FUJI ELECTRIC

MICREX-SX *series*

SPH

USER'S MANUAL

DeviceNet MASTER MODULE

Preface

This User's Manual explains the specifications of the DeviceNet modules. Read this manual carefully to ensure correct operation.
When using modules or peripheral devices, be sure to read the corresponding user's manuals listed below.

Title	Manual No.	Contents
User's Manual Instruction, MICREX-SX series SPH	FEH200	Explains the memory, language and system definitions of the MICREX-SX series.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, the specifications and operations of modules in the MICREX-SX series.
User's Manual D300win <Introduction>, MICREX-SX series	FEH250	Explains the basic operations of D300win, the programming and monitoring for MICREX-SX series.
User's Manual D300win <Reference>, MICREX-SX series	FEH251	Explains the menu and icon of D300win and all of the operations of D300win.
User's Manual D300winV2 <Reference>, MICREX-SX series	FEH254	Explains the menu and icon of D300winV2 and all of the operations of D300winV2.

Notes

1. This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
2. The contents of this manual (including specifications) are subject to change without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down (along with the manual No. shown on the cover) and contact FUJI.

Safety Precautions

Be sure to read the “Safety Precautions” thoroughly before using the module.
Here, the safety precaution items are classified into “Warning” and “Caution.”

Warning : Incorrect handling of the device may result in death or serious injury.

Caution : Incorrect handling of the device may result in minor injury or physical damage.

Even some items indicated by “Caution” may also result in a serious accident.
Both safety instruction categories provide important information. Be sure to strictly observe these instructions.

Warning
◊ Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator. ◊ Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur. ◊ Place the emergency stop circuit, interlock circuit or the like for safety outside the PC. A failure of PC might break or cause problems to the machine. ◊ Do not connect in reverse polarity, charge (except rechargeable ones), disassemble, heat, throw in fire or short-circuit the batteries, otherwise, they might burst or take fire. ◊ If batteries have any deformation, spilled fluids, or other abnormality, do not use them. The use of such batteries might cause explosion or firing. ◊ Do not open the FG terminal with the LG-FG short circuited. (It must be grounded, otherwise it might cause electric shock.)

Safety Precautions

⚠ Caution

◊ Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
◊ Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
◊ Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
◊ Use the rated voltage and current mentioned in the operating instructions and manual. Use beyond the rated values might cause fire, erratic operation or failure.
◊ Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
◊ Select a wire size to suit the applied voltage and carrying current. Tighten the wire terminals to the specified torque. Inappropriate wiring or tightening might cause fire, malfunction, failure, or might cause the product to drop from its mounting.
◊ Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur.
◊ Remove the dust-cover seals of modules after wiring, otherwise, fire, accidents, failure or fault might occur.
◊ Connect the ground terminal to the ground, otherwise, an erratic operation might occur.
◊ Periodically make sure the terminal screws and mounting screws are securely tightened.
Operation at a loosened status might cause fire or erratic operation.
◊ Put the furnished connector covers on unused connectors, otherwise, failure or erratic operation might occur.
◊ Install the furnished terminal cover on the terminal block, otherwise, electric shock or fire might occur.
◊ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run. The wrong operation might break or cause machine problems.
◊ Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
◊ Before touching the PC, discharge any static electricity that may have been collected on your body. To discharge it, touch a grounded metallic object. Static electricity might cause erratic operation or failure of the module.
◊ Be sure to install the electrical wiring correctly and securely, observing the operating instructions and manual. Wrong or loose wiring might cause fire, accidents, or failure.
◊ When disengaging the plug from the outlet, do not pull the cord, otherwiase, break of cable might cause fire or failure.
◊ Do not attempt to change system configurations (such as installing or removing I/O modules) while the power is ON, otherwise, failure or erratic operation might occur.
◊ Do not attemp to repair the module by yourself -- contact your Fuji Electric agent. When replacing the batteries, correctly and securely connect the battery connectors, otherwise, fire, accidents or failure might occure.
◊ To clean the module, turn power off and wipe the module with a cloth moistened with warm water. Do not use thinner or other organic solvents, as the module surface might become deformed or discolored.
◊ Do not remodel or disassemble the product, otherwise, a failure might occur.
◊ Follow the regulations of industrial wastes when the device is to be discarded.
◊ The modules covered in these operating instructions have not been designed or manufactured for use in equipment or systems which, in the event of failure, can lead to loss of human life.
◊ If you intend to use the modules covered in these operating instructions for special applications, such as for nuclear energy control, aerospace, medical, or transportation, please consult your Fuji Electric agent.
◊ Be sure to provide protective measures when using the module covered in these operating instructions in equipment which, in the event of failure, may lead to loss of human life or other grave results.
◊ External power supply (such as 24V DC power supply) which is connected to DC I/O should be strongly isolated from AC power supply.

Revision

***Manual No. is shown on the cover.**

Printed on	*Manual No.	Revision contents
Dec.2000	FEH232	First edition

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Safety Precautions

Revision

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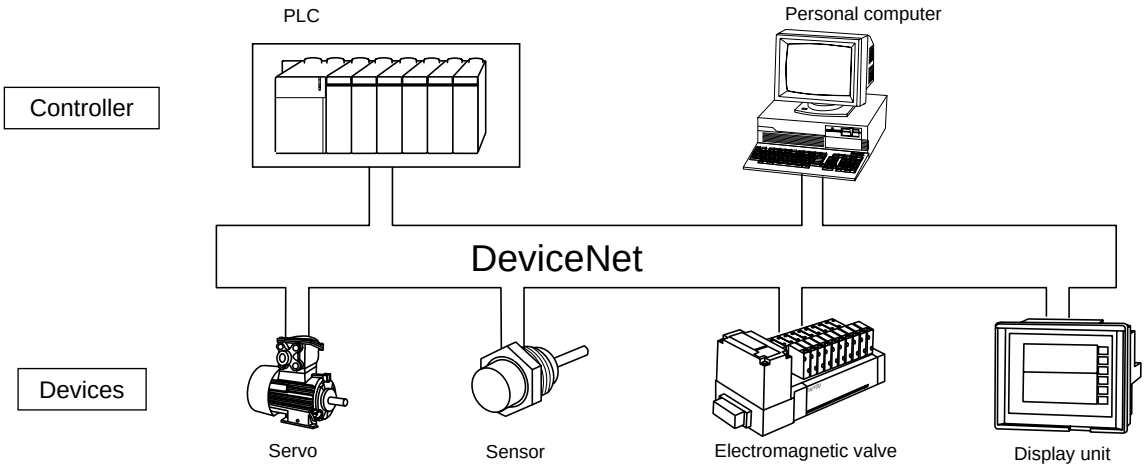
Section 1 Overview

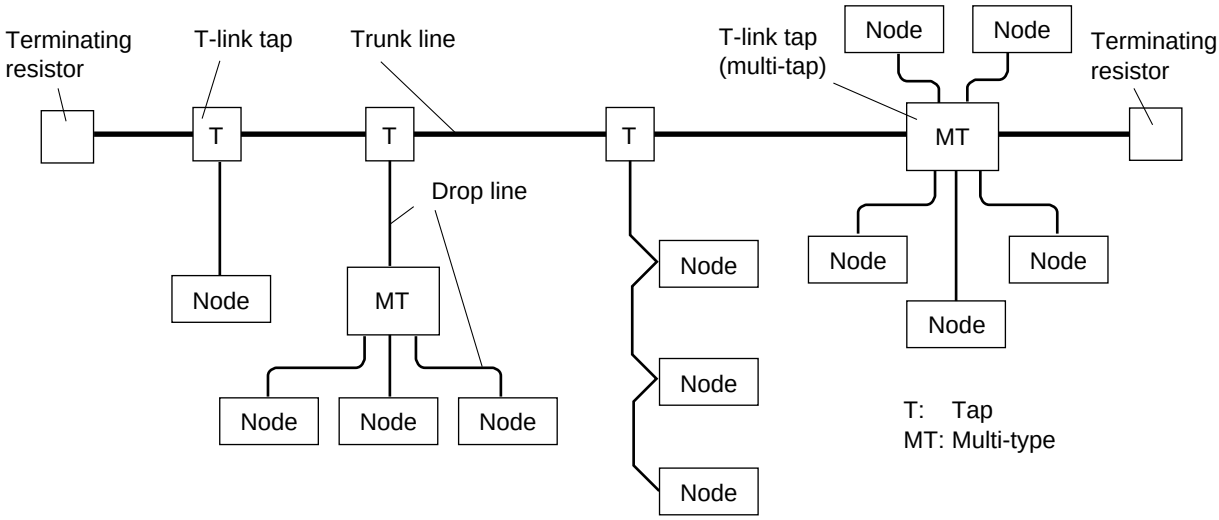
Section 1 Overview
1-1 DeviceNet

The NP1L-DN1 DeviceNet master module is mounted on the base board of the MICREX-SX Series (or connected to the SX bus) and connected to an open field network “DeviceNet” to offer the communication functions of the master devices. This product has been tested by test laboratory of the third organization approved by ODVA and the compliance with ODVA conformance test software Ver A-12 has been approved.

DeviceNet is an open field network which makes it easier to inter-connect programmable controllers, personal computers, sensors, actuators, and other control devices.
For DeviceNet, the communication protocol, the physical specifications of connectors, cables, etc. for connections, and the basic I/O data format and device profile of each device type to enable device compatibility between vendors are prescribed by ODVA (Open DeviceNet Vendor Association).



[Reference]
The information on DeviceNet can be downloaded from the home page of ODVA. The home page address of ODVA_japan is http://web.kyoto-inet.or.jp/org/odva-j/top.html



Trunk Line, Drop Line
The trunk line indicates the cable with a terminating resistor at both ends. Usually, the cable for connecting the ends which are most separated is referred to as trunk line. Cables branched from the trunk line are referred to as a drop line.

Terminating Resistor
A resistor which is connected at both terminals of the trunk line. A metal-film resistor with 120ohms, 1%, 1/4W is used. For the procedure for connecting a terminating resistor, refer to Chapter 6, “Wiring.”

T-Link Tap
A device used to link the trunk line to a drop line is referred to as T-link tap. The T-link tap is categorized into two types: the tap type which is used to link the trunk line to one drop line and the multi-tap type which is used to link it to multiple drop lines.

Node
There are two different DeviceNet nodes: the master station which manages DeviceNet and controls I/O units and other devices connected to DeviceNet and the slave station (I/O unit, etc.). A single DeviceNet system consists of one master station and multiple slave devices. Up to 63 slave devices can be connected to a single DeviceNet.
The NP1L-DN1 is the DeviceNet master module which offers the DeviceNet master function (for 1 channel per module).

Section 2 Specifications

Page

Section 2 Specifications

2-1 General Specifications

Item		Specification
Physical environment	Operating temperature	0 ~ 55°C
	Storage temperature	–25 ~ +70°C
	Relative humidity	20 to 95%RH without condensation
	Pollution level	Pollution level 2
	Resistance to corrosion	No corrosive gas present and no organic solvent attached
	Altitude used	2000 m or less (with an atmospheric pressure of 70kPa or more during transportation)
Mechanical operating conditions	15-nuke?	16-nuke?
	17-nuke?	18-nuke?
19-nuke?	Noise immunity	Noise simulator method (1ns rising time, 1us pulse width, 1.5 kV)
	Resistance to electrostatic discharge	Contact discharge method (+–6kV), aerial discharge method (+–8kV)
	Resistance to radiation field	10 V/m (80MHz ~ 1000MHz)
Structure		Built-in panel type IP30
Cooling system		Natural cooling
Insulation system		Photocoupler insulation
Dielectric strength		445VAC for 1minute, between connectors and FG
Insulation resistance		10Mohms or more with a 500VDC megger, between connectors and FG
Internal current consumption		NP1L-DN1: 24VDC 90mA or less (supplied from the SX bus (base board))
Network current consumption		24VDC 45mA or less
Weight		NP1L-DN1: about 170g
External view		Described in section 2-5

Item	Specifications
Model (Product name)	NP1L-DN1
DeviceNet communication function	Master function
Number of slave stations connected	Up to 63
MAC ID setup range	00 ~ 63
Transmission line	Trunk line, drop line
Connection format	T-link connection, daisy-chain connection
Transmission rate	(Set by the transmission rate selector switch on the front panel of module)
Transmission distance	< Trunk line length with THICK cable > 500m (125kbps), 250m (250kbps), 100m (500kbps) < Trunk line length with THIN cable > 100m (125kbps, 250kbps, 500kbps common) < Maximum drop line length > 6m (125kbps, 250kbps, 500kbps common) < Total drop line length > 156m (125kbps), 78m (250kbps), 39m (500kbps)
Number of I/O points	2032 points (127 words) maximum Usually, a 1-word I/O area is assigned to each station. Exceptionally, if subsequent MAC ID number does not exist, I/O points not exceeding 128 words can be allocated.
Communication function	1) I/O messages • Poll command/response • Bit-strobe command/response • Change of state/cyclic ACK not provided • Change of state/cyclic ACK provided 2) Explicit messages Realizes client/server function, and sets up and diagnoses remote I/O stations.
Message length	Maximum number of bytes transmitted and received using Explicit messages is 492 bytes. (Service, class, attribute, member + transmit/receive data section)
Vendor ID	319 (Fuji Electric)
Product code	7770 (hex)
Applicable class	I/O scanner

2-3 Cable Specifications

Use communication cables which conform to the DeviceNet specifications. The cable requirements for DeviceNet are as follows:

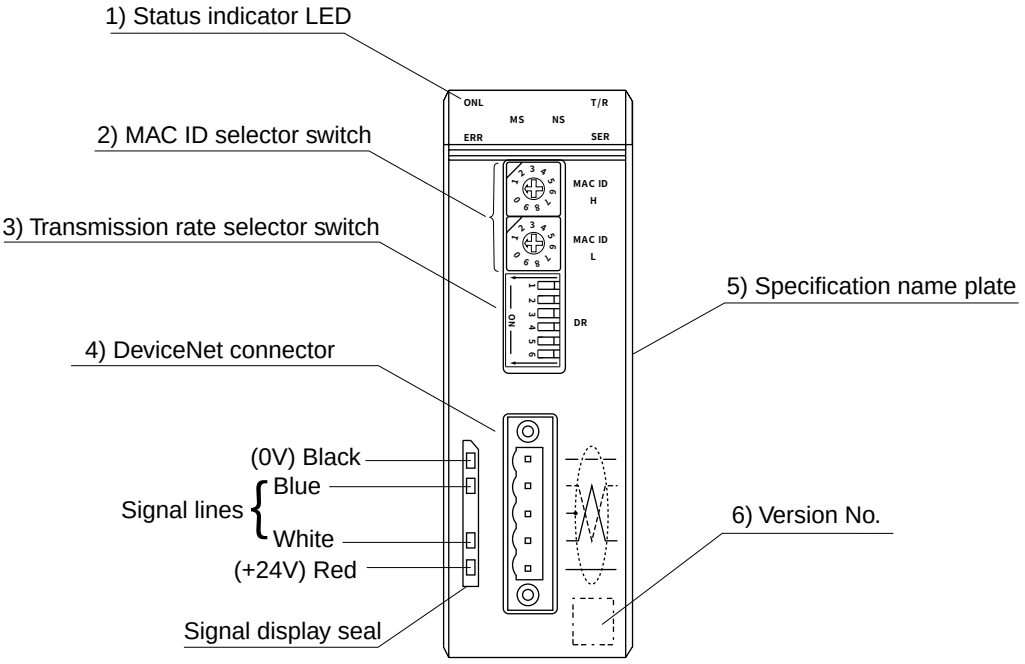
Cable type	Requirements
THICK cable (used majorly for the trunk line)	• A twisted signal line pair (#18): blue/white • A twisted power line pair (#15): black/red • Myler shield separately aluminum-plated is wound around the signal line pair and power line pair. • Wheeled/knitted shield with a drain wire (#18): bare wire The drain wire is in contact with the shield inside the cable and used to connect the shield to the connector. • The power line has a maximum current capacity of 8A. • The power line is PVC-insulated.
6- THIN cable (used majorly for drop lines)	• A twisted signal line pair (#24): blue/white • A twisted power line pair (#22): black/red • Myler shield separately aluminum-plated is wound around the signal line pair and power line pair. • Wheeled/knitted shield with a drain wire (#22): bare wire The drain wire is in contact with the shield inside the cable and used to connect the shield to the connector. • The power line has a maximum current capacity of 3A. • The power line is PVC-insulated.

Note: THIN cable is used majorly for drop lines. However, it can also be used for the trunk line for short distance.

[Reference]
The information on DeviceNet can be downloaded from the home page of ODVA. The home page address of DeviceNet product guide_cable is
http://web.kyoto-inet.or.jp/org/odva-j/catalog/sy_cable/cable_list.html

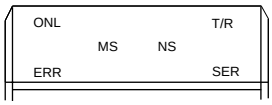
2-4 Name and Function of Each Section

2-4-1 Name of each section



2-4-2 Function of each section

1) Status indicator LED

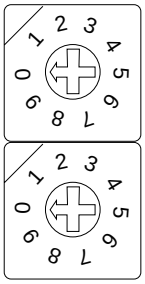


Symbol	Display color	Light-on condition
ONL	Green	• Goes on during normal operation. • Blinks when the SX bus is initialized or it is waiting for establishment of communication link.
ERR	Red	• GoMS if this module or SX bus fails.
T/R	Green	• Blinks when DeviceNet communication is established and during communication.
SER	Red	• Goes on if system configuration (parameter setup) contains an error.
MS	Green / Red	• The green LED goes on when the module is normally operating. • The red LED goes on if an unrecoverable error occurs in the module. • The red LED blinks if a recoverable error occurs in the module. • The green and red LEDs blink when the module is performing self-diagnosis. • The LEDs go off if the system power (24VDC) is not supplied.
NS	Green / Red	• The green LED goes on when the network is normally operating (there are no duplicate MAC ID stations and a set up slave station exists). • The red LED goes on if a communication-disabling error occurs on the network. 1) Duplicate MAC ID, 2) Bus off (communication stop due to communication occurrences at multiple points) • The green LED goes on, after the module completes duplicate MAC ID check, if the set slave station does not exist even in the online mode. • The LEDs go off if the system power (24VDC) is not supplied from the DeviceNet connector or if duplicate MAC ID check is not completed and the online mode is not entered.

2-4 Name and Function of Each Section

2) MAC ID selector switch

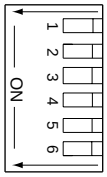
Used to set the station number on DeviceNet of the NP1L-DN1. The setup range is 00 to 63.



Note: If the setup range is exceeded, the operation is not guaranteed.

3) Transmission rate selector switch

Used to set the transmission rate. The setting of this switch is recognized when the power of this module is turned ON.



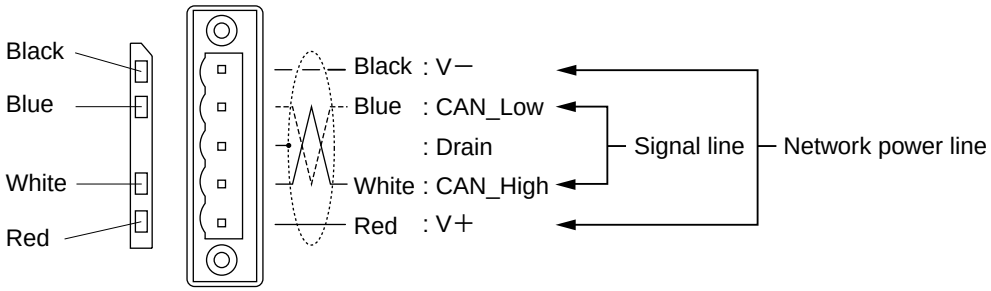
DR

SW1	SW2	Transmission rate
OFF	OFF	125kbps
ON	OFF	250kbps
OFF	ON	500kbps
ON	ON	Cannot be set

Note: Set SW3 to SW6 to OFF.

4) DeviceNet connector

Used to connect the connector of the cable side of DeviceNet (MSTB2.5/5-STF-5.08AU supplied with the product). After connection, fasten it with a screw driver (with a fastening torque of 0.4Nm).

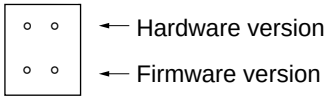


5) Specification name plate

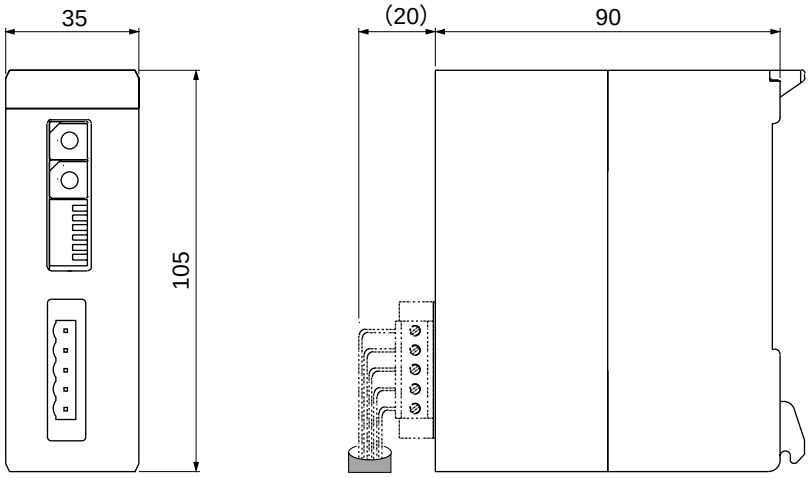
Attached to the right side of the module on which the format, production date, and serial number are printed.

6) Version No.

The hardware and firmware versions of the NP1L-DN1 are printed.



2-5 External View



Section 3 System Configuration

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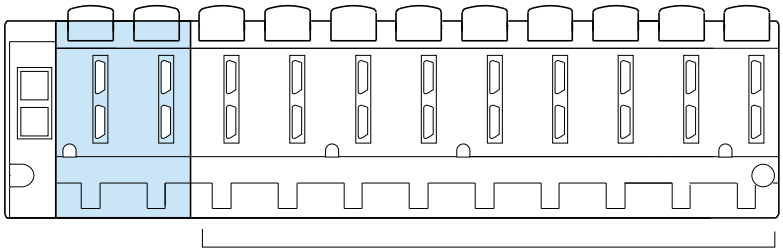
3-1-1 Slot positions

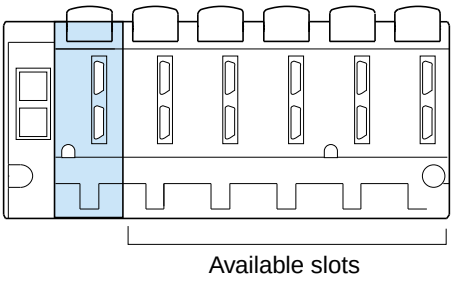
The NP1L-DN1, a remote I/O master module, is connected to the SX bus. The mount slots on the base board are shown below.

The NP1L-DN1 can be mounted to any position except the slots for the power supply module (2 slots from the leftmost position of the base board).

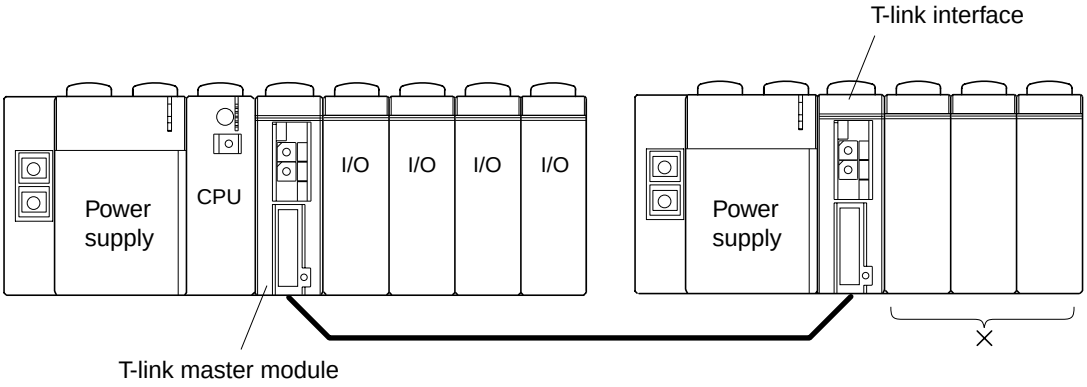
<Base board other than 6-slot base board>



<6-slot base board>



Note: The DeviceNet master module cannot be mounted on the base board of the T-link module, the JPCN-1 module, and other remote I/O slave stations.



3-1-2 Number of modules

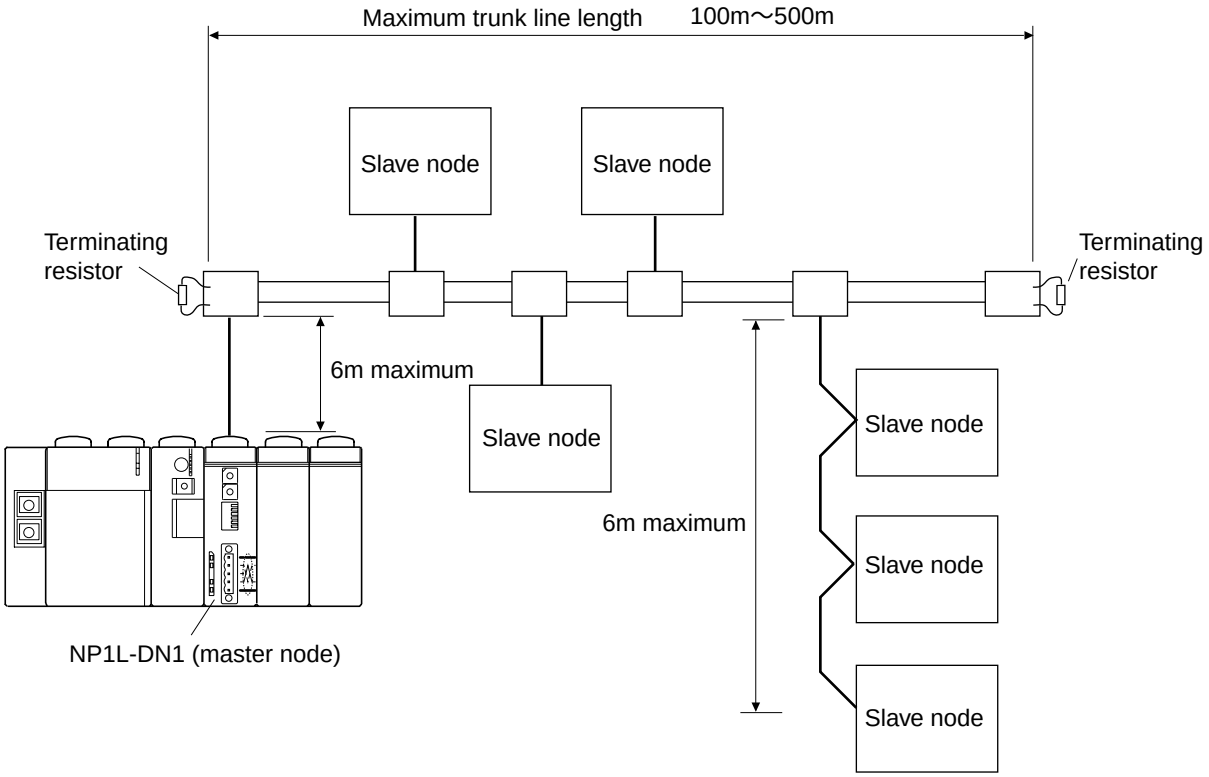
Up to 8 NP1L-DN1 can be connected to a single SX bus system. However, when other I/O master modules (such as the T-link master module and the JPCN-1 master module) are mounted, a total of 8 modules can be mounted.

(Number of DeviceNet master modules) + (Number of other I/O master modules) ≤ 8

3-2-1 Typical system configuration

By connecting a single NP1L-DN1 module to the SX bus (on the base board) of the MICREX-SX Series, you can configure a DeviceNet network system.

<Example of system configuration>



Note 1: The maximum extension distance of the trunk line depends on the transmission rate and the type of the cable used.

Key-point

- Up to 63 remote I/O modules (slave nodes) can be connected to a single master node (DeviceNet).
- Up to 8 master nodes (DeviceNet) can be mounted on the MICREX-SX Series 1 configuration.

3-2-2 Scan list

The scan list is the information about the system configuration including the addresses of the nodes connected to DeviceNet and the number of I/O points, etc. DeviceNet checks the DeviceNet configuration and maintains its integrity through communication according to the scan list.

(1) Creating a scan list

The scan list is created by the NP1L-DN1 based on System Definition set up by D300win.

(2) Scanning method

There are the following 4 different scanning methods for DeviceNet. The scanning method supported differs for each slave node (remote I/O). DeviceNet allows the 4 methods to be used at the same time on a single network.

• Polling

The master node monitors each slave node and performs data transmission with it at each scan. Since the slave node status is always monitored, an error occurring on any slave node can be detected at a scan.

• Bit strobe

The master node outputs only a 1-bit signal to each slave node. Upon reception of the signal, each slave node performs the specified operation. This minimizes the unit of data transmission between the master node and each slave node, thus increasing the overall scanning rate.

• Cyclic

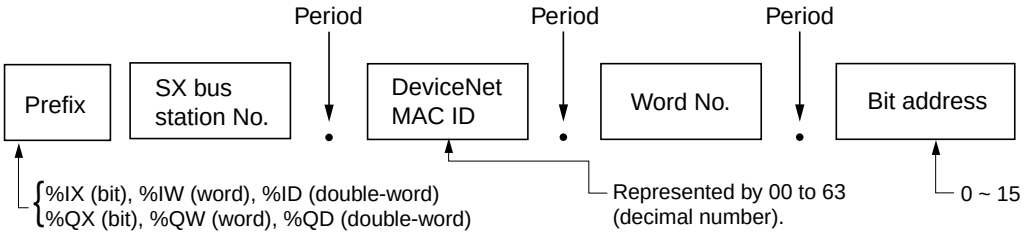
Each slave node passes data to the master node at a regular interval (cyclic time = 65535ms maximum) specified for each node.

• Change of state

Each slave node communicates with the master node only when the state of the salve node changes. This method is effective for slave nodes which monitor an object with a long change-of-state interval. However, when the change-of-state interval (65535ms maximum) specified for each slave node is reached, it passes data to the master node even if there is no state change.

3-3-1 I/O Address assignment on DeviceNet

With MICREX-SX, the I/O area of each node on the DeviceNet is assigned to the same I/O area on the SX bus. With DeviceNet, a 1-word I/O area is assigned to each MAC ID. However, only if the subsequent MAC ID does not exist, the I/O area can be occupied within the range not exceeding 127 words. The rule for address assignment is shown below.



Note 1: When used in the prefix of %ID or QD and accessed in the data format of (32-bit data length), configure the I/O address so that MAC ID of DeviceNet be assigned to an even number.

Note 2: With the DeviceNet communication protocol, only I/O data trains of slave stations are transmitted, but the distinction between the capsule type and set type and the information on the I/O configuration on the set type cannot be recognized.
Therefore, all the slave stations in the following example are recognized as the same station in system configuration collation check. In this case, even if the actual I/O implementation differs from System Definition, the error may not be detected. In any case, however, memory assignment of I/O data is the same and data access from applications is performed normally.

<Example of slave station configuration in which all stations are recognized by the master station as the same station>

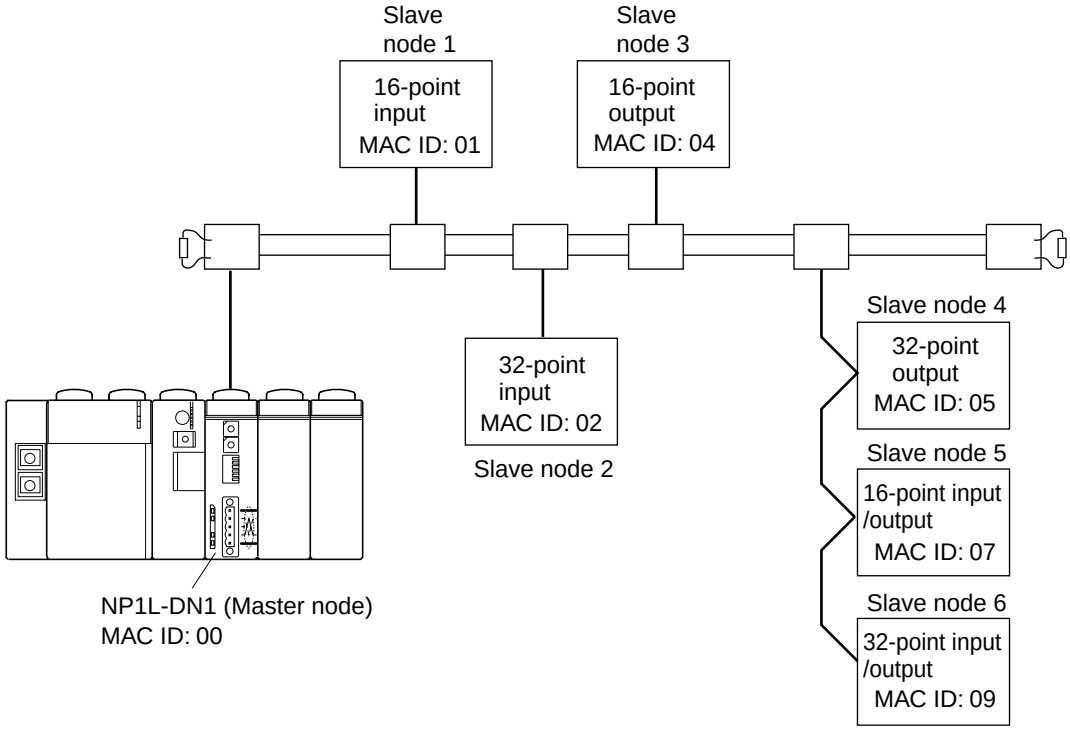
Capsule type Input 2W, Output 2W		Set type	Input 2W, Output 2W		Set type	Input 2W, Output 0W	Input 0W, Output 2W		Set type	Input 1W, Output 0W	Input 1W, Output 0W	Input 0W, Output 2W

Set type	Input 2W, Output 0W	Input 0W, Output 1W	Input 0W, Output 1W		Set type	Input 1W, Output 0W	Input 1W, Output 0W	Input 0W, Output 1W	Input 0W, Output 1W

Note 3: If an input slave device is removed, the data in the input area of that device is retained.

3-3-2 Example of address assignment

< Example of System Configuration >



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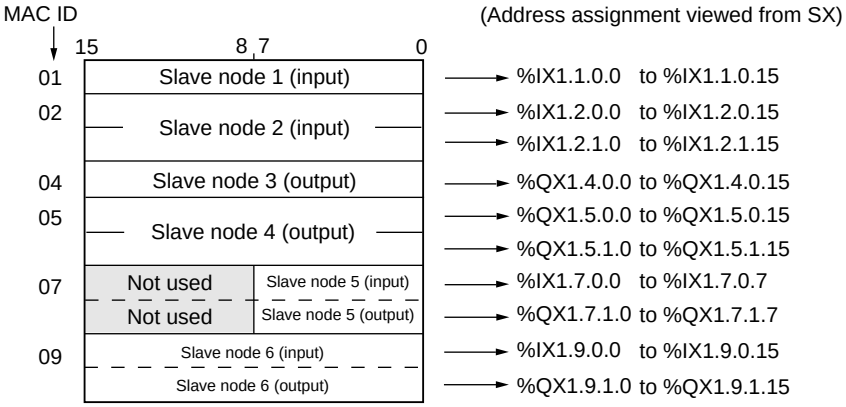
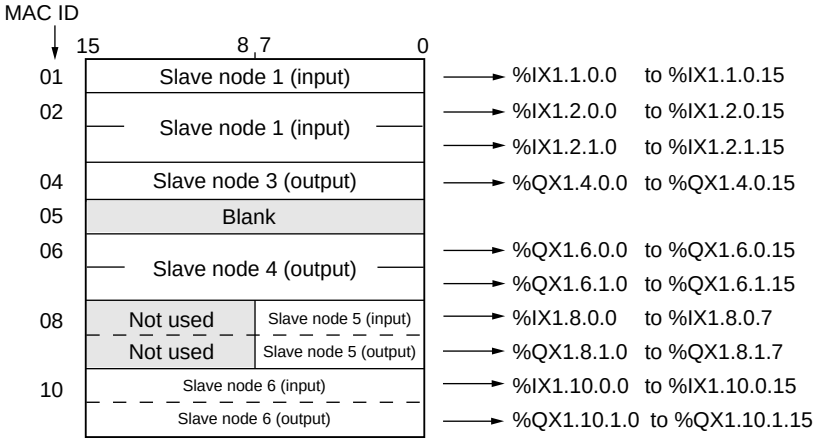


Note: When accessing slave node 4 or 6 in 32-bit data length, you need to set MAC ID to an even number. Set MAC ID as follows:



Section 4 DeviceNet Parameter Setup 1

Page

Section 4 DeviceNet Parameter Setup

4-1 Parameter Setups

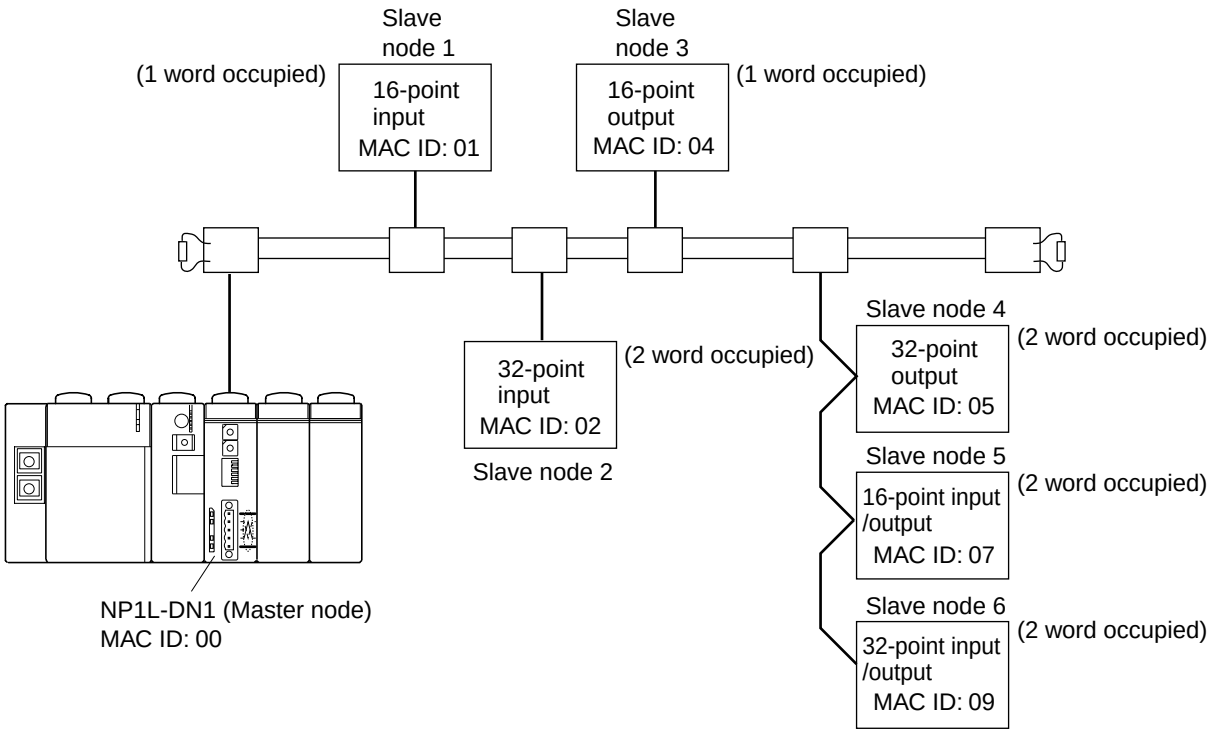
When configuring DeviceNet with the MICREX-SX Series, you need to set up the following parameters.

Category		Item	Setup location	Refer to
System Definition		System configuration registration	System Definition	P4-2 ~ P4-5
		I/O group registration	CPU parameters	P4-8, P4-9
		Compression setup		P4-10, P4-11
	10- Slave node	Number of words occupied for I/O	DeviceNet capsule parameters	P4-4, P4-5
		• Change-of-state / cyclic transmission interval • Scan type Polling / bit strobe / change-of-state / cyclic • Polling type		
	Master node NP1L-DN1	Individual hold station definition	NP1L-DN1 parameters	P4-6, P4-7
		Polling / bit strobe transmission interval		
		Inter-scan delay time		
		Background polling		

4-2-1 System configuration registration

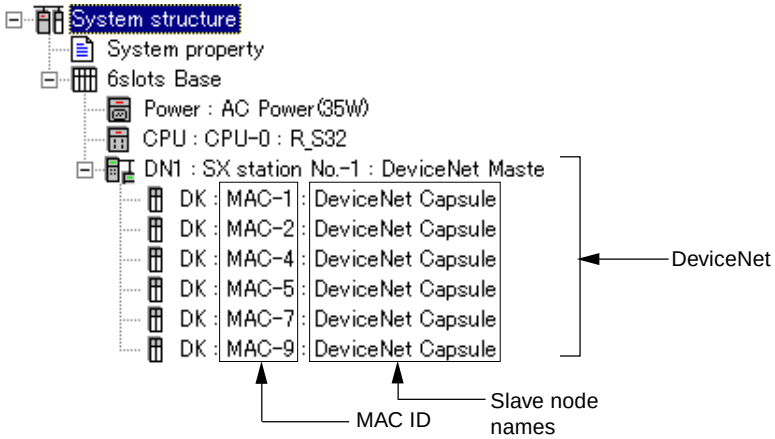
With MICREX-SX Series, you need to register the devices to be used in System Definition in the project tree at the time of system configuration. The following describes the system configuration registration procedure using an example of system configuration.

<Example of system configuration>



< System Definition Screen >

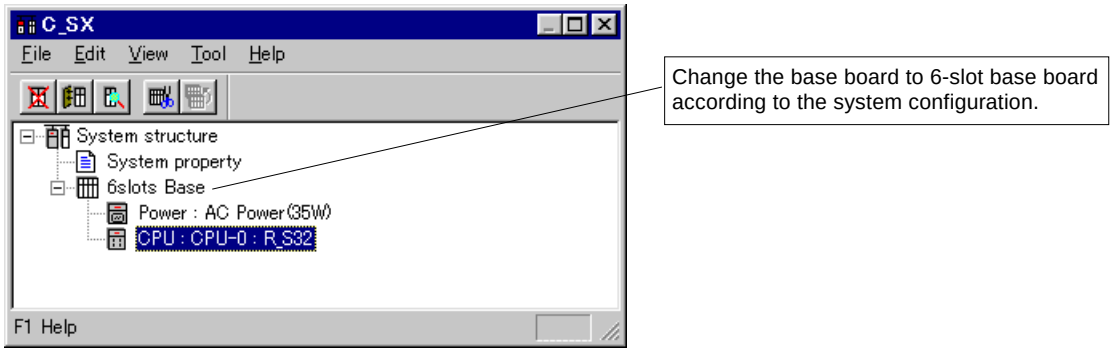
System Definition for the above system is as follows:



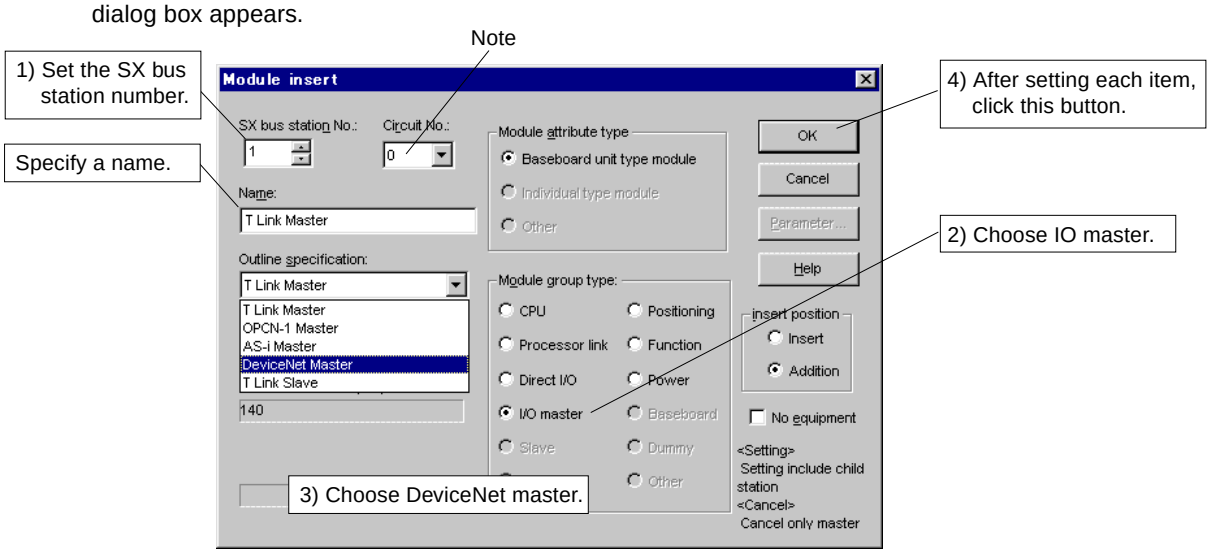
Note: MAC ID of the master node (NP1L-DN1) is set up by the MAC ID selector switch on the front panel of the NP1L-DN1 module. Be careful not to set a duplicate MAC ID with any slave node.

< Setup Procedure >

1) Double-click the [System Definition] icon of the project tree. The System Definition window appears. In the initial condition, the power supply module and the CPU module are registered in the 11-slot base board.

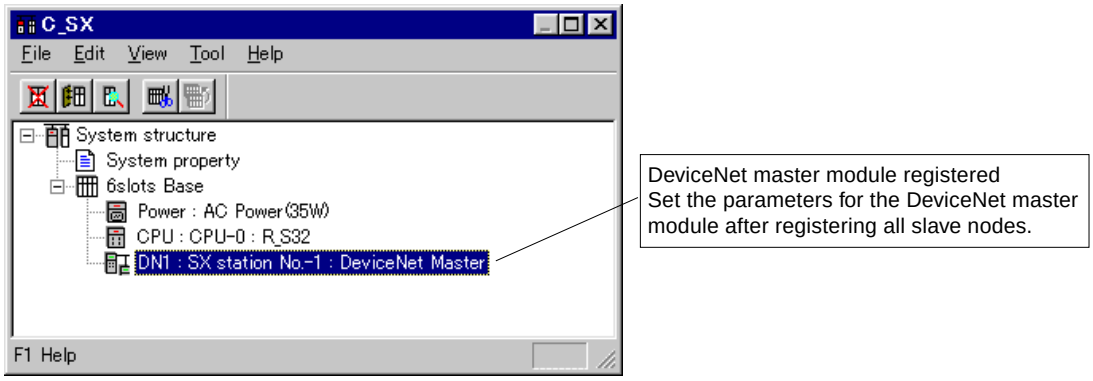


2) When you click the [Insert] button with the CPU module selected (as shown above), the following [Module Insert] dialog box appears.

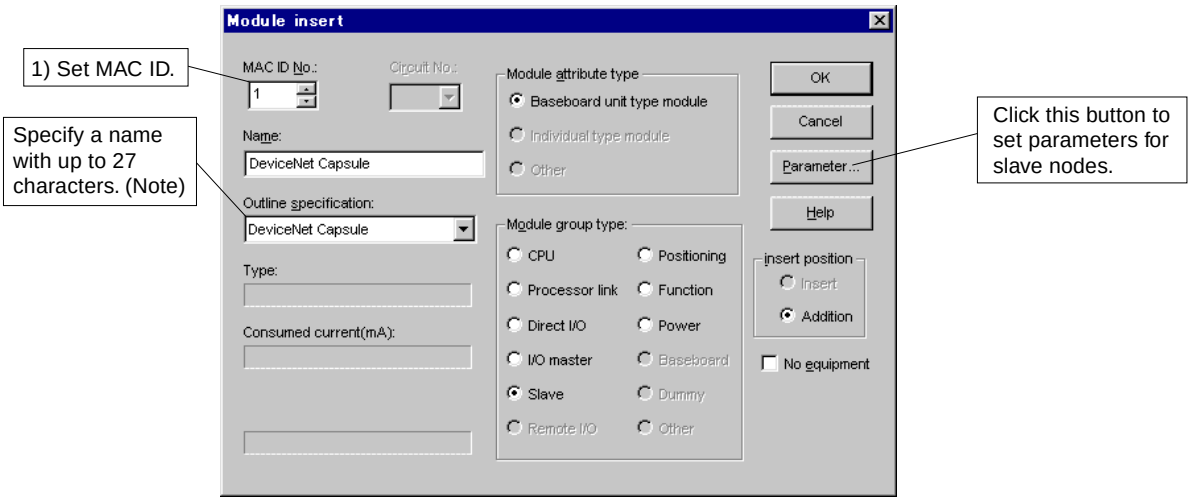


Note: The line number set here is the number of the remote I/O master (0 to 7) of the system memory (from %MW10. on).

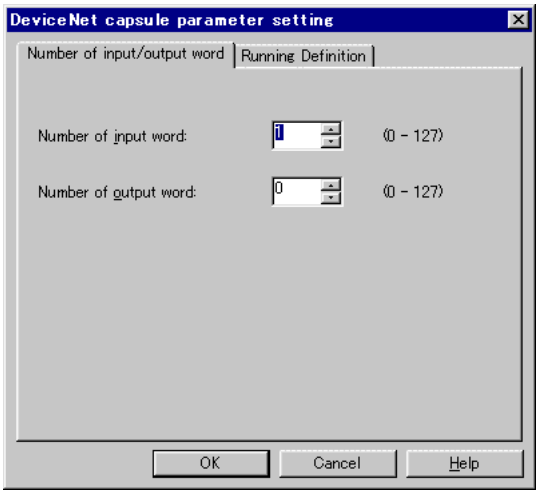
3) The DeviceNet master module is registered.



4) Then, register the slave node (DeviceNet capsule) to be connected to the master module.
When you click the [Insert] button with the DeviceNet master module selected (as shown in the screen (3)), the following [Module insert] dialog box appears.



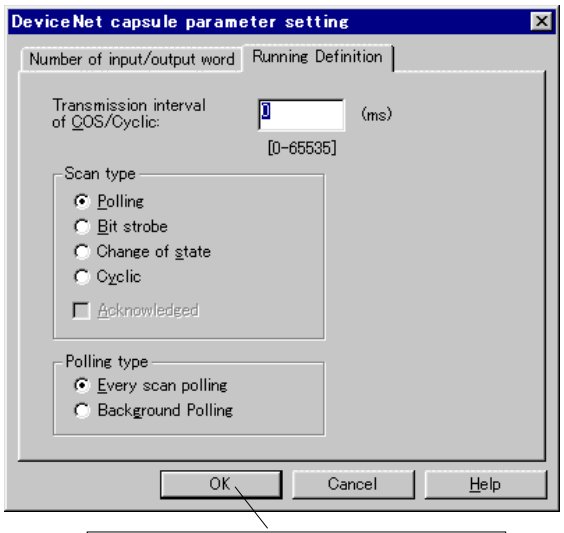
5) When you click the [Parameter...] button of the [Module insert] dialog box, the [DeviceNet capsule parameter setting] dialog box appears. First, set the number of words occupied by the I/O area of the DeviceNet capsule. With Slave node 1 in the example of system configuration, the number of words is 1 for input and 0 for output.



Note 1: The parameters for each slave node can be set even after registration of the system configuration. The MAC IDs which can be set for subsequent nodes vary according to the setting of the number of I/O words of each node. (1 word for each MAC ID)
Therefore, it is recommended that you set the number of I/O words for slave nodes at the time of registration of the system configuration.

Note 2: Before setting the number of I/O words for each slave node, be sure to check the specifications of it. For some slave nodes, the number of I/O words is used for status information, in addition to the actual number of I/O points.

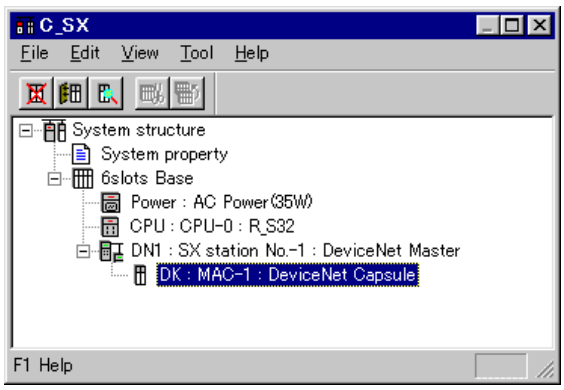
6) Click the [Running Definition] tab and then set the transmission time of change-of-state/cyclic, scan type, and polling type.



After setting each item, click this button to return to the Module Insertion dialog box.

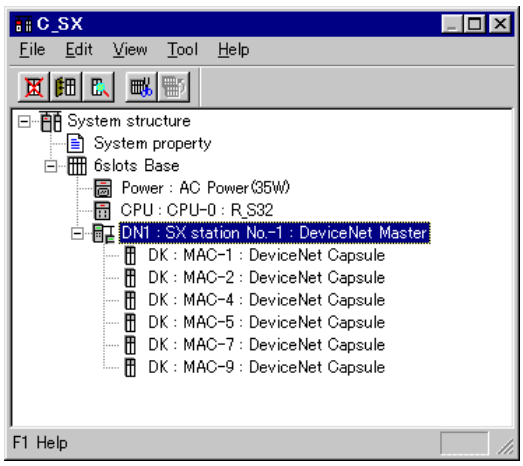
Note 1: Set the scan type according to the specifications of the slave nodes.
Note 2: When you set the scan type to change-of-state or cyclic, if you set the transmission interval to 0ms, data transmission from the node is not performed.

7) The DeviceNet capsule is registered. Register it in the same manner for other slave nodes.

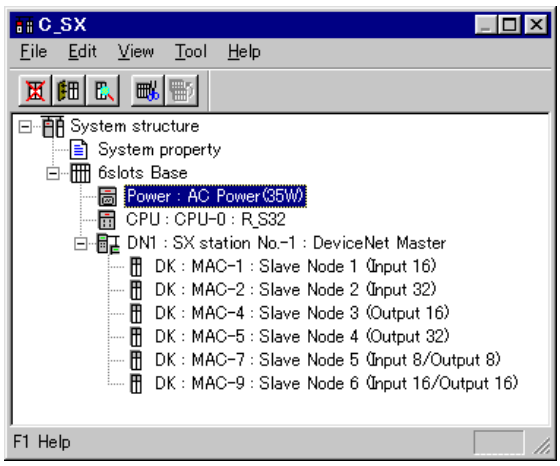


[One-Point Advice]
For slave nodes to be connected to DeviceNet, the default name is “DeviceNet capsule.” It is recommended that you change the name appropriately for each node used.

<System Registration Screen with Default Name>



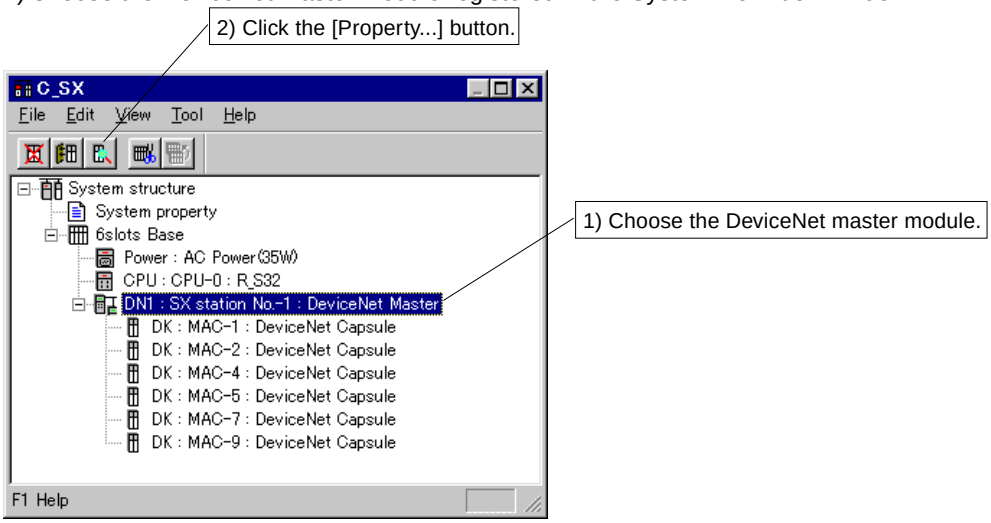
<System Registration Screen with Modified Name>



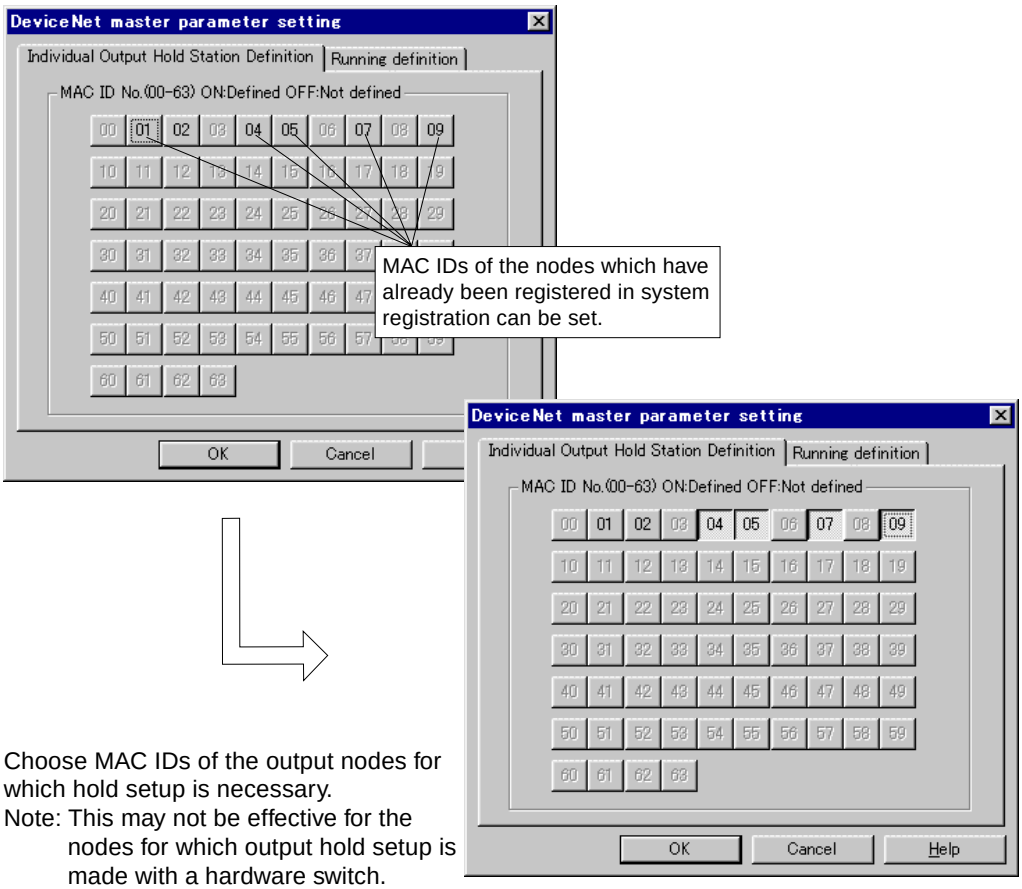
4-2-2 NP1L-DN1 (master node) parameter setup

<Setup Procedure>

1) Choose the DeviceNet master module registered in the System Definition window.



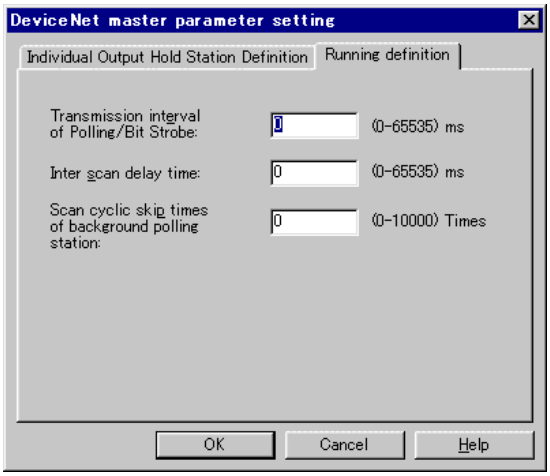
2) When you click the [Parameter...] button in the [Module property] dialog box, the [DeviceNet master parameter Setting] dialog box appears. You can choose the [Individual Output Hold Station Definition] or [Specific Operation Definition] setup panel by clicking the corresponding tab.



Choose MAC IDs of the output nodes for which hold setup is necessary.

Note: This may not be effective for the nodes for which output hold setup is made with a hardware switch. Confirm the specifications of the nodes to be used.

3) Set the Specific Operation Definition parameters of the master module.



Transmission Interval Of Polling/Bit Strobe (EPR)
The expected_packet_rate attribute value used in a slave node for which the scan method is polling or bit strobe. The attribute value multiplied by 4 is the time-out value for the slave node. If the slave node does not receive data within the time-out value, the node is removed from DeviceNet. If you set 0 as this value, this parameter is set according to the number of slave nodes connected and the transmission rate as shown in the table below.

Inter-Scan Delay Time (ISD)
The master node transmits I/O data to slave nodes, then waits for the response from them for the specified time. If you set 0 as this value, this parameter is set according to the number of slave nodes connected and the transmission rate as shown in the table below.

<EPR and ISD Values When 0 Is Set>

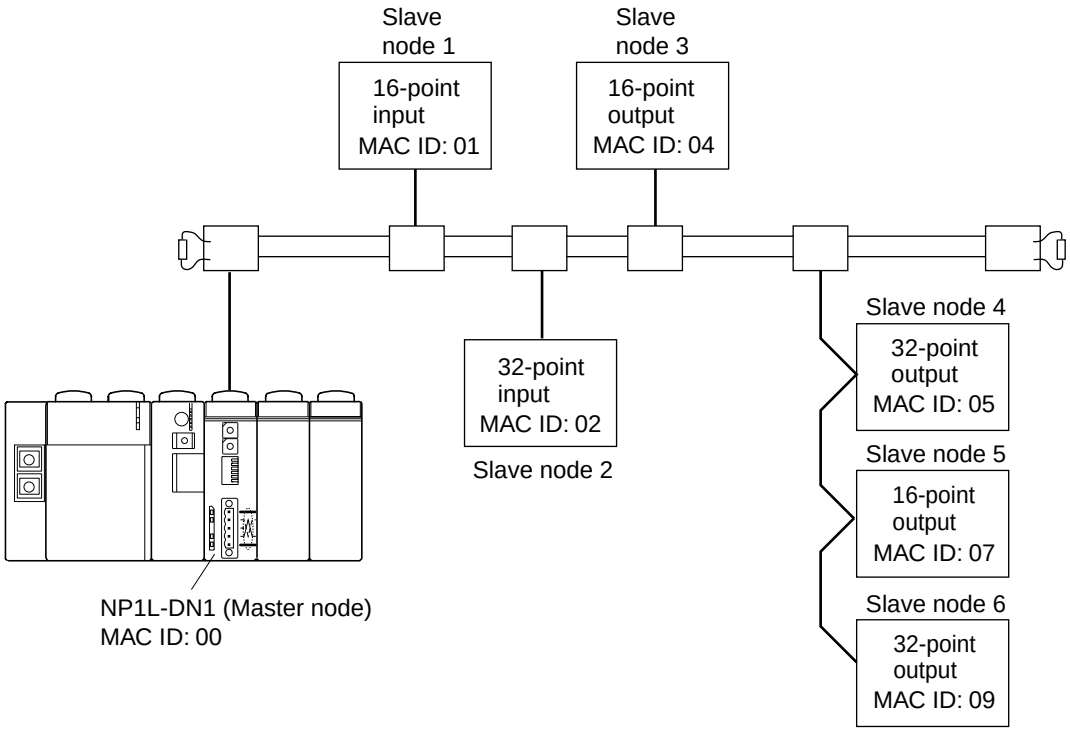
Number of slave nodes connected	Transmission rate (bps)	ERR (ms)	ISD (ms)
1 to 21	125	30	40
	250	26	36
	500	20	26
22 to 42	125	64	86
	250	50	66
	500	38	50
43 to 63	125	94	126
	250	76	100
	500	56	76

Number Of Scan Cycle Skips Of Background Polling Station
Set the number of scan cycle skips performed by the slave nodes with the background polling setting. Up to 10000 can be set. If you set 0, the polling operation which is the same as each scan polling results.

4-2-3 I/O group setup

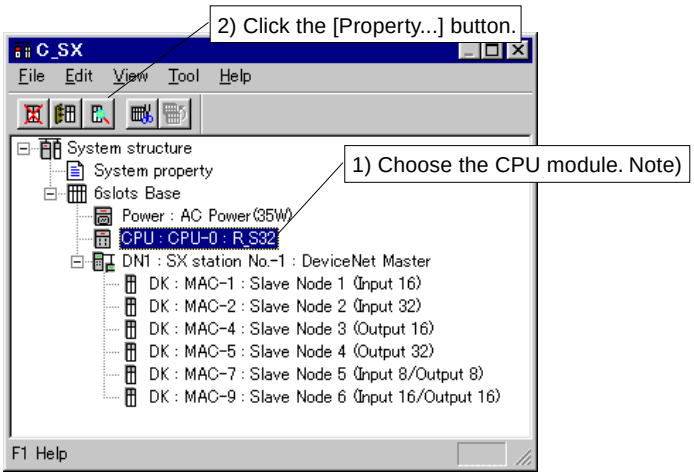
Like the I/O modules directly connected to the SX bus, I/O group setup is also necessary for the slave nodes (I/O units) on DeviceNet. Slave nodes without I/O group setup cannot be used as an I/O on application programs.

<Example of System Configuration>



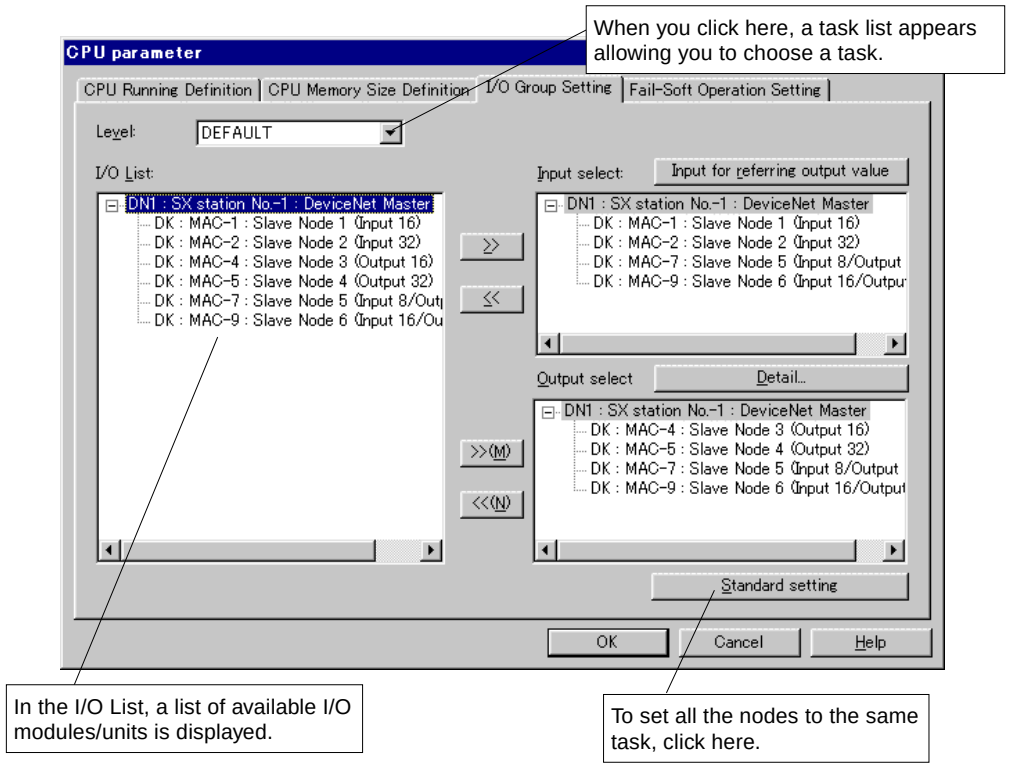
< Setup Procedure >

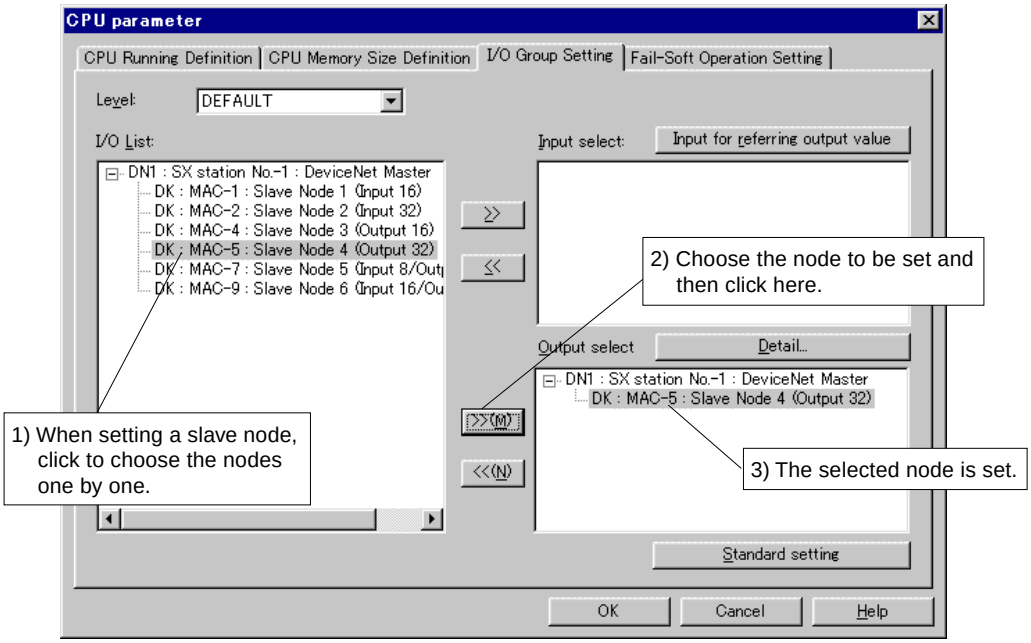
1) Make I/O group setting using the CPU parameters.



Note: A single CPU system is shown in the example of system configuration above. With a multi-CPU system which has multiple CPUs in a single configuration, you can choose the slave nodes to be controlled for each CPU.

2) When the [Module property] dialog box of the CPU module appears, click the [Parameter...] button. When the [CPU parameter] dialog box appears, click the [I/O Group setting] tab.

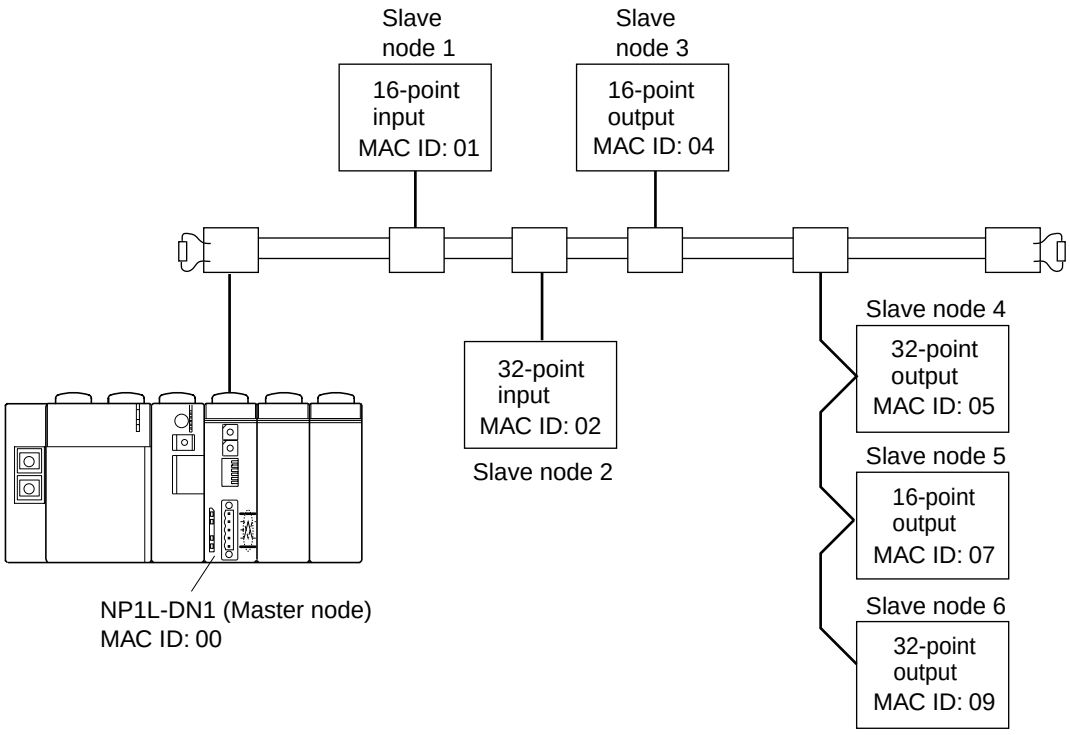




4-2-4 Compression setup

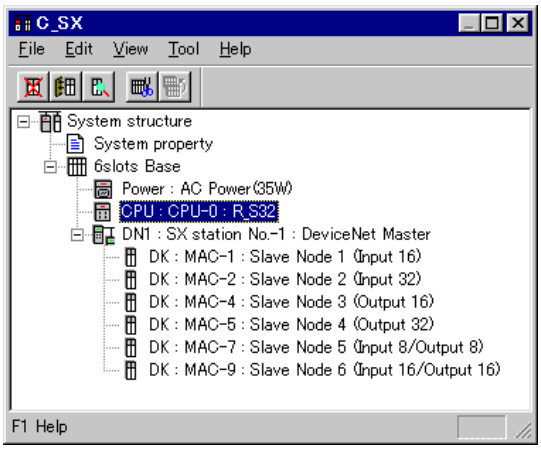
The compression operation is an operation mode in which operations of normal modules or capsules are continued even if any remote I/O module or capsule on the SX bus or DeviceNet fails.
Registration of Compression Operation is performed by parameter “Compression Setup” for the CPU module.

<Example of System Configuration>



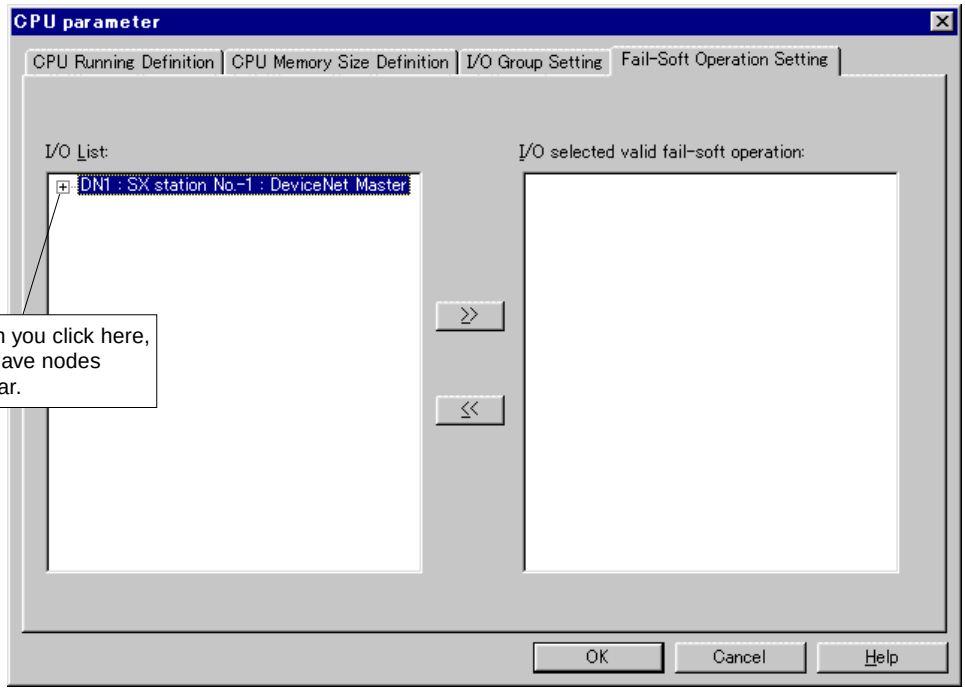
<Setup Procedure>

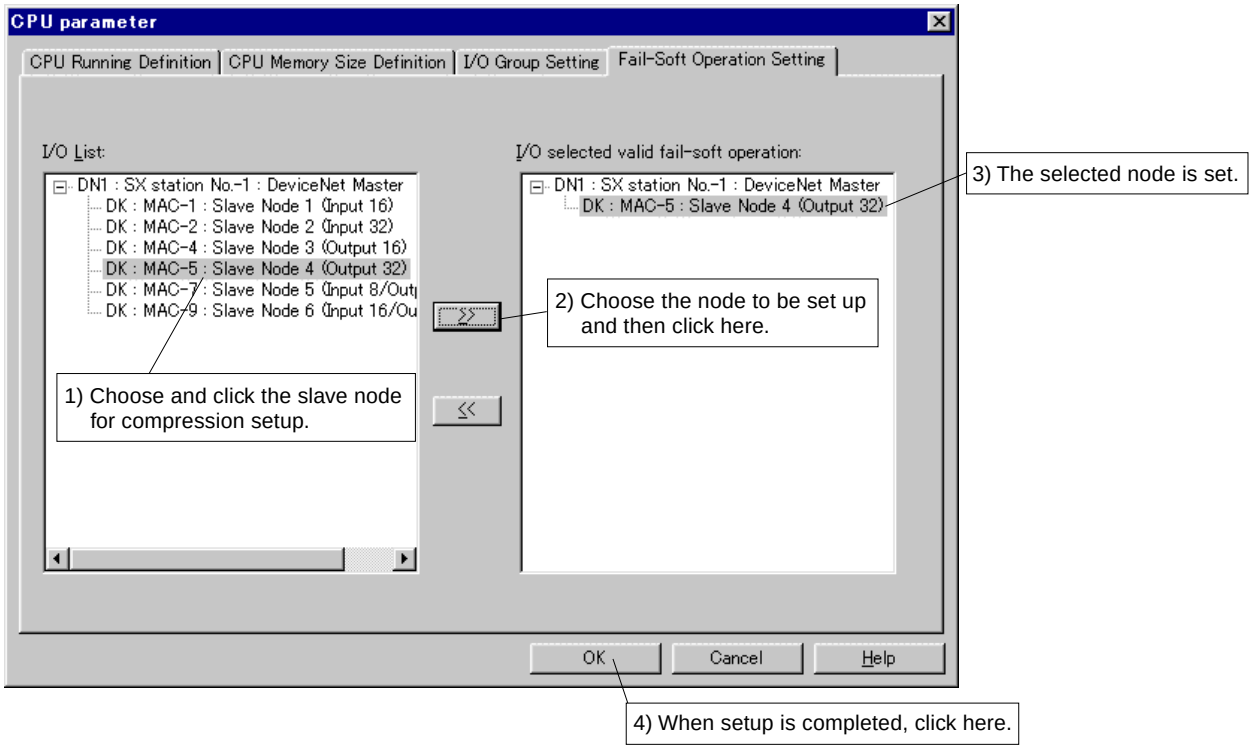
1) Make I/O group setting using the CPU parameters.



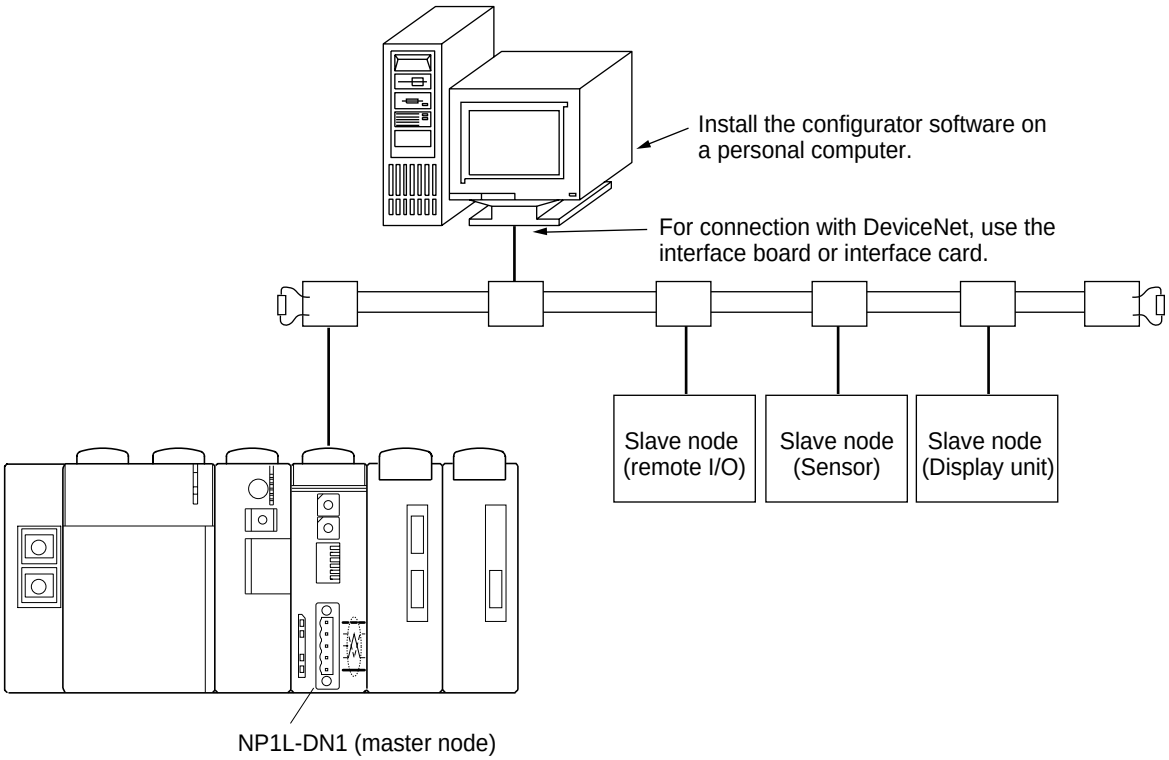
Note: A single CPU system is shown in the example of system configuration above. With a multi-CPU system which has multiple CPUs in a single configuration, you can choose the slave nodes to be controlled for each CPU.

2) When the [Module property] dialog box of the CPU module appears, click the [Parameter...] button. When the [CPU parameter] dialog box appears, click the Compression Setup tab.





The use of a commercial configurator allows you to confirm and specify the number of I/O points and the scan type of slave nodes.



<Introduction Of Configurator>
The following configurators are recommended.

Type	Maker	Format	Remarks
Interface board	Allen-Bradley	1784-PCIDS	PCI bus
Interface card	Allen-Bradley	1784-PCD	PCMCIA
Interface card	SST	5136-DN-PCM	PCMCIA
Configurator software	Allen-Bradley	DeviceNet Manager	Operating environment (Windows3.1/95/98/ NT(Ver3.51)/NT(Ver4.0)) Customized to Japanese version by Japan System Development (NSD).
Configurator software	NSD	DeviceNet Wizard	V1.00J(Japanese version)/V1.00E(English version) Operating environment (Windows3.1/95/98/ NT(Ver3.51))

* For the usage of configurator, refer to the manual of the product used.

Section 5 Communication Application

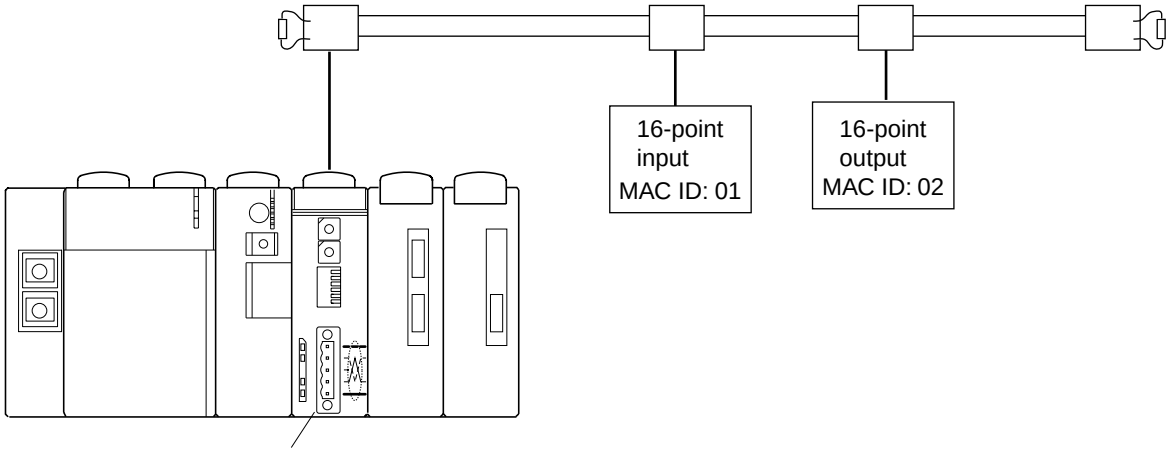
Page

Section 5 Communication Application

5-1 Accessing I/O Capsules on DeviceNet

Accessing I/O capsules on DeviceNet can be programmed in the same manner as I/O modules connected to the SX bus.

<Example of System Configuration>



<Example of Operation>

In the example above, when switch 0 is connected to bit 0 of the 16-point input capsule and indicator 0 is connected to bit 0 of the 16-point output capsule, turning switch 0 ON or OFF turns indicator 0 ON or OFF.

<Sample Program>

Code work sheet

Variable work sheet

```
1    VAR
2        Switch0   AT %IX1.1.0.0  :   BOOL;
3        Lamp0     AT %QX1.2.0.0  :   BOOL;
4    END_VAR
5
```

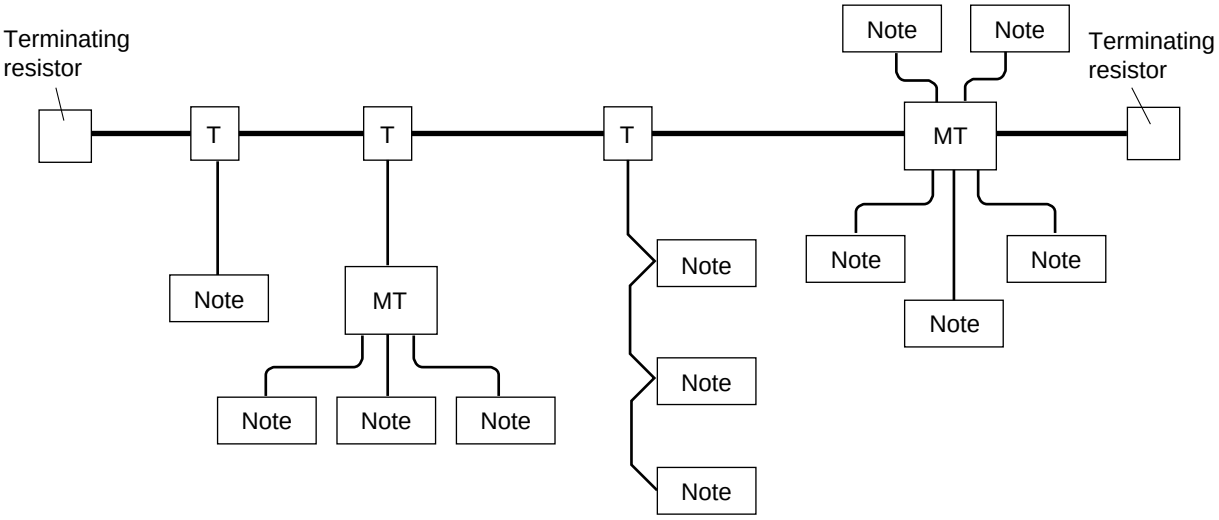
Bit address
Word No.
DeviceNet NAC ID
SX bus station No.

Section 6 Wiring Connections

Page

Section 6 Wiring Connections
6-1 DeviceNet Connections

There are two different node connection formats: T-link connection and daisy chain connection.



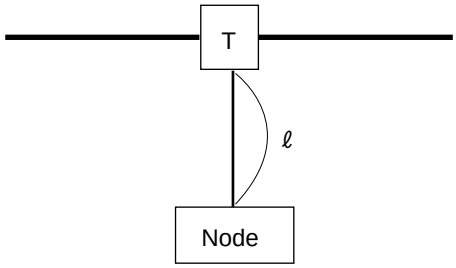
<Key Points Of Network Configuration>

- The thick cable and thin cable can be used for both the trunk line and drop lines.
- The network distance between terminals depends on the data transmission rate and cable thickness. For details, refer to Section 2-2, “DeviceNet Communication Specifications.”
- The power of the nodes is supplied directly from the DeviceNet cable, allowing data transmission using the same cable.
- Nodes can be added to or removed from the network without turning the network power OFF.
- The power tap can be added to any point in the network, allowing the power to be supplied to multiple points.
- The rated current of the trunk line (thick cable) is 8A. The rated current of the thin cable is 3A.

6-1-1 T-Link connection

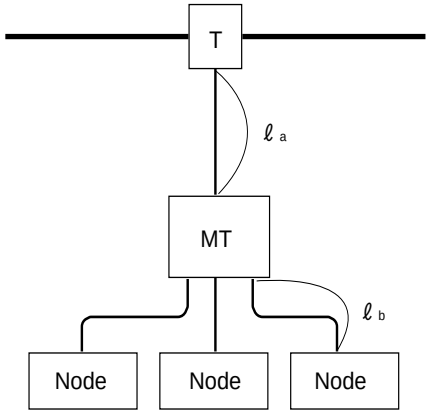
With T-link connection, drop lines are branched from the trunk line or a drop line through a T-link tap for node connection. The distance from the tap to the end of a drop line must be 6m or less.

1) Linking a drop line from the trunk line through a T-link tap



$\ell \leq 6m$

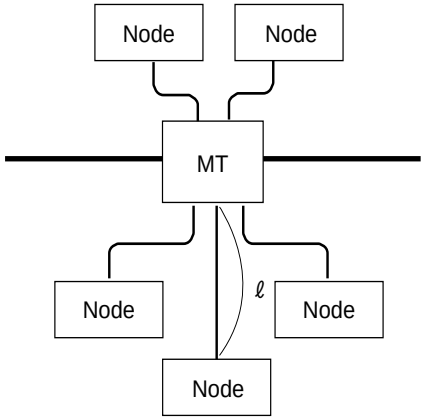
2) Linking a drop line from the trunk line through a T-link tap and then linking multiple drop lines through a multi-tap



$\ell_a + \ell_b = \ell \leq 6m$

ℓ_a: Drop line length from T-link tap to multi-tap
ℓ_b: Drop line length from multi-tap to the farthest node

3) Linking multiple drop lines through a multi-tap



$\ell \leq 6m$

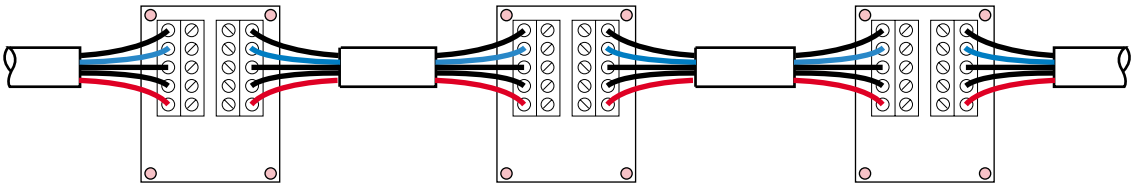
ℓ : Drop line length from multi-tap to the farthest node

Note: The total length of drop lines for a single DeviceNet is limited, as shown below.

Transmission rate	Total length of drop lines
125kbps	156m
250kbps	78m
500kbps	36m

6-1-2 Daisy chain connection

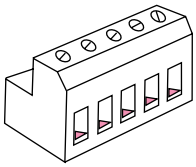
In daisy chain connection, a node is connected directly to the trunk line or drop line in the form of daisy chain. Usually, the daisy chain connection is used for an open type node (for in-panel installation) with an open type connector.



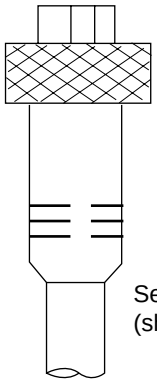
To connect the NP1l-DN1 in daisy chain form, use an open type connector with two signal terminals (TMSTBP2.5/5-STF-5.08AU) from Phenix Contact). The connector supplied with the NP1L-DN1 cannot be used because it is provided with only one signal terminal.

6-2-1 DeviceNet connector types

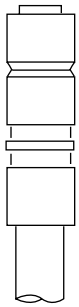
There are the following types of connectors used for DeviceNet. Since the connector type differs according to the slave node used, you need to prepare the connectors which suit the slave devices used at the time of line connection.



Open type screw connector
(non-shielded type)



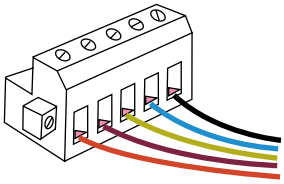
Sealed type mini-connector
(shielded type)



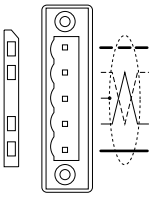
Sealed type micro-connector
(shielded type)

6-2-2 Connector pin assignment

(1) Open Type Screw Connector



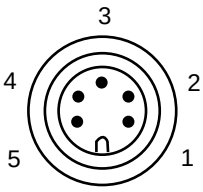
Cable side connector (male)



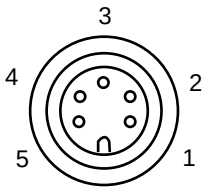
5: Black (OV)
4: Blue (CAN_L)
3: Shielded line (drain)
2: White (CAN_H)
1: Red (+24VDC)

Module side connector (female)

(2) Sealed Type Mini-Connector



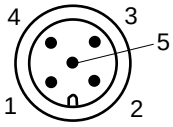
Male (pin)



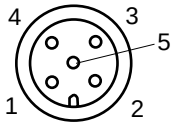
Female (socket)

1: Shielded line (drain)
2: Red (+24VDC)
3: Black (OV)
4: White (CAN_H)
5: Blue (CAN_L)

(3) Sealed Type Micro-Connector



Male (pin)



Female (socket)

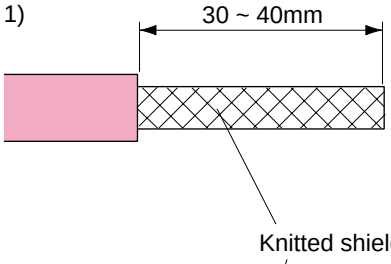
1: Shielded line (drain)
2: Red (+24VDC)
3: Black (OV)
4: White (CAN_H)
5: Blue (CAN_L)

6-3-1 Cable processing

The NP1L-DN1 uses an open type screw connector. Follow the steps below to process the cable and then connect it to the connector.

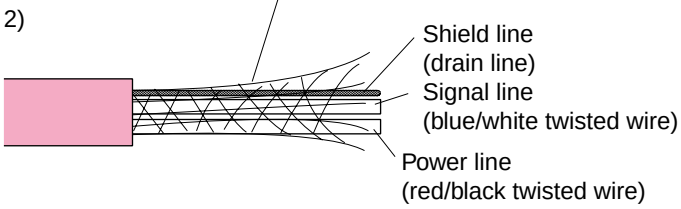
< Processing Procedure >

1)



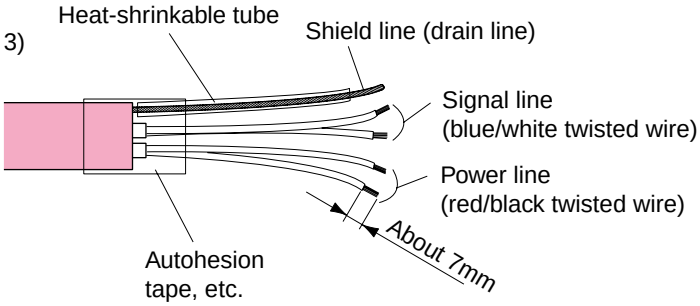
1) Leaving the knitted shield of the cable, cut off the cable coating by 30 to 40mm.

2)



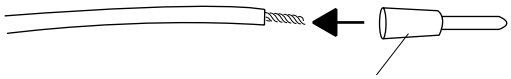
2) Loosen the knitted shield, then you can see the shield wire, and the signal line and power line around which Mylar tape separately aluminum-plated is wound.
Cut off the knitted shield being careful not to damage the shield wire, signal line, and power line.

3)



3) Process the uncoated portion of the cable using autohesion tape or heat-shrinkable tape. Then, remove the Mylar tape wound around the signal line and power line.
Peel off the coat of the cable by 7mm or around.
Perform insulation processing of the shield wire using heat-shrinkable tube.

4)

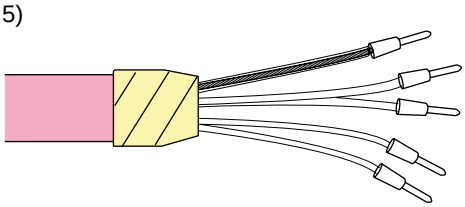


Solderless terminal
(AI series from Phenix Contact recommended)

4) Strand the signal line, power line, and shield wire together, then attach a solderless terminal.

Note: For clamping, a specialized tool (ZA3 from Phenix Contact) is required.

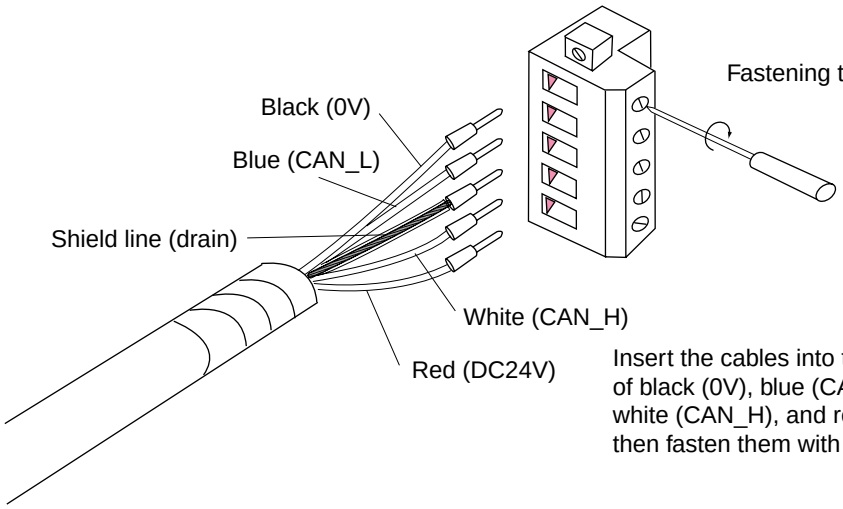
5)



5) The cable processed is shown at left.

6-3-2 Attaching cable to connector

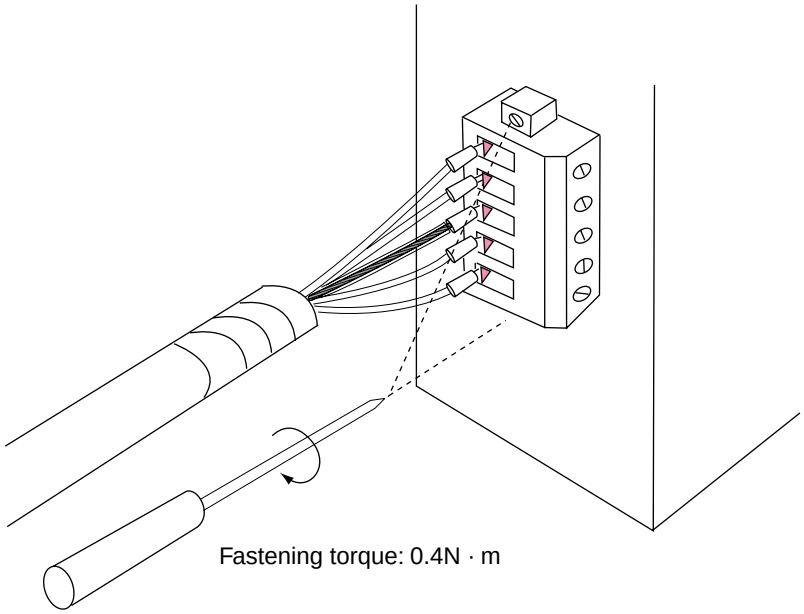
Attach the terminal-processed cable to the supplied open type screw connector (TMSTBP2.5/5-STF-5.08AU from Phenix Contact).



Insert the cables into the connector in order of black (0V), blue (CAN_L), shield wire (drain), white (CAN_H), and red (+24VDC) from the top, then fasten them with a screw driver.

6-3-3 Attaching connector to DeviceNet connector on front panel of module

Attach the connector to the DeviceNet connector on the front panel of the module.

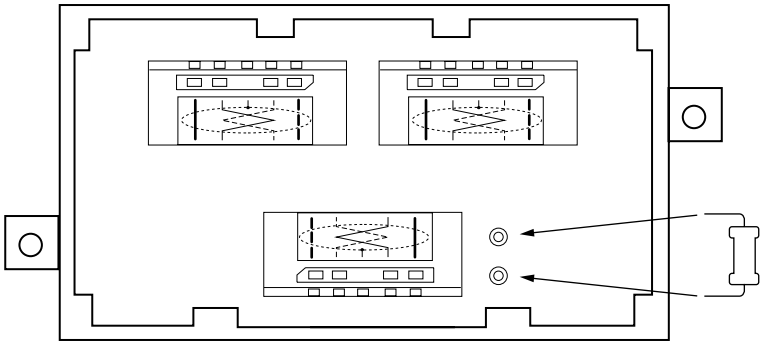


6-4 Connecting Terminating Resistor

With DeviceNet, you need to connect a terminating resistor (121ohms, 1%, 1/4W, metal-film resistor) at both terminals of the trunk line.

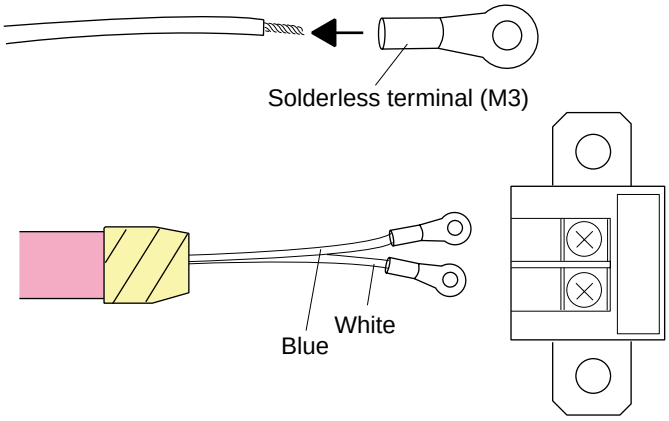
(1) Attaching a Terminating Resistor to T-Link Tap from OMRON

Insert the terminating resistor supplied with the T-link tap into the attachment position on the T-link tap. For details, refer to the manual of the T-link tap from OMRON Corporation.



(2) Using a Terminal-Type Terminating Resistor from OMRON

Process the terminal of the trunk line as shown below, then fix it to the terminal of a terminal-type terminating resistor using a screw. For details, refer to the manual of the terminating resistor from OMRON Corporation.

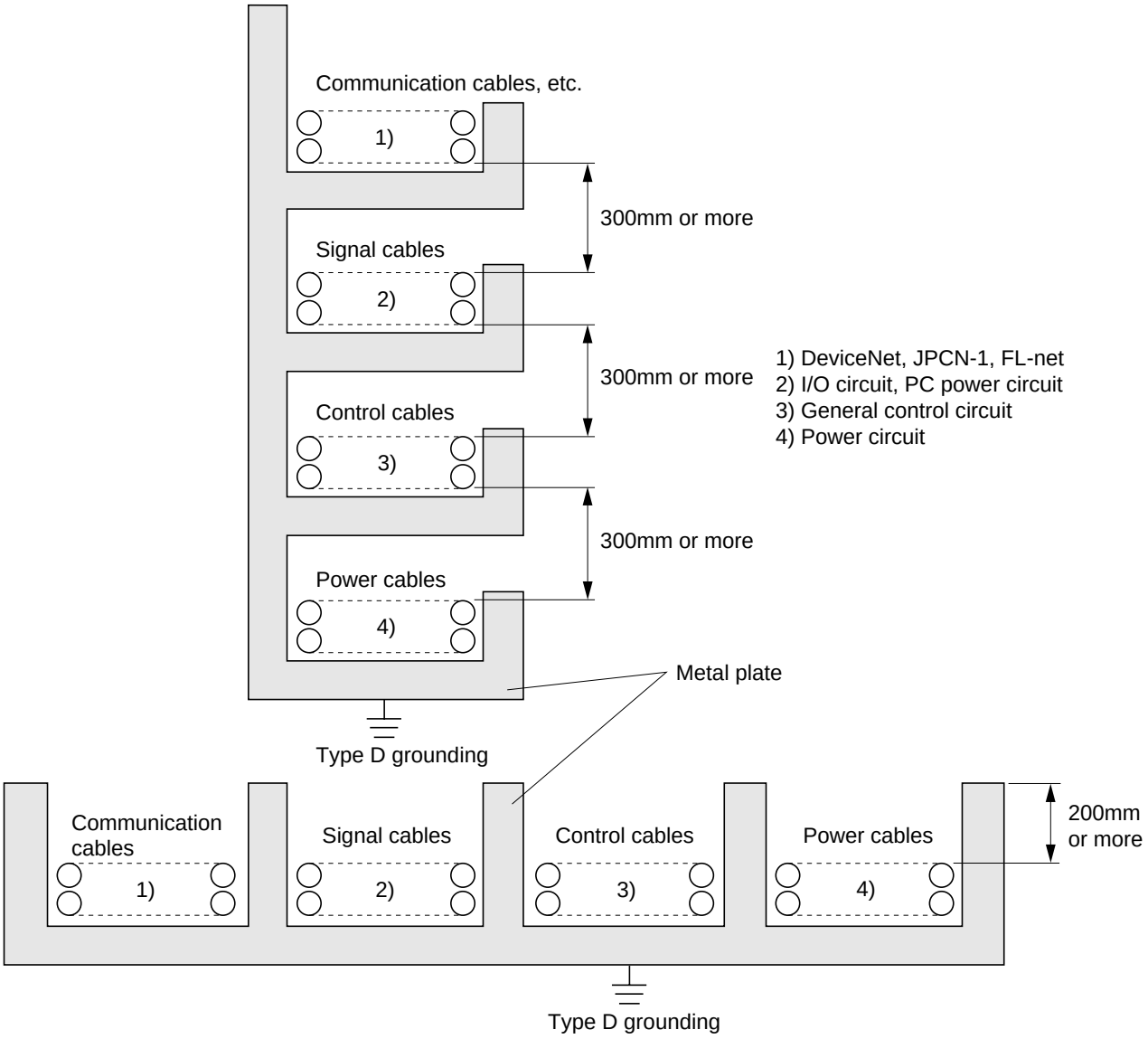


[Reference]

The information on DeviceNet-related products from OMRON Corporation can be downloaded from the home page of OMRON Corporation.

http://www.omron.co.jp/ib-info/products/prd/cbd/CBD1.htm

(1) Before removing a connector, remove the connector mounting screws.
(2) Separate the communication cable from high-voltage line or power line. Avoid wiring the communication cable together with a high-voltage or power line.
(3) The following cable installation is recommended. Be sure to use shielded cables.

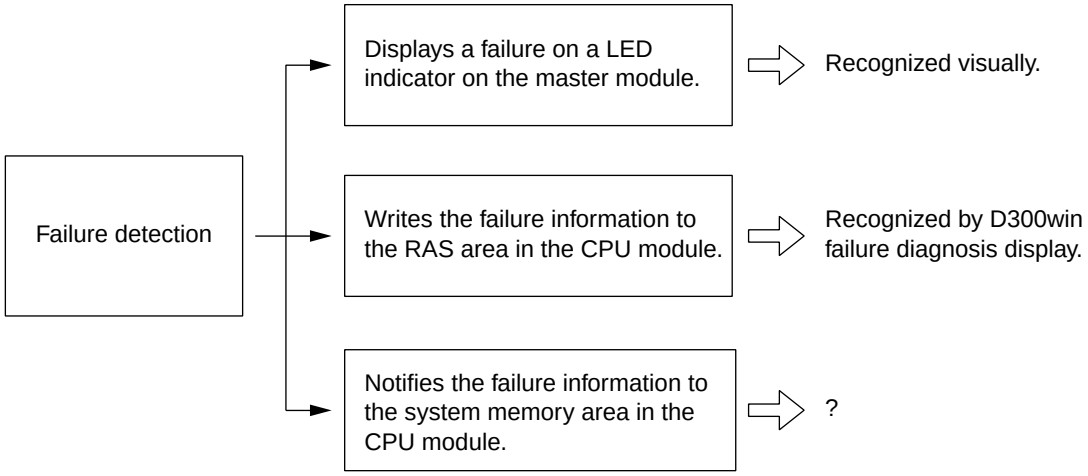


Section 7 Troubleshooting

Page

Section 7 Troubleshooting
7-1 Operating Status LED Indicators

The NP1L-DN1 DeviceNet master module always monitors itself and the DeviceNet system managed by it.
If a failure occurs, the failure information is displayed by the corresponding LED indicator on the module and transferred to the SX Series CPU module. The NP1L-DN1 is provided with the self-diagnostic function which is performed by front panel switch operation.



7-1-1 LED indicator lighting conditions

The lighting condition for each LED indicator of the NP1L-DN1 is shown below.

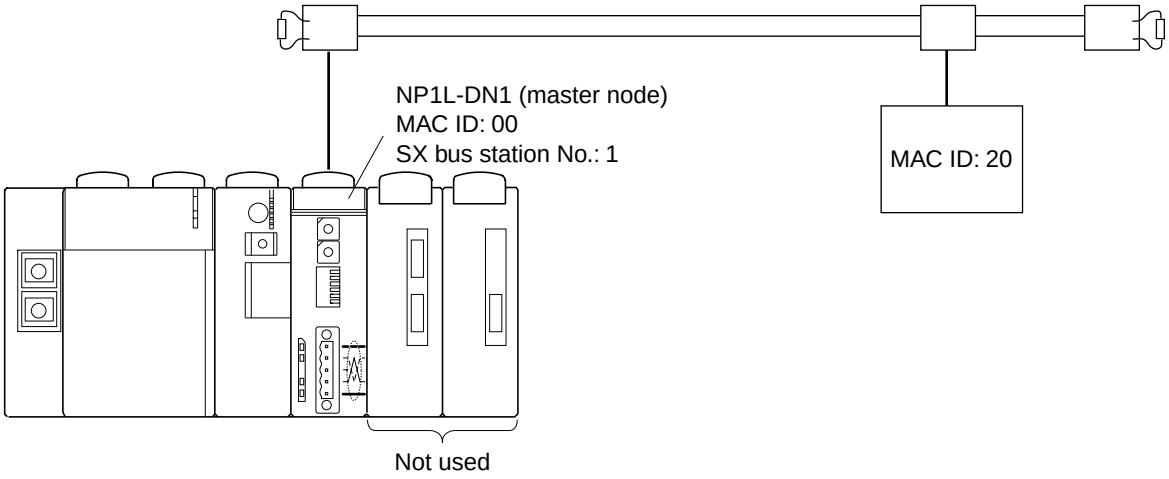
☼: ON ◐: Blink ● : OFF

Symbol	Color	Status	Condition
ONL	Green	☼	The module is normally connected to the SX bus and normally operating.
		◐	The SX system is being activated (SX bus connection in progress).
		●	• The system power is turned OFF. • A fatal fault occurs in this module, resulting in inoperable condition.
ERR	Red	☼	• A hardware failure occurs in this module. (Internal LSI or memory failure) • Bus off (The CAN chip in this module detected a line failure.)
MS	Green	☼	This module is normally operating.
	Red	☼	An unrecoverable failure occurs in this module.
		◐	Blinks in green and red during self-diagnosis (initialization).
	–	●	The system power is not supplied.
NS	Green	☼	The network is normally operating (duplicated MAC ID check completed).
		◐	Duplicated MAC ID check is completed. The set slave node is not present.
	Red	☼	• Duplicated MAC ID • Bus off (The CAN chip in this module detected a line failure.)
	–	●	• Duplicated MAC ID check is not completed. • The network power is not supplied from the DeviceNet connector.
T/R	Green	☼	Data transmission is being executed. (This indicator may seem blinking depending on the communication condition.)
SER	Red	☼	System Definition contains an incorrect setting.

7-2 DeviceNet Failure Analysis by D300win

If a failure occurs in the DeviceNet system configured by NP1L-DN1, you can perform failure diagnosis using D300win.

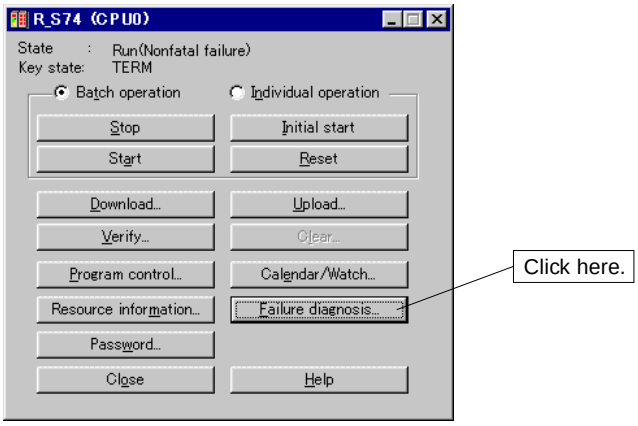
<Example of System Configuration>



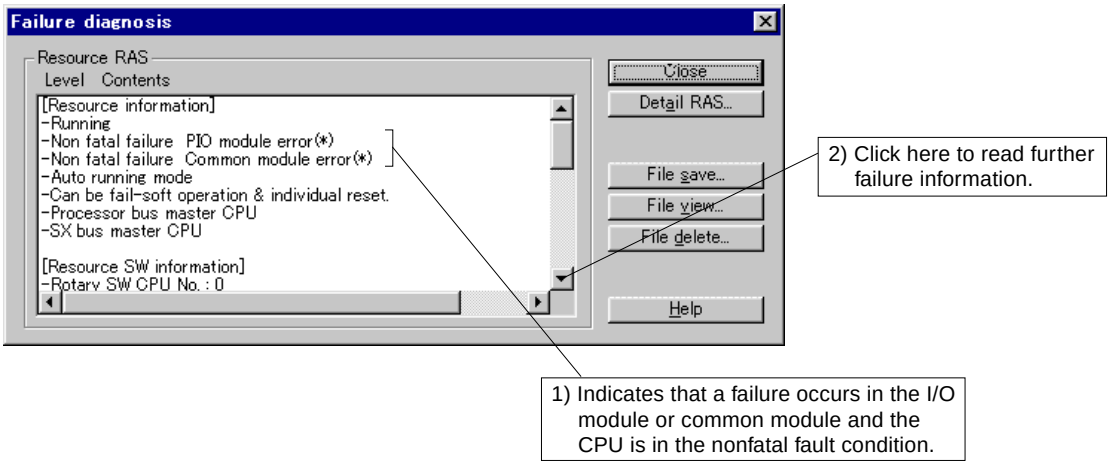
<Diagnosis Procedure>

The following describes the diagnosis procedure for the example above.

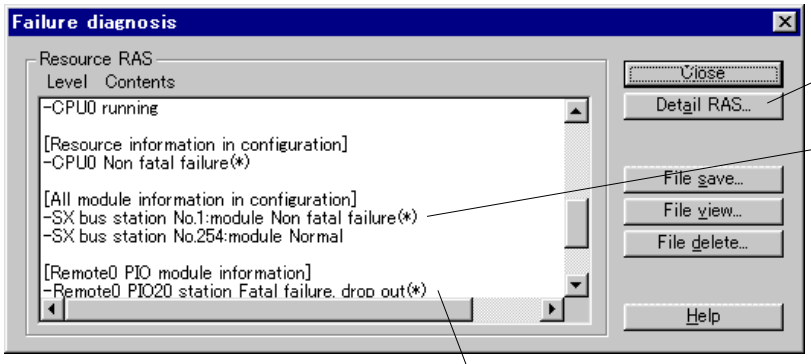
1) Connect D300win to the CPU module of the MICREX-SX Series, then display the [Control] dialog box.



2) The [Failure Diagnosis] dialog box appears.



7-2 DeviceNet Failure Analysis by D300win

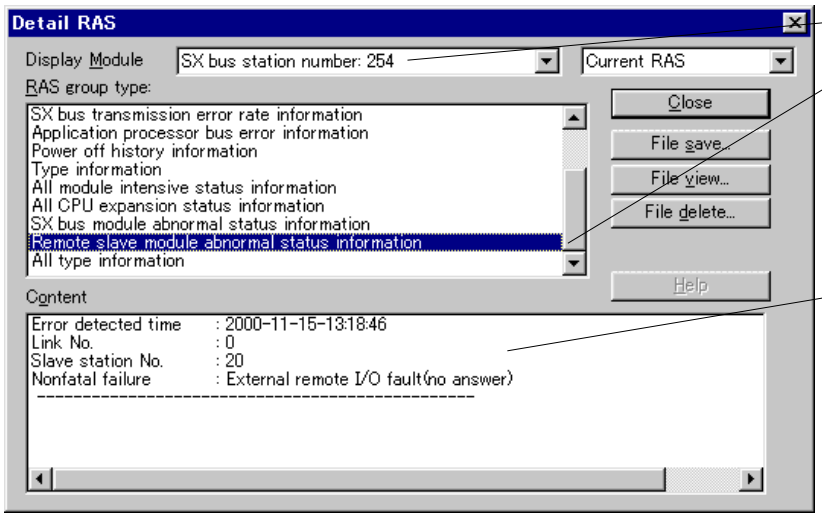


3) If the failure location is identified, click here.

1) Indicates a nonfatal fault occurs in the DeviceNet master module.

2) A fatal fault occurs in the remote I/O station (slave node with a MAC ID of 20) and it is removed from DeviceNet. (A cause of a nonfatal fault of the DeviceNet master module)

3) The Detailed [RAS] dialog box appears. First check the failure information notified to the CPU module.

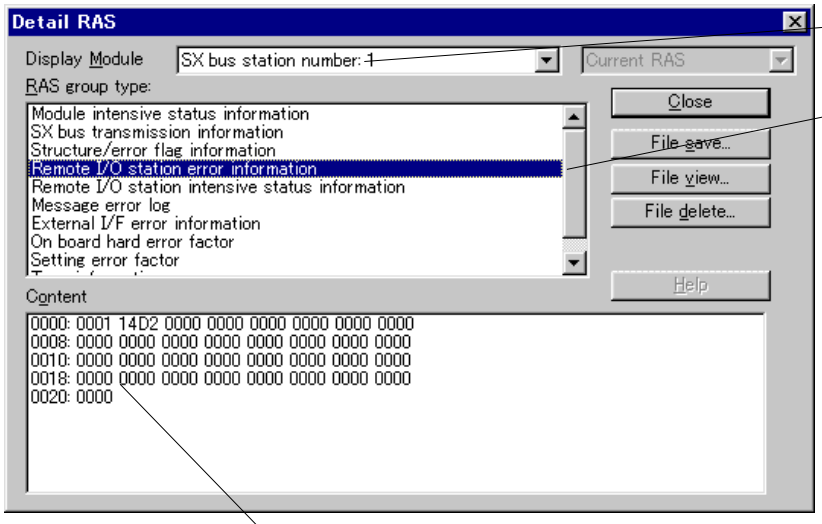


CPU is selected.

2) Choose here because the cause of fault is removal of a DeviceNet slave node with a MAC ID of 20.

3) The latest failure condition is displayed here, together with the time of occurrence. If the system power is turned ON, the failure history is also displayed.

4) Display the detailed RAS of the DeviceNet master module (with an SX bus station number of 1).



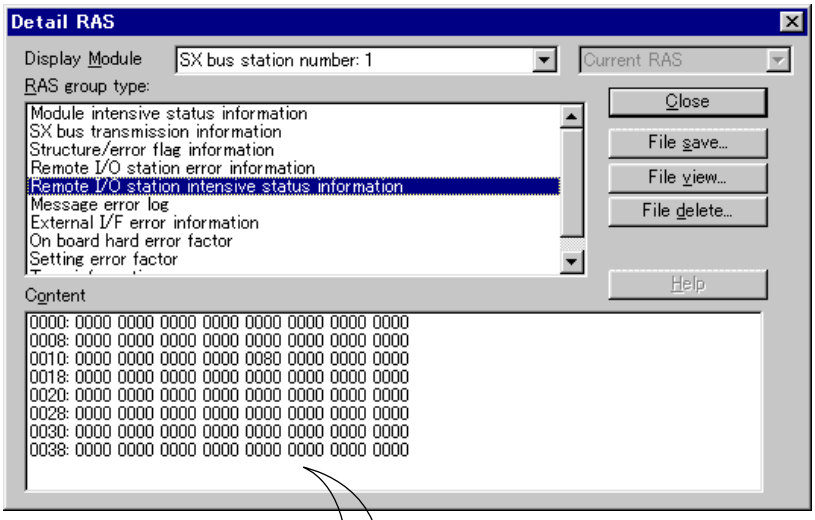
1) Choose the DeviceNet master module.

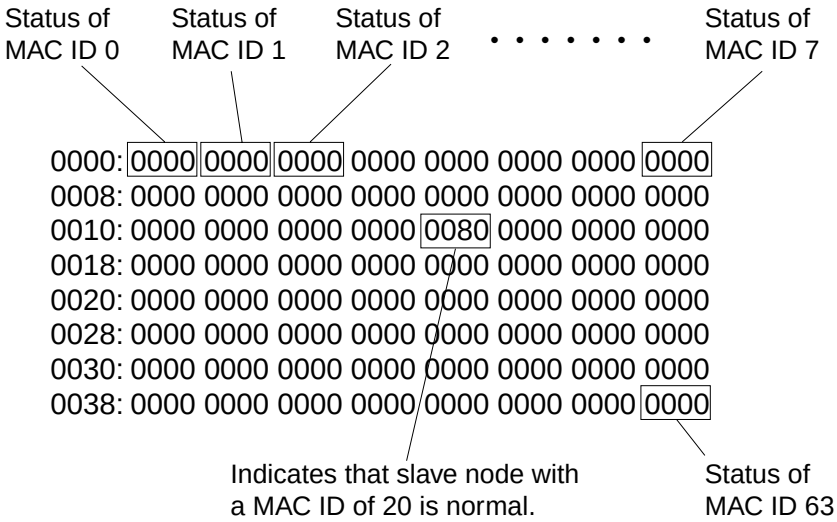
2) Choose it here.

* The following 2 different failure codes are prepared:
D1: Remote I/O station configuration mismatched
D2: Remote I/O station removed

3) 0001: Indicates that a failure occurs in a slave node. If a failure occurs in two slave nodes, 0002 results.
14D2: Indicates that the MAC ID of the failed slave node is 14 (hex) (with a MAC ID of 20). 3) D2 is a code indicating the failure information.

5) When you choose Remote I/O Station Collected Status Information, you can check the condition of all the slave nodes connected to the DeviceNet master module.





* The slave node status is shown by the following 3 different codes:
  0080: Normal
  00D1: Remote I/O station configuration mismatched
  The configuration on System Definition does not agree with the actual configuration.
  00D2: Remote I/O station removed
  There is no response to the master module because of a dislocated cable, slave node fault, etc.

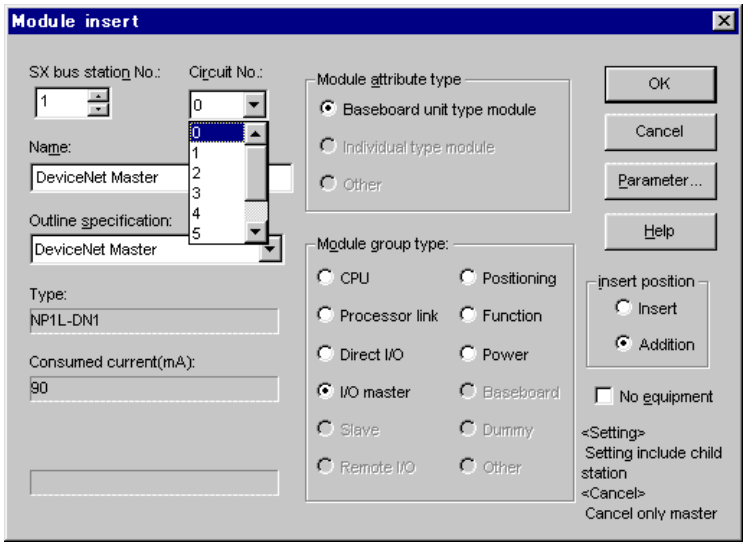
The system memory in the CPU module contains the flags for the remote I/O master modules (DeviceNet master, T-link master, and JPCN-1 master).

(1) I/O Module Failure (%MX10.2.5)
This bit is set to ON if a failure occurs in the I/O module on the SX bus and the remote I/O modules set to the CPU module as “I/O Group Registration” and compression setting is not made for them. If compression setting is made for the failed I/O module, the entire system continues operation.

(2) Remote I/O Master Initialization Failure (%MX10.25.0 to %MX10.25.7)
If a failure occurs during initialization of the DeviceNet master module, the corresponding bit is set to ON.

%MX10.25.0	Remote I/O master 0 operation definition failure
%MX10.25.1	Remote I/O master 1 operation definition failure
%MX10.25.2	Remote I/O master 2 operation definition failure
%MX10.25.3	Remote I/O master 3 operation definition failure
%MX10.25.4	Remote I/O master 4 operation definition failure
%MX10.25.5	Remote I/O master 5 operation definition failure
%MX10.25.6	Remote I/O master 6 operation definition failure
%MX10.25.7	Remote I/O master 7 operation definition failure

Note: The number of the remote I/O master is set by “Line Number” in the [Module insert] dialog box or [Module property] dialog box.



For example, if you set the line number to 0, the DeviceNet master module becomes “Remote I/O Master 0.”

(3) Remote I/O Master I/O Module Configuration / Failure Information (%MW10.128 to MW10.255)

%MW10.128 ≀ %MW10.135	Remote I/O master 0 I/O module configuration information
%MW10.136 ≀ %MW10.143	Remote I/O master 0 I/O module failure information
%MW10.144 ≀ %MW10.151	Remote I/O master 1 I/O module configuration information
%MW10.152 ≀ %MW10.159	Remote I/O master 1 I/O module failure information
%MW10.160 ≀ %MW10.167	Remote I/O master 2 I/O module configuration information
%MW10.168 ≀ %MW10.175	Remote I/O master 2 I/O module failure information
%MW10.176 ≀ %MW10.183	Remote I/O master 3 I/O module configuration information
%MW10.184 ≀ %MW10.191	Remote I/O master 3 I/O module failure information
%MW10.192 ≀ %MW10.199	Remote I/O master 4 I/O module configuration information
%MW10.200 ≀ %MW10.207	Remote I/O master 4 I/O module failure information
%MW10.208 ≀ %MW10.215	Remote I/O master 5 I/O module configuration information
%MW10.216 ≀ %MW10.223	Remote I/O master 5 I/O module failure information
%MW10.224 ≀ %MW10.231	Remote I/O master 6 I/O module configuration information
%MW10.232 ≀ %MW10.239	Remote I/O master 6 I/O module failure information
%MW10.240 ≀ %MW10.247	Remote I/O master 7 I/O module configuration information
%MW10.248 ≀ %MW10.255	Remote I/O master 7 I/O module failure information

Remote I/O master I/O module configuration information
If a slave node is connected to the DeviceNet master and no fault or a nonfatal fault occurs, the corresponding MAC ID is set to ON.

Remote I/O master I/O module failure information
If a slave node is connected to the DeviceNet master and a fatal or nonfatal fault occurs, the corresponding MAC ID is set to ON.

<Flag Assignment>
The following describes flag assignment using remote I/O master 0 I/O module configuration / failure information (%MW10.128 to MW10.143) as an example. Flags are also assigned to remote I/O master modules 1 to 7 in the same manner.

<Configuration Information>

Word address ↓	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0 ← Bit address
%MW10.128	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%MW10.129	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
%MW10.130	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
%MW10.131	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
%MW10.132	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
%MW10.133	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
%MW10.134	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
%MW10.135	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

<Failure Information>

%MW10.136	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%MW10.137	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
%MW10.138	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
%MW10.139	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
%MW10.140	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
%MW10.141	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
%MW10.142	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
%MW10.143	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Note: 64 to 127 are not used with DeviceNet.

<Slave Node (Remote I/O) Status Diagnosis>

The DeviceNet slave node status can be diagnosed based on the configuration information and failure information.

	Configuration information	**Failure information**
Normal	ON	OFF
Nonfatal fault	ON	ON
Fatal fault	OFF	ON

Appendix 1 I/O Response Performance

Page

Appendix 1 I/O Response Performance

1-1 Time Factor Necessary for Response Time Calculation

<Slave Communication Time>

Indicates the communication time necessary for a single slave node. 1 slave communication time is used to calculate the minimum I/O response time.

1 slave communication time = 16 x T_k x (Number of bytes input + Number of bytes output + 12) + T_s [μs]

<Communication Cycle Time>

Indicates the time between I/O communication processing for a certain slave and another I/O communication processing for the same slave. When the master module polls a slave node, it proceeds with polling of the next slave node without waiting for the response (acknowledgment) from the previous slave. The master module receives the response from the previous slave during polling of subsequent slave nodes.

The following expression applies to the environment only with I/O data communication. When message communication is performed, the following < Communication Cycle Time at Message Communication > is applied.

Communication cycle time (T_c) = $\sum$ (1 slave communication time x 0.67) + T_{ISD} [μs]

<Communication Cycle Time at Message Communication>

When message communication is performed, the message communication time is added to the communication cycle time (Tc) without message communication.

Communication cycle time at message communication (T_{mc}) = Communication cycle time (T_c) + 448 x T_k [μs]

<Protocol Processing Time>

Indicates the internal processing time of the master module (500 μs).

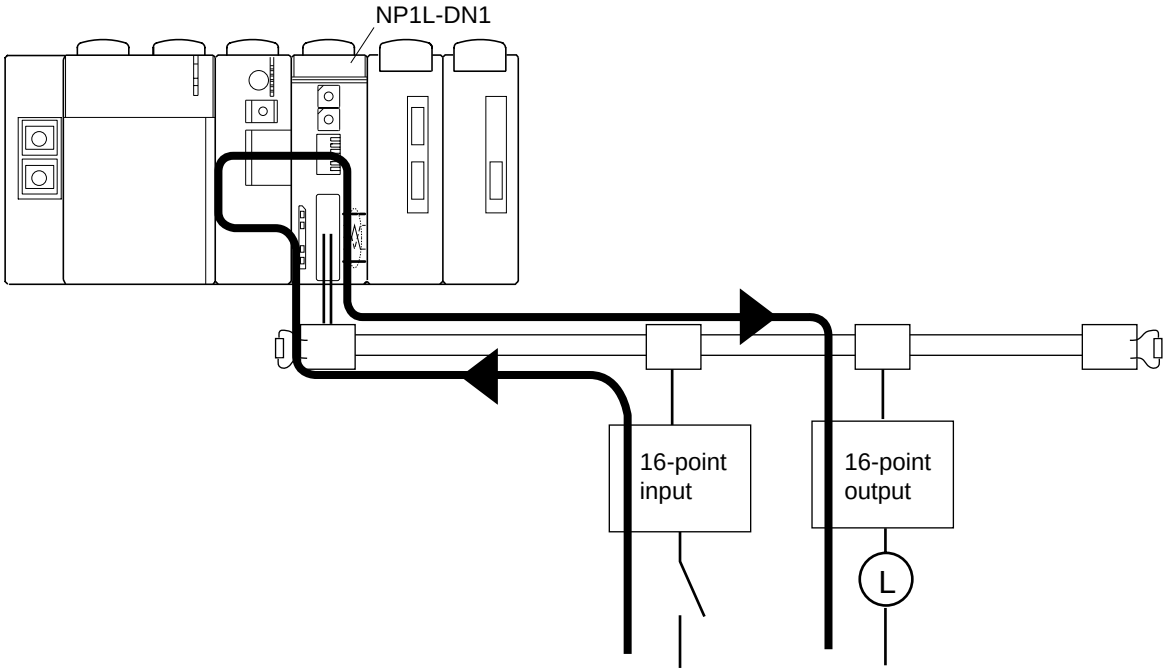
Note 1: T_k is a communication factor. When the transmission rate is 500kbps, T_k is 1; when it is 250kbps, T_k is 2; when it is 125kbps, T_k is 4.

Note 2: T_s is the internal processing time of slave nodes. T_s differs for each slave node. Usually, 100 [μs] is used as the average value of slave nodes.

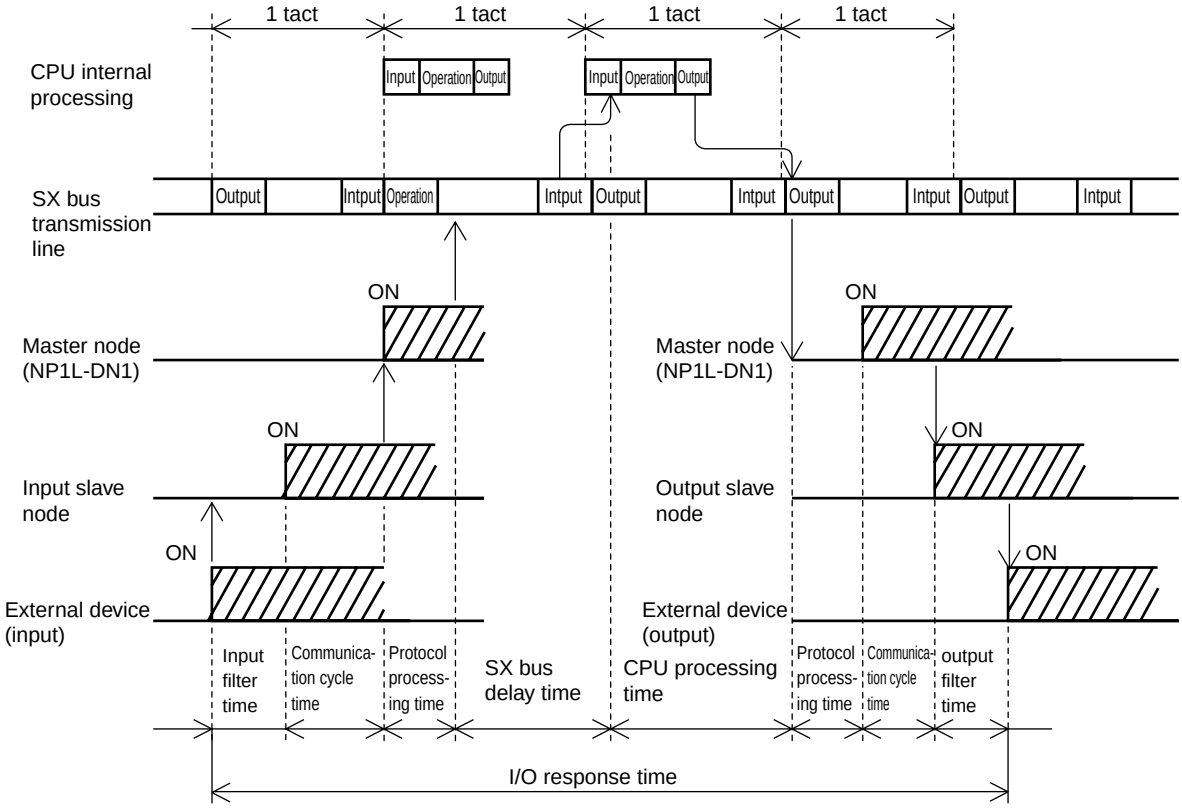
Note 3: The inter-scan delay time (T_{ISD}) can be set to 0 to 65535ms.
T_{ISD} defines the interval of the scan cycle. T_{ISD} is calculated from:
Number of slave nodes connected x K
where K is a factor dependent on the transmission rate.
When the transmission rate is 500kbps, T_{ISD} is 1.3; when it is 250kbps, T_{ISD} is 1.8; when it is 125kbps, T_{ISD} is 2.0.

1-2 Calculating I/O Response Time

The following describes I/O response time calculation using an example of system configuration.



<I/O Response Time Chart>



(I/O response time) = (Input filter time) + (Communication cycle time) + (Protocol processing time)
+ (SX bus delay time) + (CPU processing time)
+ (Protocol processing time) + (Communication cycle time)
+ (Output delay time)

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