512

・Scanner 1 Number of signals 128 (16 bytes), Offset 128 (16 bytes)
Start sig. No.: 129, End sig. No.: 256

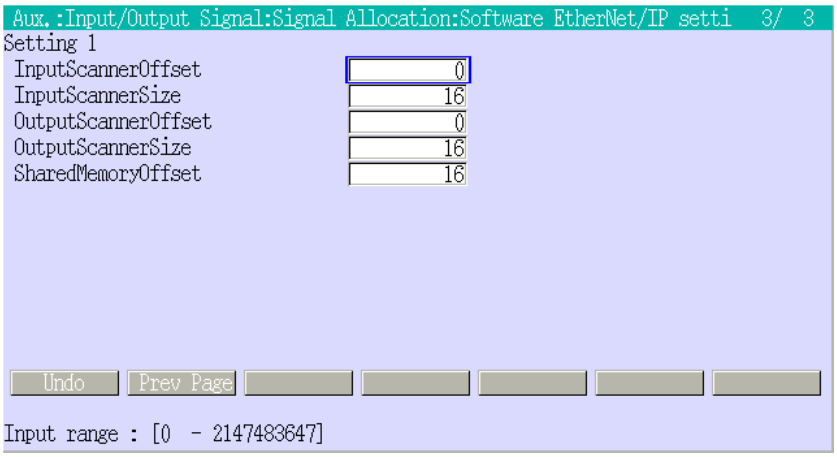
・Scanner 2 Number of signals 128 (16 bytes), Offset 640 (80 bytes)
Start sig. No.: 641, End sig. No.: 768

・Scanner 3 Number of signals 128 (16 bytes), Offset 768 (96 bytes)
Start sig. No.: 769, End sig. No.: 896

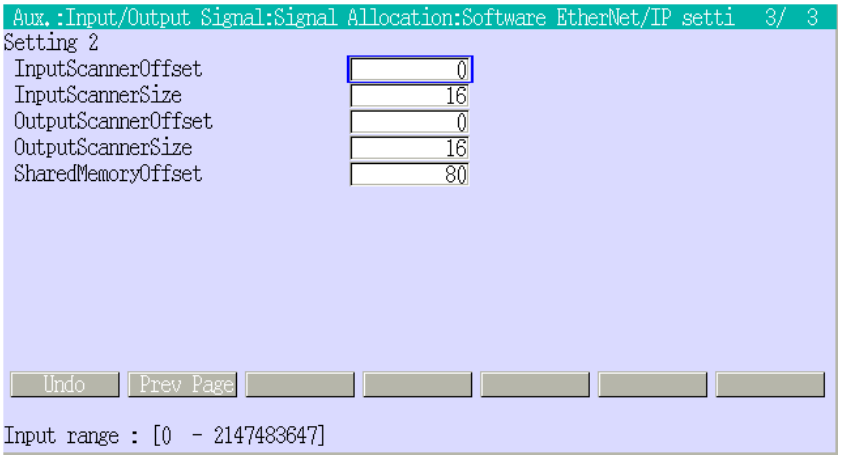
Aux. function 0608-9-3 (for adapter)



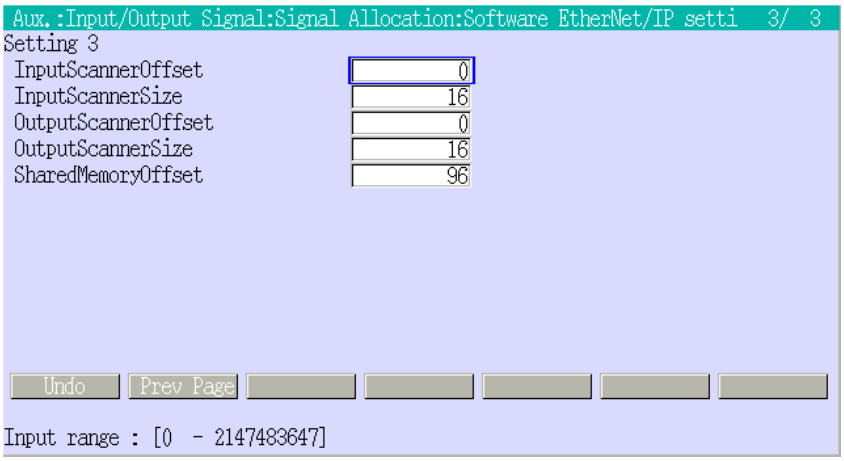
Aux. function 0608-9-4 01: Setting 1 (for scanner 1)



Aux. function 0608-9-4 02: Setting 2 (for scanner 2)



Aux. function 0608-9-4 03: Setting 3 (for scanner 3)



Use Aux. function 0608-1 to relate the actual signal numbers for AS application and channel.

I5.4 ETHERNET/IP STATUS ACQUISITION FUNCTION

Function

EIPSTATUS (Instance number)

Function

Returns connecting status of adapter and scanner used in software EtherNet/IP.

Parameter

Instance number

Setting 0 for Instance number returns connecting status of adapter 0.
Setting 1 or upper number for Instance number returns connecting status of the scanner corresponding to the set instance number.

TRUE: Connected
FALSE: Disconnected
-2: Unset

Example

```
>TYPE EIPSTATUS (1)
-1              Connected
>TYPE EIPSTATUS (2)
0               Disconnected
>TYPE EIPSTATUS (3)
-2              Not connected
```

Monitor command

EIPSTATUS [Instance number]

Function

Returns connecting status of adapter, scanner used in software EtherNet/IP.

Parameter

Instance number

Setting 0 for Instance number returns connecting status of adapter 0.
Setting 1 or upper number for Instance number returns connecting status of the scanner corresponding to the set instance number.
When the applicable scanner does not exist, nothing is displayed.
When instance number is omitted, connecting status of all the available adapters and scanners is

displayed.

Example

>EIPSTATUS 1

Instance: 1 Status: ONLINE

>EIPSTATUS 0

Instance: 0 Status: OFFLINE code: #XXXX

APPENDIX J ETHERCAT (E CONTROLLER)

J1.0 OUTLINE OF ETHERCAT FOR ROBOT CONTROLLER

For EtherCAT slave communication, AnyBus-S EtherCAT slave card is used. The features of EtherCAT are shown below:

1. Protocol & Supported Functions
   - Protocol : CANopen over EtherCAT
   - Protocol version : DS301 v4.02
   - Baud rate range : 100 Mbit/s

2. Physical Interface
   - Topology : Master-Slave communication
   - Fieldbus connectors : Ethernet Connector (RJ45)
   - Isolation : The bus is galvanically separated from the other electronics with an on board DC/DC converter.

3. Configuration & Indications
   - Address range : 1 - 65535
   - Max. cyclic I/O data size : Max. 120 bytes for input, Max. 120 bytes for output (960 points)
   - LED-indications : Link/Activity indication x 2, Error indication, Run indication

4. Data Exchange
   - Process data : Cyclic I/O data

[NOTE]

The connectivity with all EtherCAT products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all EtherCAT products.

J2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board (See Chapter 3.)
2. Turn robot controller power ON
3. Set the allocation for the fieldbus interface (Signal allocation setting)
   In step 5 below, before resetting the number of external I/O signals lower than the current setting, ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See Chapter 5, Example 2.)
4. Set the number of external I/O signals (See Chapter 5.)
5. Set relation between physical I/O interface and master/slave ports (See Section 6.1.)
6. Turn robot controller power OFF then ON
7. Set the signal allocation data (See Section 6.2.)
8. Set the order of signals for the master/slave ports (See Section 6.3.)
9. Network configuration
   Please follow a manual of a master device like PLC to configure an EtherCAT Network configuration. If you use the network configuration tool (ex. TwinCAT System Control), you should install ESI file (XML format) into the designated area by the tool. (See J3.3.1.)
10. Start operation.

J3.0 ETHERCAT - SLAVE

J3.1 MECHANICAL OVERVIEW OF MODULE

Figure J1 is top view of AnyBus-S EtherCAT card appearance.

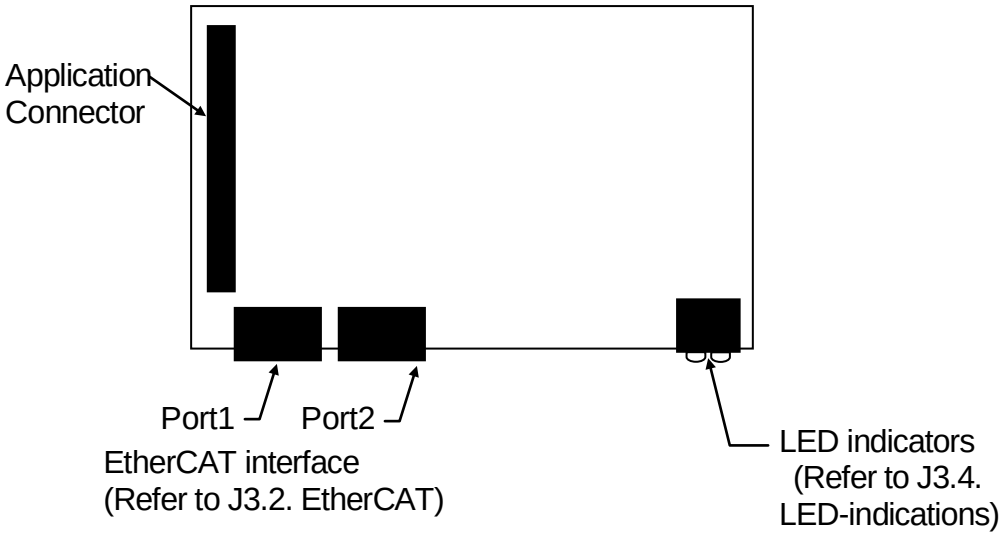


Fig. J1 Overview of AnyBus-S EtherCAT card (Top view)

J3.2 ETHERCAT CONNECTOR

Use Ethernet Connector (RJ45) for EtherCAT interface. Table J1 shows the assignment of signals.

Table J1 Ethernet Connector(RJ45)

Pin	Name	Function
1	TX+	Send +
2	TX-	Send -
3	RX+	Receive +
4	Not used	
5	Not used	
6	RX-	Receive -
7	Not used	
8	Not used	

J3.3 CONFIGURATION

J3.3.1 SETTING FILE (ESI)

ESI (EtherCAT Slave Information) is a XML file, including information of the device.
The Network Configuration tool refers to the ESI file when the network is configured. (Example : TwinCAT System Control) Before the network configuration, install the ESI file into a personal computer which executes the Configuration. Please follow a manual of the configuration tool to install ESI file into the designated area by the tool. Kawasaki supplies the ESI file for this ANYBUS-S EtherCAT.

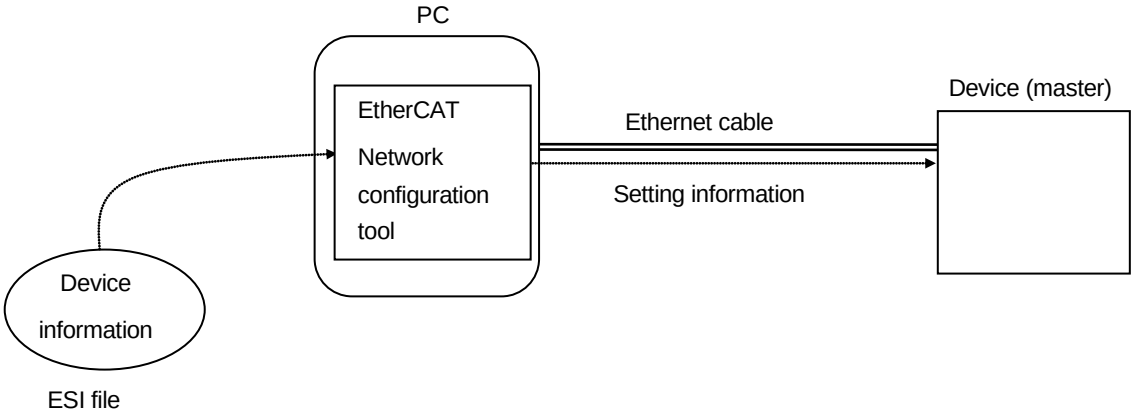
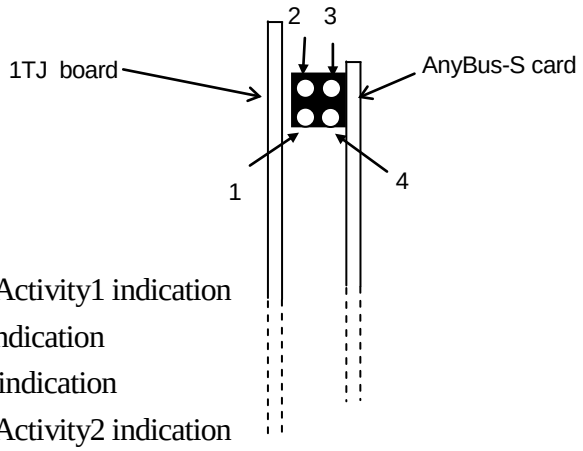


Fig. J2 ESI File

J3.4 LED INDICATOR

The AnyBus-S is equipped with four LEDs in the front section and one LED on the board. The specification of the LED is as follows:



LED1 : Link/Activity1 indication
LED2 : Run indication
LED3 : Error indication
LED4 : Link/Activity2 indication

Fig. J3 Indicator Front View

Table J2 Link/Activity1indication

Name of LED	State	Description
1.Link/Activity1 indication	OFF	No link sensed on Ethernet port 1
	Green	Link sensed on Ethernet port 1
	Green, blinking	Exchanging packets on Ethernet port 1

Table J3 Run indication

Name of LED	State	Description
2. Run indication	OFF	The device is in INIT state.
	Green, blinking (hight frequency)	The device is PRE-OPERATIONAL state
	Green, single flash	The device is in SAFE-OPERATIONAL state
	Green	The device is in OPERATIONAL state

Table J4 Error indication

Name of LED	State	Description
3. Error indication	OFF	EtherCAT communication is in working condition
	Red, blinking (hight frequency)	General configuration error
	Red, single flash	Slave device application has changed the EtherCAT state autonomously
	Red, double flash	Sync manager watchdog timeout
	Red	Application watchdog timeout

Table J5 Link/Activity2 indication

Name of LED	State	Description
4. Link/Activity2 indication	OFF	No link sensed on Ethernet port 2
	Green	Link sensed on Ethernet port 2
	Green, blinking	Exchanging packets on Ethernet port 2

Other indicator: Watchdog LED (On AnyBus card)

Table J6 Watchdog

Name	State	Description
Watchdog	Green, blinking (1 Hz)	Module is initialized and running.
	Green, blinking (2 Hz)	Module is not initialized.
	Red, flashing (1 Hz)	RAM check fault
	Red, flashing (2 Hz)	ASIC and Flash ROM check fault
	Red, flashing (4 Hz)	DPRAM check fault

APPENDIX K CC-LINK IE

K1.0 CC-LINK IE FOR ROBOT CONTROLLER

Anybus-S CC-Link IE board is used for CC-Link IE slave communication. The feautures of CC-Link IE are shown below.

Table K1 Communication specification

Device type	Slave
Supported spec.	CC-Link IE Field Network
Baud rate range	1Gbps
Number of I/O signals	Maximum bit points Input: 832 Output: 832 Maximum number of word data Input: 204 Output: 204
Access method	Token passing
Transmission path	Ethernet cable (Category 5e)
connector	RJ45 connector
Max. number of units connected	254 (Total number of master and slave station)
Available station number (Address range on CC-Link IE)	1 to 120
Hardware configuration	Anybus-S CC-Link IE board and 1TJ/1UK board

Table K2 shows combinations of the available number of signals and word data at Anybus-S CC-Link IE board. 16 bit per 1 point is available for word data.

Table K2 Combination of bit points and word points

Bit points	Word points	Bit points	Word points	Bit points	Word points	Bit points	Word points
16	4	224	52	432	104	640	156
32	4	240	56	448	108	656	160
48	8	256	60	464	112	672	164
64	12	272	64	480	116	688	168
80	16	288	68	496	120	704	172
96	20	304	72	512	124	720	176
112	24	320	76	528	128	736	180
128	28	336	80	544	132	752	184
144	32	352	84	560	136	768	188
160	36	368	88	576	140	784	192
176	40	384	92	592	144	800	196
192	44	400	96	608	148	816	200
208	48	416	100	624	152	832	204

[NOTE]

The connectivity with all CC-Link products has not been confirmed. We assume that it is generally possible; however, we do not guarantee the connection with all CC-Link products.

K2.0 PROCEDURE BEFORE OPERATION

Follow the procedures shown below. [ ] indicates an individual process for each fieldbus.

1. Prepare the fieldbus interface board (See Chapter 3.)
   ↓
2. Set the fieldbus interface card
   Set the node number via dip switches. (See K3.3.)
   ↓
3. Turn robot controller power ON
   ↓
4. Set the allocation for the fieldbus interface (Signal allocation setting)
   In step 5 below, before resetting the number of external I/O signals lower than the current setting ensure the number of signals to be set (via Aux. 0611) matches the number allocated in Aux. 0608-1. (See chapter 5, Example 2.)
   ↓
5. Set the number of external I/O signals (See Chapter 5.)
   ↓
6. Set relation between physical I/O interface and master/slave ports (See Section 6.1.)
   ↓
7. Set the number of word data . (See K3.3.3.)
   ↓
8. Turn robot controller power OFF then ON.
   ↓
9. Set the signal allocation data. (See Section 6.2.)
   ↓
10. Set the order of signals for the master/slave ports. (See Section 6.3.)
    ↓
[11. Network configuration]
    Make network parameter setting according to the manual for master device (PLC, etc.).
    ↓
12. Start operation.

K3.0 CC-LINK IE - SLAVE

K3.1 MECHANICAL OVERVIEW OF MODULE

The outline view of Anybus-S CC-Link IE card (Fig. K1) and interface board installed with 1TJ/1UK board and Anybus-S CC-Link IE card (Fig. K2) are shown below.

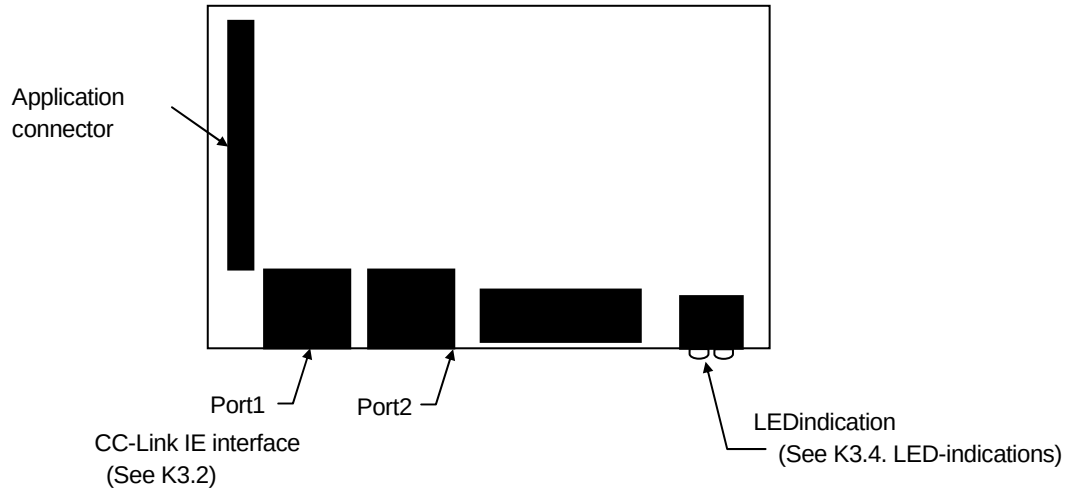


Fig. K1 Anybus-S CC-Link IE board (Plane view)

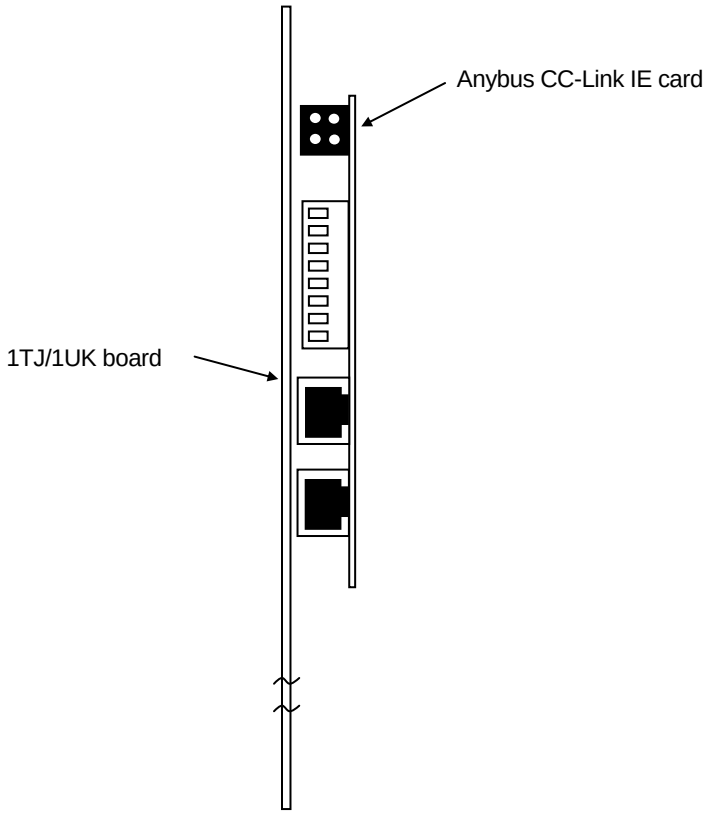


Fig. K2 Interface board (Front view)

K3.2 CABLE CONNECTION

Use Ethernet Connector (RJ45) for CC-Link IE interface. Table K3 shows the assignment of signals.

Table K3 Ethernet Connector (RJ45)

Pin	Name	Function
1	TX+	Send +
2	TX-	Send -
3	RX+	Receive +
4	Not used	
5	Not used	
6	RX-	Receive -
7	Not used	
8	Not used	

K3.3 CONFIGURATION

K3.3.1 NODE NUMBER SETTING

Set the node number for CC-Link IE slave via dip switches on Anybus-S CC-Link IE card.

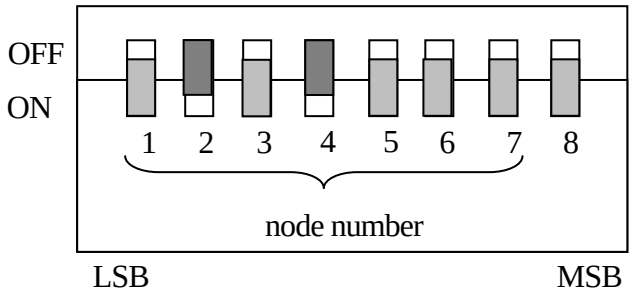


Fig. K3 Dip switches (node number)

Table K4 Node number setting

Switch setting	Description
0	Reserve. ERROR LED turns red when set.
1-120	Valid node number setting
121-126	Invalid node number setting. ERROR LED turns red.
127	Reserve. ERROR LED turns red when set.

The example in Fig. K3 shows node number 10.

[NOTE]

Node number cannot be changed during operation.

K3.3.2 LED 3/4 ASSIGNMENT

Set LED3/4 function via dip switches on Anybus-S CC-Link IE card.

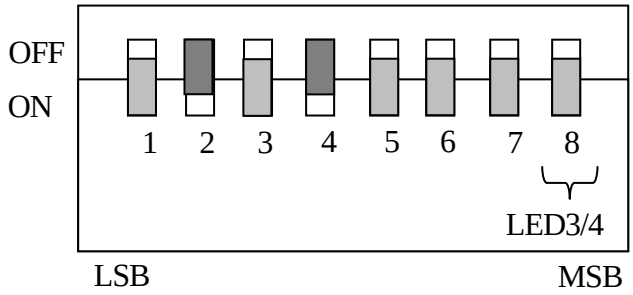


Fig. K4 Dip switches (LED3/4)

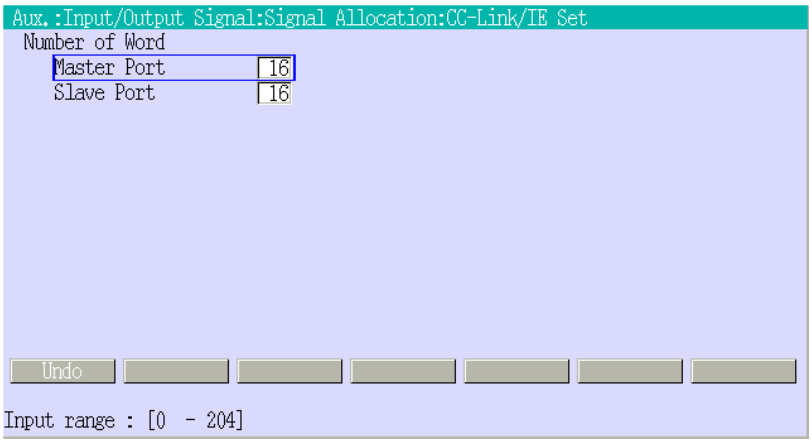
Table K5 LED3/4 function assignment

Switch setting	Description
ON	LINK state indication
OFF	RD/SD state indication.

K3.3.3 NUMBER OF WORD DATA SETTING (AUX. 060811)

Set the number of word data used for CC-Link IE communication.

Selecting [Aux. 0608 Signal Allocation]→[11 CC-Link/IE Set] displays the screen below.



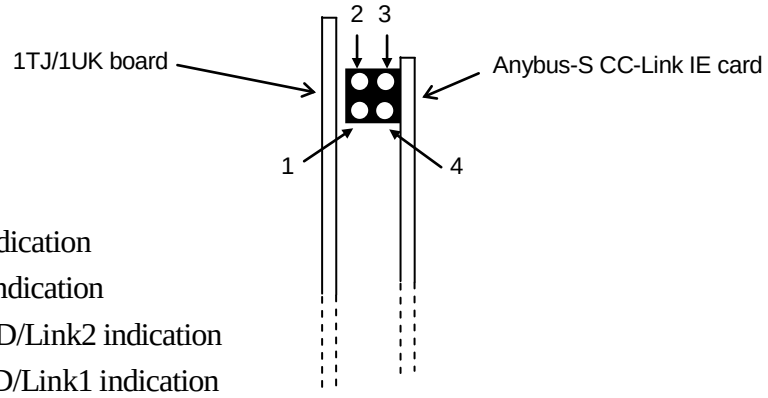
Number of Word Data (Master Port/Slave Port)
Set the number of word data for master port and slave port. The set values will be valid for the CC-Link IE card allocated to each of the ports.

Default value for each port is 16. Settable range: 0 to 204.
Set the number less than the corresponding number of word data to the bit points in table K2.
Setting 0 disables integer (word) data communication.

Turn controller power OFF/ON after changing the settings. The set values become valid only after rebooting the controller.

K3.4 LED INDICATOR

Anybus-S CC-Link IE has four LEDs on the front. The specifications for the front LEDs are below.



LED1 : Run indication
LED2 : Error indication
LED3 : RDLED/Link2 indication
LED4 : SDLED/Link1 indication

Fig. K5 Front view of LED indicator

Table K6 Run indication

Name of LED	State	Description
1. Run indication	OFF	No power No network detected Network timeout
	Green	Normal state

Table K7 Error indication

Name of LED	State	Description
2. Error indication	OFF	Normal operation No power
	Red	Station not operating normally Duplicate station number Master parameter error Illegal station address during initialization
	Blinking red	Link error

Table K8 RDLED/Link2indication

Name of LED		State	Description
3.	RDLED	OFF	No data received No power
		Green	Data received
	Link2	OFF	No data link No power
		Green	Link is eatablished to an Ethernet network

Table K9 SDLED/Link1indication

Name of LED		State	Description
4.	SDLED	OFF	No data transmission No power
		Green	Data transmission
	Link1	OFF	No data link No power
		Green	Linked is established to an Ethernet network

Other indicator: Watchdog LED (On AnyBus card)

Table K10 Watchdog

Name	State	Description
Watchdog	Green, blinking (1 Hz)	Module is initialized and running.
	Green, blinking (2 Hz)	Module is not initialized
	Red, flashing (1 Hz)	RAM check fault
	Red, flashing (2 Hz)	ASIC and Flash ROM check fault
	Red, flashing (4 Hz)	DPRAM check fault

APPENDIX X PRODUCT CODE LIST

Table X1 Fieldbus mother board Product code list

Board name	Type	Applicable controller	
		D	E
1JF	50999-2142	○	×
1QK	50999-2773	○	×
1TJ	50999-2923	×	○
1UK	50999-0007	×	○

Table X2 PCI adpter board Product code list

Board name	Type	Applicable controller		
		E0x/E7x	E9x	E1x/E2x/E3x/E4x
1UQ (INTERBUS)	50999-0192	×	×	○
1UQ (Oothers)	50999-0191	×	×	○
1YQ	50999-0430	○	○	○

Table X3 Fieldbus interface board Product code list

Fieldbus name	Type	Device name	Code	Applicable controller	
				D	E
DeviceNet	slave	Anybus-S DeviceNet	50999-0045	○	○
	master	Anybus-M DeviceNet	50999-2280	○	○
PROFIBUS	slave	Anybus-S PROFIBUS-DP	50999-0044	○	○
	master	Anybus-M PROFIBUS-DPV1	50999-0062	○	○
INTERBUS	slave	Anybus-S INTERBUS	50999-2806	○	○
	master	I IBS PCI SC/I-T	50999-0184	○	○
EtherNet/IP	slave	Anybus-S EtherNet/IP	50999-0107	○	×
			50999-0086	×	○
	master	Anyhbus-M EtherNet/IP	50999-0087	○	×
			50999-0088	×	○
Modbus-TCP	Server (slave)	Anybus-S EtherNet/IP	50999-0107	○	×
			50999-0086	×	○
CC-Link	slave	1PS	50999-2902	○	○
	master	Q50BD-CCV2	50999-2738	○	○
CANopen	slave	Anybus-S CANopen	50999-2545	×	○
PROFInet IO	slave	Anybus-S PROFInet	50999-0061	×	○
	master	CP1616	50999-0177	×	○
ControlNet	slave	Anybus-S ControlNet	50999-0077	×	○
EtherCAT	slave	Anybus-S EtherCAT	50999-0420	×	○
CC-Link/IE	slave	Anybus-S CC-Link/IE	50999-0425	×	○

In some cases some fieldbus may not be available.

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