FANUC Series 30*i*-MODEL A/B
FANUC Series 31*i*-MODEL A/B
FANUC Series 32*i*-MODEL A/B
FANUC Series 35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F

DeviceNet Board

CONNECTION MANUAL

B-64043EN/04

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Further, re-export to another country may be subject to the license of the government of the country from where the product is re-exported. Furthermore, the product may also be controlled by re-export regulations of the United States government.
Should you wish to export or re-export these products, please contact FANUC for advice.

In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

This manual contains the program names or device names of other companies, some of which are registered trademarks of respective owners. However, these names are not followed by ® or ™ in the main body.

SAFETY PRECAUTIONS

"SAFETY PRECAUTIONS" describes the safety precautions related to the use of CNC units, to ensure safe operation of machines fitted with FANUC CNC units. Read this section carefully before attempting to use any function described in this manual.
Users should also read the relevant descriptions in the Operator's Manual of the CNC to become fully familiar with the functions to be used.

Contents

DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warnings and Cautions according to their bearing on safety. Also, supplementary information is described as Notes. Read the Warnings, Cautions, and Notes thoroughly before attempting to use the machine.

⚠ WARNING
Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

⚠ CAUTION
Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE
The Note is used to indicate supplementary information other than Warning and Caution.

- Read this manual carefully, and store it in a safe place.

GENERAL WARNINGS AND CAUTIONS

⚠ WARNING

1 Before operating the machine, thoroughly check the entered data. Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

2 Never attempt to machine a workpiece without first checking the programmed value, compensation value, current position, and external signal settings. Also, never attempt to machine a workpiece without first checking the operation of the machine. Before starting a production run, ensure that the machine is operating correctly by performing a trial run using, for example, the single block, feedrate override, or machine lock function, or by operating the machine with neither a tool nor workpiece mounted. Failure to confirm the correct operation of the machine may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

3 Ensure that the specified feedrate is appropriate for the intended operation. Generally, for each machine, there is a maximum allowable feedrate. The appropriate feedrate varies with the intended operation. Refer to the manual provided with the machine to determine the maximum allowable feedrate. If a machine is turn at other than the correct speed, unexpected load may be applied to the machine, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

4 When using a tool compensation function, thoroughly check the direction and amount of compensation.
Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

5 The parameters for the CNC and PMC are factory-set. Usually, there is no need to change them. When, however, there is no alternative other than to change a parameter, ensure that you fully understand the function of the parameter before making any change.
A failure to set a parameter correctly may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

⚠ CAUTION

1 Immediately after switching on the power, do not touch any of the keys on the MDI unit until the position display or alarm screen appears on the CNC unit.
Some of the keys on the MDI panel are dedicated to maintenance or other special operations. Pressing any of these keys may place the CNC unit in other than its normal state. Starting the machine in this state may cause it to behave unexpectedly.

2 The operator's manual for the CNC describes all the basic functions of the CNC, including the optional functions. The selected optional functions vary with the machine. Some functions described in this manual may not, therefore, be supported by your machine. Check the machine specifications before using the optional functions.

⚠ CAUTION

3 Some machine operations and screen functions are implemented by the machine tool builder. For an explanation of their usage and related notes, refer to the manual provided by the machine tool builder.
For example:
- On some machines, executing a tool function causes the tool change unit to operate. When executing a tool function on such a machine, stand well clear of the tool change unit. Otherwise, there is a danger of injury to the operator.
- Many auxiliary functions trigger physical operations, such as rotation of the spindle. Before attempting to use an auxiliary function, therefore, ensure that you are fully aware of the operation to be triggered by that function.

NOTE

Command programs, parameters, and variables are stored in nonvolatile memory in the CNC. Generally, the contents of memory are not lost by a power on/off operation. However, the contents of memory may be erased by mistake, or important data in nonvolatile memory may have to be erased upon recovering from a failure.
To enable the restoration of data as soon as possible if such a situation arises, always make a backup of the data in advance.

GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT

⚠ WARNING

Be careful enough for the following warnings when you develop two or more applications or use networks.
If you neglect them, there is a danger of the user being injured or there is a danger of both the user being injured and the equipment being damaged.

1 Be careful enough if you write an identical CNC data, an identical PMC data or a series of related data set by two or more above applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the data will be written in an unexpected order.
Therefore, do NOT write above data in the following cases.
- Applications and network functions
- Two or more applications
- Two or more network functions

Data, applications and network functions of interest are listed in below.
However, all may not be listed completely because new features will be added in the future.

2 Be careful enough that you must prevent PMC signals in the same byte from being written by the following two or more applications including network functions. While an application reads and writes one byte of PMC signals, other applications may write the same byte.

3 Be careful enough if you process a PMC signal set that is related to a CNC function by using the following two or more applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the NC may receive the PMC signal set in an unexpected order.

⚠ WARNING

4 Generally, when multi-byte data are read or written at once among the following two or more applications including network functions, the coherency of the read multi-byte data (in other words, reading all latest data at once) is not guaranteed. To ensure the coherency of the multi-byte data, prepare flags to notify the completion of reading or writing process that is separated from the entity of the data and make the handshaking process to access the data by using the flags.

Data List Table

Category	Data
General data for CNC	Parameter, Tool compensation value and related data, Work zero offset value and related data, Workpiece coordinate system shift value and related data, Macro variable, P-CODE variable, Program and related data, Tool management function data, Tool life management data, Error compensation related data , Overtravel check (Interference check) related data , Software operator's panel related data
PMC data	PMC signal, PMC parameter
Data for Laser, Punch press or Wire cut	Tool data for punch press and related data, Safety zone data and related data, Laser cutting condition data and related data, Laser oscillator setting data and related data, Wire consumption compensation data, Guide position compensation data, Workpiece leveling data
Other data	Parameters for Data Server, Parameters for network setting

List Table of Applications and Network Functions

Category	Functions
Applications	PMC Ladder, Macro Executor, C Language Executor, FANUC PICTURE, FOCAS2
Network functions	FL-net, EtherNet/IP, PROFINET, Modbus/TCP, PROFIBUS-DP, DeviceNet, CC-Link

5 CNC has functions that read or write PMC signals in other than the G/F address. Be careful enough if the above mentioned applications and network read or write PMC signals used by these functions. When reading or writing the same PMC signal, applications or CNC functions may work in an unexpected manner.
For the relevant CNC functions, refer to "LIST OF FUNCTIONS USING PMC SIGNALS OTHER THAN G/F ADDRESS" in Appendix in the CONNECTION MANUAL (FUNCTION) of the relevant CNC.

TABLE OF CONTENTS

I. GENERAL

1 GENERAL

This chapter explains the organization of this manual and how to read this manual.

1.1 ORGANIZATION

This manual consists of the following parts:

SAFETY PRECAUTIONS
Describes the precautions which must be observed when any of the functions explained in this manual is used.

I. GENERAL
This part describes the chapter organization, applicable models, and related manuals.

II. COMMON
This part describes the common instructions for using the DeviceNet functions.

III. SETTING
This part describes the setting and maintenance required for enabling DeviceNet communication.

IV. CONNECTION
This part describes how to connect devices to enable DeviceNet communication, as well as related precautions.

V. MAINTENANCE
This part describes DeviceNet board drawing numbers and the meanings of LED indications.

APPENDIX
Provides additional descriptions.

1.2 APPLICABLE MODELS

The models covered by this manual are as follows. The abbreviations listed below may be used to refer to the corresponding models.

<table>
<tr><th>Model name</th><th colspan="4">Abbreviation</th></tr>
<tr><td>FANUC Series 30i-MODEL A</td><td>Series 30i-A</td><td colspan="2" rowspan="3">Series 30i/31i/32i-A</td><td rowspan="10">Series 30i/31i/32i-A/B, 35i-B, PMi-A</td></tr>
<tr><td>FANUC Series 31i-MODEL A</td><td rowspan="2">Series 31i-A</td></tr>
<tr><td>FANUC Series 31i-MODEL A5</td></tr>
<tr><td>FANUC Series 32i-MODEL A</td><td>Series 32i-A</td></tr>
<tr><td>FANUC Series 30i-MODEL B</td><td>Series 30i-B</td><td rowspan="4">Series 30i/31i/32i-B</td><td rowspan="5">Series 30i/31i/32i/35i-B</td></tr>
<tr><td>FANUC Series 31i-MODEL B</td><td rowspan="2">Series 31i-B</td></tr>
<tr><td>FANUC Series 31i-MODEL B5</td></tr>
<tr><td>FANUC Series 32i-MODEL B</td><td>Series 32i-B</td></tr>
<tr><td>FANUC Series 35i-MODEL B</td><td>Series 35i-B</td><td>Series 35i-B</td></tr>
<tr><td>FANUC Power Motion i-MODEL A</td><td>Power Motion i-A</td><td>Power Motion i-A</td><td>PMi-A</td></tr>
<tr><td>FANUC Series 0i-MODEL F</td><td>Series 0i-F</td><td>Series 0i-F</td><td>Series 0i-F</td><td>0i-F</td></tr>
</table>

1.3 RELATED MANUALS

The related manuals are shown below.
See also the following manuals together with this manual. This manual is indicated by an asterisk(*).

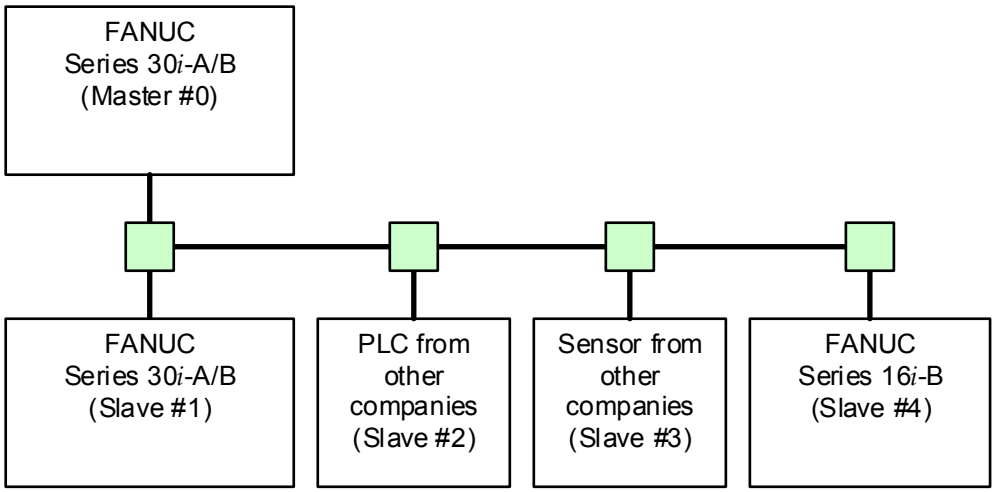
Manual name	Specification number	
Related to Series 30*i*/31*i*/32*i*-A		
DESCRIPTIONS	B-63942EN	
CONNECTION MANUAL (HARDWARE)	B-63943EN	
CONNECTION MANUAL (FUNCTION)	B-63943EN-1	
OPERATOR'S MANUAL (Common to Lathe System/Machining Center System)	B-63944EN	
OPERATOR'S MANUAL (For Lathe System)	B-63944EN-1	
OPERATOR'S MANUAL (For Machining Center System)	B-63944EN-2	
MAINTENANCE MANUAL	B-63945EN	
PARAMETER MANUAL	B-65950EN	
Related to Series 30*i*/31*i*/32*i*-B		
DESCRIPTIONS	B-64482EN	
CONNECTION MANUAL (HARDWARE)	B-64483EN	
CONNECTION MANUAL (FUNCTION)	B-64483EN-1	
OPERATOR'S MANUAL (Common to Lathe System/Machining Center System)	B-64484EN	
OPERATOR'S MANUAL (For Lathe System)	B-64484EN-1	
OPERATOR'S MANUAL (For Machining Center System)	B-64484EN-2	
MAINTENANCE MANUAL	B-64485EN	
PARAMETER MANUAL	B-64490EN	
Related to Series 35*i*-B		
DESCRIPTIONS	B-64522EN	
CONNECTION MANUAL (HARDWARE)	B-64523EN	
CONNECTION MANUAL (FUNCTION)	B-64523EN-1	
OPERATOR'S MANUAL	B-64524EN	
MAINTENANCE MANUAL	B-64525EN	
PARAMETER MANUAL	B-64530EN	
Related to Power Motion *i*-A		
DESCRIPTIONS	B-64572EN	
CONNECTION MANUAL (HARDWARE)	B-64573EN	
CONNECTION MANUAL (FUNCTION)	B-64573EN-1	
OPERATOR'S MANUAL	B-64574EN	
MAINTENANCE MANUAL	B-64575EN	
PARAMETER MANUAL	B-64580EN	
Related to Series 0*i*-F		
DESCRIPTIONS	B-64602EN	
CONNECTION MANUAL (HARDWARE)	B-64603EN	
CONNECTION MANUAL (FUNCTION)	B-64603EN-1	
CONNECTION MANUAL (FUNCTION) (For Series 0*i*-PF)	B-64623EN	
OPERATOR'S MANUAL (Common to Lathe System / Machining Center System)	B-64604EN	
OPERATOR'S MANUAL (For Series 0*i*-PF)	B-64624EN	
OPERATOR'S MANUAL (For Lathe System)	B-64604EN-1	
OPERATOR'S MANUAL (For Machining Center System)	B-64604EN-2	
MAINTENANCE MANUAL	B-64605EN	
PARAMETER MANUAL	B-64610EN	
PARAMETER MANUAL (For Series 0*i*-PF)	B-64630EN	
PMC		
PMC PROGRAMMING MANUAL (For Series 30*i*/31*i*/32*i*-A)	B-63983EN	

Manual name	Specification number	
PMC PROGRAMMING MANUAL (For Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F)	B-64513EN	
Network		
PROFIBUS-DP Board CONNECTION MANUAL	B-63993EN	
Industrial Ethernet CONNECTION MANUAL	B-64013EN	
Fast Ethernet / Fast Data Server OPERATOR'S MANUAL	B-64014EN	
DeviceNet Board CONNECTION MANUAL	B-64043EN	*
FL-net Board CONNECTION MANUAL	B-64163EN	
CC-Link Board CONNECTION MANUAL	B-64463EN	

II. COMMON

1 OVERVIEW OF DeviceNet FUNCTIONS

DeviceNet is a field network to which CNCs, PLCs, sensors, or other control units can be connected.



The CNC support the DeviceNet master function and DeviceNet slave function.
DeviceNet-compliant control units including third party products can be connected.

⚠ WARNING

To use the DeviceNet functions, fully understand the instructions described in this manual before making the setting. If you make the setting without fully understanding them, the machine may behave unexpectedly when started, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.
After making the communication setting for the first time or changing any communication setting, conduct communication tests thoroughly.

⚠ CAUTION

1 Be sure to read through this part, "COMMON".
2 The time after the power is turned on until communication actually starts may vary depending on the power-on timing, connected device status, and other factors. If it is necessary to strictly determine whether communication starts, use not the time or status, but actual communication data.
3 If connecting to communication devices made by other companies, thoroughly read the manuals supplied with the communication devices made by the other companies and sufficiently conduct connection tests beforehand.

NOTE

1 The DeviceNet functions cannot be used simultaneously with the PROFIBUS-DP functions or CC-Link functions.

NOTE

2 In this manual, a DI represents a signal input to the CNC and a DO represents a signal output from the CNC, unless otherwise specified.
The directions of data are shown below:
- DI: Communication destination device → CNC
- DO: Communication destination device ← CNC

For communication between CNCs, for example, for communication between CNC1 and CNC2, the directions of data are shown below:
- CNC1(DO) → CNC2(DI)
- CNC1(DI) ← CNC2(DO)

Carefully read the manual of a non-FANUC DeviceNet product since "input" may represent the input as viewed from the master and "output" may represent the output as viewed from the master.

3 In this manual, for each screen example, the corresponding screen of Series 30*i*/31*i*/32*i*-A is given. The basic contents are the same as for Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F but detailed layout might be different. When the setting items are different between these series, however, the screen of each series is described.

Overview of master functions

Specifications of the master functions

Master functions	Setting range of the MAC ID of the master	0 to 63
	Setting range of the MAC IDs of slaves for which communication can be made	0 to 63 (excluding the MAC ID of the master)
	Maximum number of slaves for which communication can be performed NOTE)	63
	Maximum size of DI/DO data per slave NOTE)	128 bytes / 128 bytes
	Types of connections to be supported	Poll I/O Connection Bit Strobe I/O Connection

NOTE

In master functions, the number of slaves for which communication can be made and the size of DI/DO data per slave are restricted as follows. Use the master function under these restrictions.

<1> The maximum total size of DI data of all slaves is 320 bytes.
<2> The maximum total size of DO data of all slaves is 320 bytes.
<3> When an odd number of bytes is set as the size of DI/DO data of a slave, 1 byte is added and the size is assumed to be an even number of bytes. For this reason, the maximum total size of DI/DO data of all slaves may be smaller than 320 bytes/320 bytes.

Overview of slave functions

Specifications of the slave functions

Slave functions	Setting range of the MAC ID of the slave	0 to 63
	Maximum size of DI/DO	64 bytes / 64 bytes
	Types of connections to be supported	Poll I/O Connection Bit Strobe I/O Connection

2 SETTING COMMUNICATION FUNCTIONS

This chapter contains the information necessary for setting the DeviceNet function.

2.1 DI/DO DATA AND STATUS DATA

As communication parameters, in addition to the setting items depending on the communication specification of the DeviceNet functions, setting items used for allocating DI/DO data and status data (data for monitoring the communication status) to a PMC area are to be set.
This section describes the allocation of DI/DO data and status data to a PMC area.

⚠ WARNING
Before allocating DI/DO data and status data to a PMC area, fully understand the instructions written in "GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT" in "SAFETY PRECAUTIONS" at the beginning of this manual, and in this section.
Allocate the PMC area so that multiple communication functions do not write it.
Immediately after setting all communication parameters including those for allocation to the PMC area, make sure that DI/DO data and status data operate correctly in the status in which safety is ensured before starting operation.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

NOTE
For the DeviceNet master function, status data corresponds to setting items "COMMON STATUS" and "DETAIL STATUS".

2.1.1 Allocating PMC Areas

To allocate a PMC area in the setting screen of each communication function, specify it as follows:

Input format)
<Path number>:<PMC address>

For example, for R0500 on the second path of the PMC, input "2:R500".
If <Path number> is omitted (R500), the first path is assumed (1:R0500).
If the <:> key is not available, it can be substituted with the </> key or the <EOB> key. ":" is optional.
To clear "<Path number>:<PMC address>" previously set, input " " (blank). ("---" will be displayed). In this case, it is assumed that no PMC area is used.

⚠ CAUTION
1 In the PMC area, the R area, and E area in volatile memory are all set to 0 immediately after power-on.
2 The E area in the PMC area is normally allocated to volatile memory. However, it can also be used as nonvolatile memory by setting the option.
When the area is used as nonvolatile memory, the contents of the area are retained even after the power is turned off. So, special attention should be paid not to cause an unpredictable operation when the power is turned on next time.

2.2 BACKING UP AND RESTORING COMMUNICATION PARAMETERS

After the completion of communication parameter setting, communication parameters can be backed up as a batch, and previously backed up communication parameters can be restored as a batch.
As the input/output device to which to back up communication parameters and from which to restore them, the memory card or USB memory can be used. To select an input/output device, use parameter No. 20. For details of this parameter, see the Item, "Related NC parameters" in this section.

⚠ WARNING

When [RESTORE] is executed for communication parameters, the communication parameters including the allocation of a PMC area to each communication function are all restored. When [ALL RESTORE] is executed for communication parameters, the communication parameters valid for embedded, Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are all restored. When the unsolicited messaging function is enabled, the allocation of macro variables is also restored.
For this reason, immediately after executing [RESTORE] or [ALL RESTORE] for communication parameters, fully understand instructions written in "GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT" in "SAFETY PRECAUTIONS" at the beginning of this manual, Section 2.1, "DI/DO DATA AND STATUS DATA", and carefully check the setting of the communication parameters of the relevant communication functions before starting operation.
For any communication function for which any PMC area or macro variable is allocated, make sure that DI/DO data, status data, and macro variable operate correctly before starting operation.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

⚠ CAUTION

While an external input/output device such as the memory card or USB memory is being accessed, do not turn the power to the CNC off or remove the external input/output device. Doing so may damage the external input/output device.

NOTE

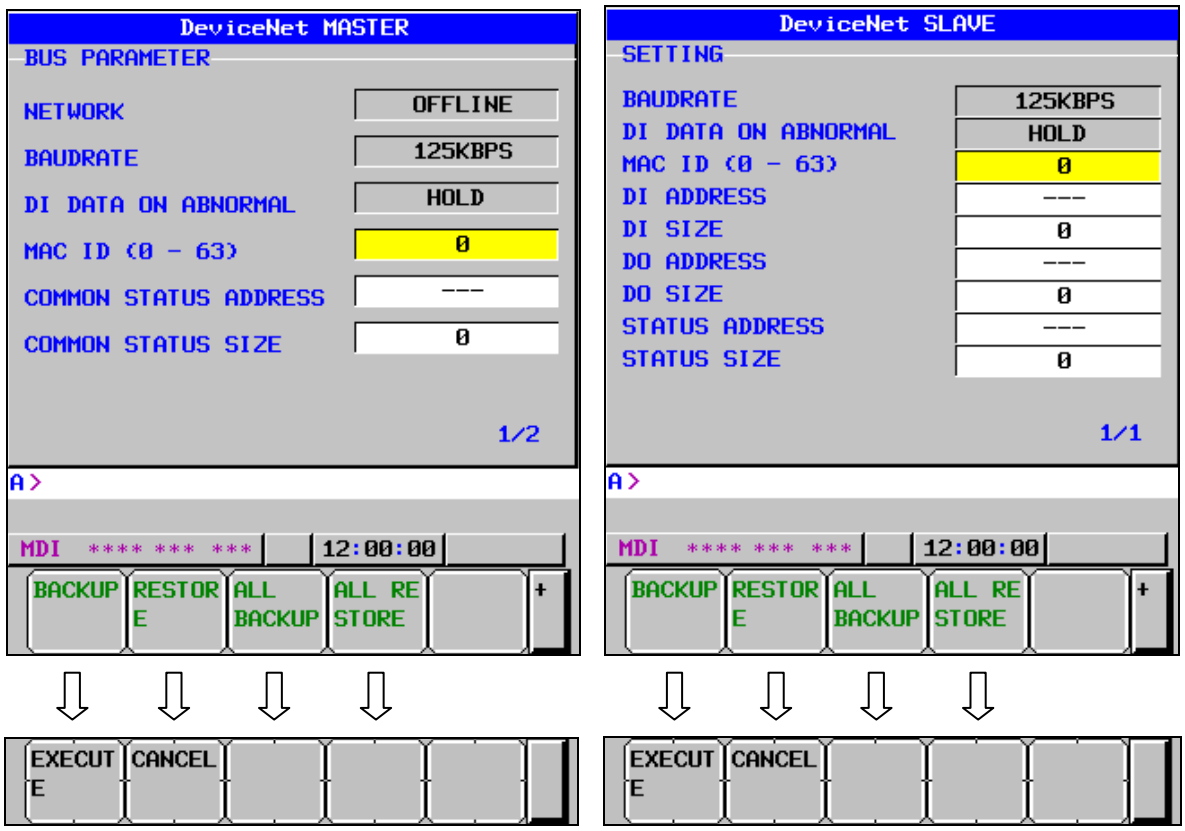
1 A backup or restore operation for communication parameters can only be performed in the MDI mode, EDIT mode, or emergency stop state.
2 It is not possible to backup and restore the communication parameters by using devices other than the memory card and the USB memory.
With Series 30*i*/31*i*/32*i*-A, the USB memory cannot be used.

Procedure

1 Press function key 

.

2 Soft key [DEVNETMASTER] or [DEVNETSLAVE] appears. (When soft key [DEVNET MASTER] or [DEVNETSLAVE] does not appear, press the continue key located at the right end of soft keys several times.)
3 If you press soft key [DEVNET MASTER], the BUS PARAMETER screen, SLAVE PARAMETER screen, NODE INFORMATION screen, or MONITOR screen appears.
If you press soft key [DEVNETSLAVE], the SETTING screen or MONITOR screen appears.
4 Press soft keys [BUS PARAM] - [(OPRT)] for the master function, or soft keys [SETTING] - [(OPRT)] for the slave function, and then [+]. Soft keys [BACKUP], [RESTORE], [ALL BACKUP], and [ALL RESTORE] for backing up and restoring communication parameters appear as shown below.
5 Press the soft key [BACKUP], [RESTORE], [ALL BACKUP], or [ALL RESTORE]. The soft keys [EXECUTE] and [CANCEL] appear.
6 Enter the name of a file to be backed up or restored in the key-in buffer, and press the soft key [EXECUTE]. The operation selected at the above step is executed.
The character string "EXECUTING" blinks during execution.



Operation

BACKUP

The communication parameters for DeviceNet master functions or DeviceNet slave functions are saved from the SRAM of the CNC main unit to the input/output device.
When a file name is specified in the key-in buffer, the parameters are saved to a file with the specified name in the input/output device. Otherwise, a file called "DEVNTMST.MEM" is used for the DeviceNet master function, or a file called "DEVNTSLV.MEM" is used for the DeviceNet slave function.

RESTORE

The communication parameters for DeviceNet master functions or DeviceNet slave functions are read from the input/output device and saved to the SRAM of the CNC main unit.

When a file name is specified in the key-in buffer, the file with the specified name is read from the input/output device. Otherwise, a file called "DEVNTMST.MEM" is used for the DeviceNet master function or a file called "DEVNTSLV.MEM" is used for the DeviceNet slave function.

ALL BACKUP

All valid communication parameters for embedded Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are saved from the SRAM of the CNC main unit to the input/output device.
When a file name is specified in the key-in buffer, the parameters are saved to a file with the specified name in the input/output device. If no file name is specified, the file name "NETWORK.MEM" is used.

ALL RESTORE

All valid communication parameters for embedded Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are read from the input/output device and saved to the SRAM of the CNC main unit.
However, if a communication function related to a valid communication parameter is disabled in the CNC, that parameter is not saved to the SRAM.
If a file name is specified in the key-in buffer, the specified file name is read from the input/output device. If no file name is specified, the file name "NETWORK.MEM" is used.

NOTE
When communication parameters are restored, an alarm condition occurs that requires power-off.

Related NC parameters

0020	I/O CHANNEL : Input/output device selection, or interface number for a foreground input/output device

[Input type] Setting input
[Data byte] Byte
[Valid data range] 4: Selects the memory card as the input/output device.
17: Selects the USB memory as the input/output device.
It is not possible to backup and restore the communication parameters by using other devices.

NOTE
In case of Series 30*i*/31*i*/32*i*-A, the memory card is used regardless for this NC parameter.

III. SETTING

1 DeviceNet MASTER FUNCTIONS

This chapter describes how to set the master functions of DeviceNet

1.1 SETTING SCREEN OF THE DeviceNet MASTER FUNCTION

The setting screen of the DeviceNet master function consists of the BUS PARAMETER screen and SLAVE PARAMETER screen.
To perform DeviceNet communication, set the bus parameter and slave parameter.
The bus parameter is required to manage the whole DeviceNet network. The slave parameter is required to communicate with each of the slaves.

NOTE
1 Before setting the bus parameter, the following conditions must be satisfied.
<1> The MDI mode or emergency stop state is entered.
<2> NETWORK on the BUS PARAMETER screen is OFFLINE.
2 Before setting the slave parameter, the following conditions must be satisfied.
<1> The MDI mode or emergency stop state is entered.
<2> NETWORK on the BUS PARAMETER screen is OFFLINE.
<3> COMMUNICATE on the SLAVE PARAMETER screen is ENABLE.
3 When the bus parameter or slave parameter is changed, "PW0000 POWER MUST BE OFF" appears on the CNC ALARM MESSAGE screen. For the changed parameters to take effect, turn the CNC power off and back on again.

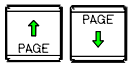
Procedure

1 Press function key 

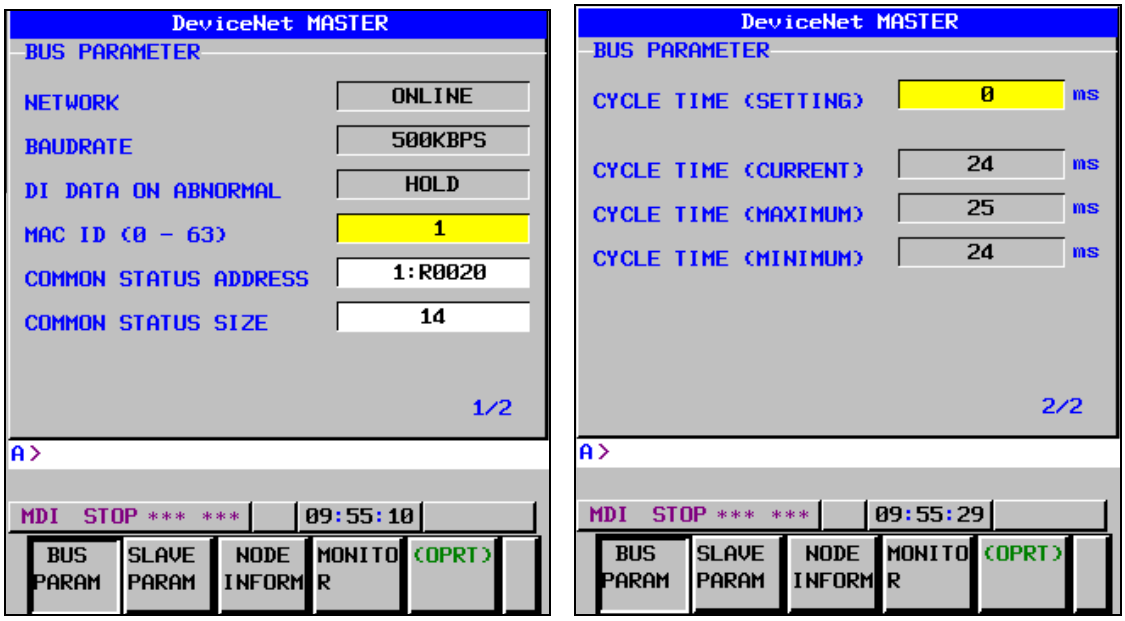
.
2 Soft key [DEVNET MASTER] appears. (When soft key [DEVNET MASTER] does not appear, press the continue key located at the right end of soft keys several times.)
3 If you press soft key [DEVNET MASTER], the BUS PARAMETER screen, SLAVE PARAMETER screen, NODE INFORMATION screen, or MONITOR screen appears.
4 Press soft keys [BUS PARAM] and [SLAVE PARAM] and then enter the parameters for the setting items of all setting screens that appear.

BUS PARAMETER screen

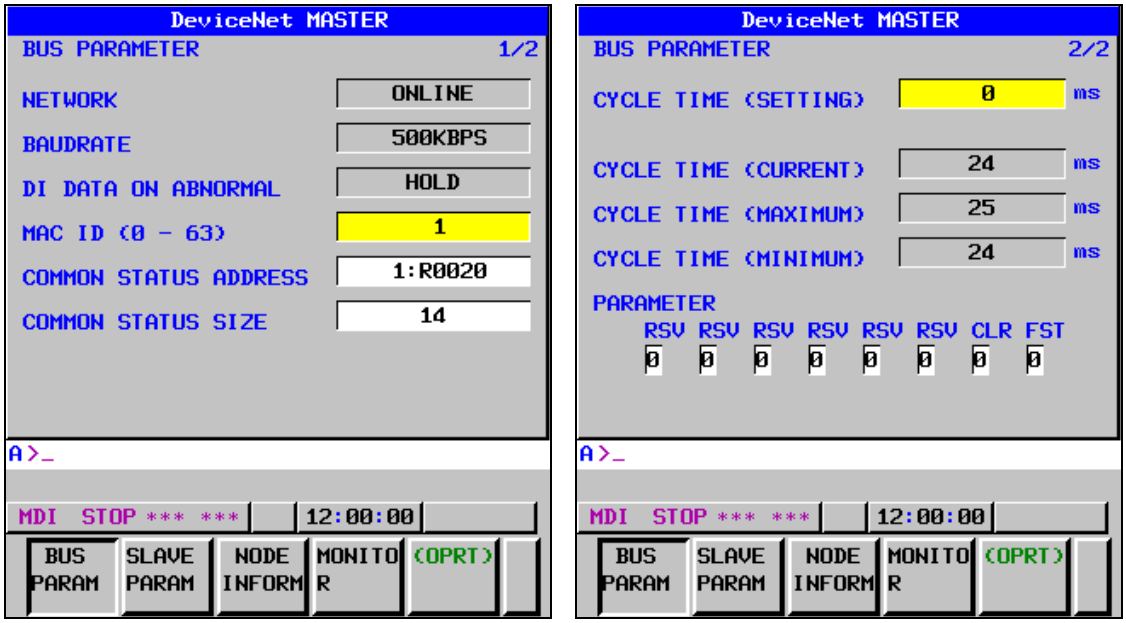
Procedure

1 Press soft key [BUS PARAM] to display the BUS PARAMETER screen (Screen 1-1).
2 On the BUS PARAMETER screen, page keys 

can be used to switch between pages.
3 Move the cursor to the item to set and then enter the parameter.



Series 30*i*/31*i*/32*i*-A

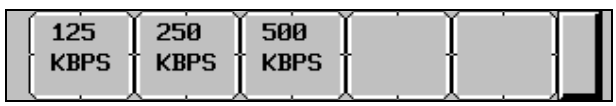


Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F
Screen 1-1

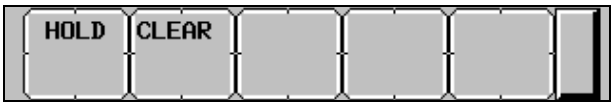
4 Press soft key [(OPRT)] as needed and then use the following soft keys.

[NETWORK] :

[BAUDRATE] :



[DI DATA] :



Setting item

Item	Description
NETWORK	Sets whether the DeviceNet master is removed from or added to the network. OFFLINE : Removed from the network. ONLINE : Added to the network.
BAUDRATE	Sets the communication rate. The communication rate is limited by the maximum length or maximum total branch length of a network. For details, see Section 1.2, "CABLE LENGTH AND TRANSFER RATE" in Part IV, "CONNECTION." One of 125 Kbps, 250 Kbps, and 500 Kbps can be set.
DI DATA ON ABNORMAL	Sets whether DI data is restored to the value before occurrence of a communication error or cleared to 0 when communication stops due to a communication error. HOLD : DI data is restored to the value before occurrence of a communication error. CLEAR : DI data is cleared to 0.
MAC ID (0 - 63)	Sets the MAC ID of the DeviceNet master. The MAC ID must be unique on the network. The setting range is between 0 and 63.
COMMON STATUS ADDRESS (WARNING)	Sets the address of the PMC area in which the common status is to be stored. When the common status is not required, set " " (space). The setting range is the R or E area of PMC. Set the address in units of two bytes. Example) R1000, R1002, R1004, E1000, E1002
COMMON STATUS SIZE	Sets the size of the PMC area in which the common status is to be stored. When the common status is not required, set 0. The setting range is 0, 2, 4, and 6 to 14.
CYCLE TIME (SETTING)	Sets the communication cycle time. 0 : Fastest value 1 to 500 : 1 to 500 ms
CLR (only Series 30*i*/31*i*/32*i* /35*i*-B, Power Motion *i*-A, Series 0*i*-F)	If "CLEAR" is set to "DI DATA ON ABNORMAL" when the communication error generates, 0 : DI data of the only error slave is clear. 1 : DI data of the all slaves is clear. (This is same on Series 30*i*/31*i*/32*i*-A)
FST (NOTE) (only Series 30*i*/31*i*/32*i* /35*i*-B, Power Motion *i*-A, Series 0*i*-F)	When the slave that has 8 bytes or more of DI/DO data exists on the network, 0 : The communication cycle time is delayed. (This is same on Series 30*i*/31*i*/32*i*-A) 1 : The communication cycle time is not delayed.

⚠ WARNING
Before allocating the PMC area, be sure to read Section 2.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

NOTE
In case of a slave device that has 8 bytes or more of DI/DO data, there is the slave device that cannot be communicated if the communication cycle time is not delayed. Please set 0 to FST when connecting with such a slave device.

Display item

Item	Description
CYCLE TIME (CURRENT)	The current value of the communication cycle time is displayed.
CYCLE TIME (MAXIMUM)	The maximum value of the communication cycle time is displayed.
CYCLE TIME (MINIMUM)	The minimum value of the communication cycle time is displayed.

COMMON STATUS

This is status information found by the DeviceNet master. The common status includes four types of status information: DeviceNet MPU status 1, DeviceNet MPU status 2, master function status 1, and slave communication states 1 to 8.

The common status occupies up to 14 bytes (size of the common status), beginning with the common status address.

COMMON STATUS

COMMON STATUS ADDRESS	DeviceNet MPU status 1 (2 bytes)
COMMON STATUS ADDRESS + 2	DeviceNet MPU status 2 (2 bytes)
COMMON STATUS ADDRESS + 4	Master function status 1 (2 bytes)
COMMON STATUS ADDRESS + 6	Slave communication state 1 (1 byte)
COMMON STATUS ADDRESS + 7	Slave communication state 2 (1 byte)
COMMON STATUS ADDRESS + 8	Slave communication state 3 (1 byte)
COMMON STATUS ADDRESS + 9	Slave communication state 4 (1 byte)
COMMON STATUS ADDRESS + 10	Slave communication state 5 (1 byte)
COMMON STATUS ADDRESS + 11	Slave communication state 6 (1 byte)
COMMON STATUS ADDRESS + 12	Slave communication state 7 (1 byte)
COMMON STATUS ADDRESS + 13	Slave communication state 8 (1 byte)

DeviceNet MPU status 1

Bit 0 : An error has occurred.
An error indicated by one of Bits 1, 4 to 8 has occurred.
Bit 1 : A master function error has occurred.
Bit 2, Bit 3 : Reserved.
Bit 4 : An error has occurred in the nonvolatile memory on the DeviceNet daughter board.
Bit 5 : Busoff has been detected.
(Communication stopped because a communication error occurred frequently.)
Bit 6 : MAC IDs are duplicate or a MAC ID error has occurred.
Bit 7 : A network power failure has occurred.
Bit 8 : A transmit error has occurred.
Bit 9 to Bit15 : Reserved.

NOTE
For details on the DeviceNet daughter board, see Subsection 1.1.1, "Part Layout on the DeviceNet Master Board" in Part V, "MAINTENANCE".

DeviceNet MPU status 2

Bit 0 : Online
Bit 1 : I/O communication is in progress.
Bit 2 : Reserved.
Bit 3 : Master function
Bit 4 : The DI/DO sizes of all slaves are zero.
Bit 5 to Bit 7 : Reserved.
Bit 8 : Failed to read the error record from the DeviceNet board.
Bit 9 to Bit 14 : Reserved.
Bit 15 : An error record has been registered.

NOTE
For details on error records, see "MONITOR screen" in Section 1.2, "MAINTENANCE SCREEN OF THE DeviceNet MASTER FUNCTION" in this Part.

Master function status 1

Bit 0	: A verification error has occurred. (The DI/DO size set in the slave parameter differs from that of the actual slave.)
Bit 1	: Reserved.
Bit 2	: An I/O communication error has occurred.
Bit 3 to Bit 11	: Reserved.
Bit 12	: Failed to set the communication cycle time.
Bit 13, Bit 14	: Reserved.
Bit 15	: I/O communication with one or more slaves is in progress.

Slave communication state 1 (node number: 0 to 7)
Slave communication state 2 (node number: 8 to 15)
Slave communication state 3 (node number: 16 to 23)
Slave communication state 4 (node number: 24 to 31)
Slave communication state 5 (node number: 32 to 39)
Slave communication state 6 (node number: 40 to 47)
Slave communication state 7 (node number: 48 to 55)
Slave communication state 8 (node number: 56 to 63)

Bit 0 : Communication with the node with a node number of ((N - 1) × 8 + 0) is in progress.
Bit 1 : Communication with the node with a node number of ((N - 1) × 8 + 1) is in progress.
Bit 2 : Communication with the node with a node number of ((N - 1) × 8 + 2) is in progress.
Bit 3 : Communication with the node with a node number of ((N - 1) × 8 + 3) is in progress.
Bit 4 : Communication with the node with a node number of ((N - 1) × 8 + 4) is in progress.
Bit 5 : Communication with the node with a node number of ((N - 1) × 8 + 5) is in progress.
Bit 6 : Communication with the node with a node number of ((N - 1) × 8 + 6) is in progress.
Bit 7 : Communication with the node with a node number of ((N - 1) × 8 + 7) is in progress.
N (1 to 8) indicates the slave communication state.

COMMUNICATION CYCLE TIME

This time is measured from when I/O data communication to the slave with a certain node number is processed until I/O data communication to the slave with the node number is processed again. The communication cycle time depends on whether the number of masters on a network is only one or more than one, whether the Explicit message communication was performed, or other factors.
When the number of masters on a network is only one, it is recommended that the normal communication cycle be set to 0 (fastest value).
However, the communication cycle time needs to be changed when, for example:

1 There are multiple masters on a network.
2 I/O data needs to be updated at predetermined time intervals rather than the shortest time intervals.

NOTE

For a network on which multiple masters are present, follow a procedure as described below to determine the communication cycle time.

Example)

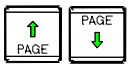
To set the communication cycle time for a network on which two masters (master #1 and master #2) are present:

<1>Configure a network with only this master and the slaves that communicate with this master #1.
<2>Set the communication cycle time of this master #1 to 0.
<3>Measure the maximum communication cycle time (T1) of this master #1.
<4>Similarly, configure a network with only the other master #2 and the slaves that communicate with the other master #2 and measure the maximum communication cycle time (T2) of the other master #2.
<5>The communication cycle time of masters #1 and #2 is (T1 + T2 + α). The value of α represents an arbitrary time value.

SLAVE PARAMETER screen

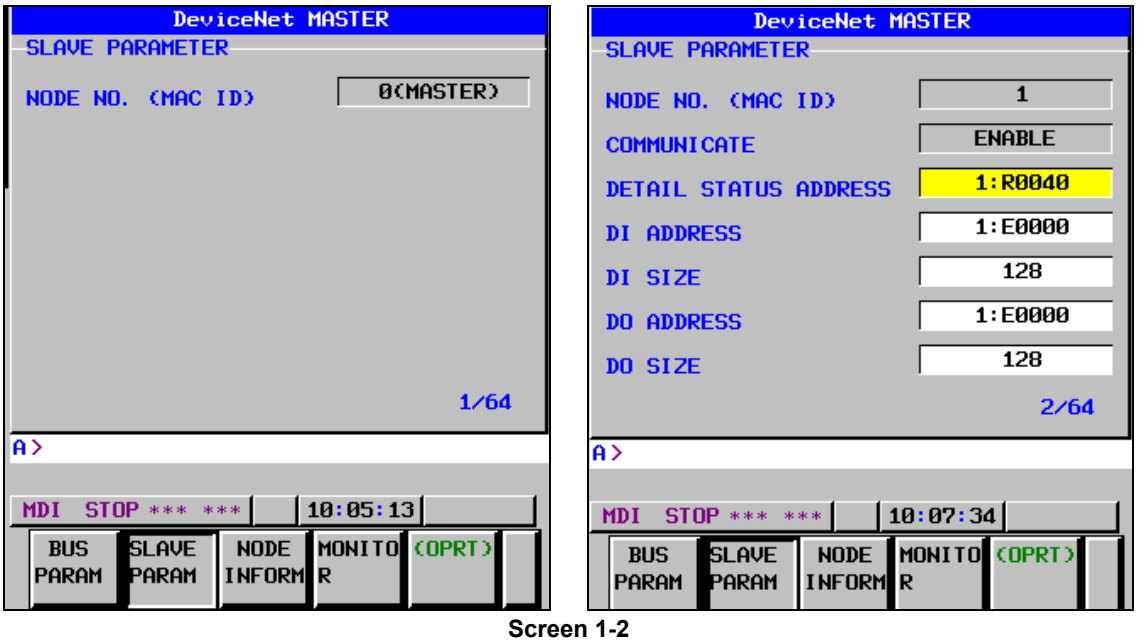
Procedure

1 Press soft key [SLAVE PARAM] to display the SLAVE PARAMETER screen (Screen 1-2). The SLAVE PARAMETER screen includes 64 pages for all nodes.

2 To switch between pages on the SLAVE PARAMETER screen, use page keys 

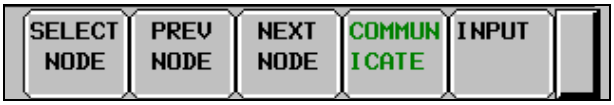
, soft key [SELECT NODE], [PREV NODE], or [NEXT NODE].

3 Move the cursor to the item to set and then enter the parameter.

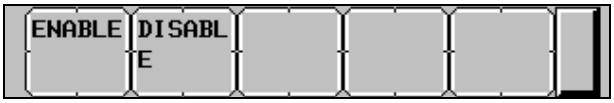


Screen 1-2

4 Press soft key [(OPRT)] as needed and then use the following soft keys.



[COMMUNICATE]



Setting item

Item	Description
COMMUNICATE	Sets whether communication with the slave of this node number is enabled or disabled. DISABLE : Communication is disabled. ENABLE : Communication is enabled.
DETAIL STATUS ADDRESS (WARNING)	Sets the address of the PMC area in which the detailed status is to be stored. When the detailed status is not required, set " " (space). The setting range is the R or E area of PMC.
DI ADDRESS (WARNING)	Sets the address of the PMC area in which DI data (input data) is to be stored. When DI data is not required, set " " (space). The setting range is the R or E area of PMC.
DI SIZE	Sets the size of the PMC area in which DI data is to be stored. When DI data is not required, set 0. The setting range is between 0 and 128.
DO ADDRESS (WARNING)	Sets the address of the PMC area in which DO data (output data) is to be stored. When DO data is not required, set " " (space). The setting range is the R or E area of PMC.
DO SIZE	Sets the size of the PMC area in which DO data is to be stored. When DO data is not required, set 0. The setting range is between 0 and 128.

> ⚠ **WARNING**
> Before allocating the PMC area, be sure to read Section 2.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

Display item

Item	Description
NODE NO. (MAC ID)	The node number (MAC ID) of a slave is displayed. If the number is the same as the MAC ID of the master, "<node-number>(MASTER)" is displayed. For example, when the MAC ID of the master is 0, "0 (MASTER)" is displayed.

DETAIL STATUS ADDRESS

Status information of each slave detected by the DeviceNet master. The detailed status occupies a 1-byte area beginning at the detail status address.

	DETAIL STATUS
DETAIL STATUS ADDRESS	Slave communication status details (1 byte)

Slave communication status details

Bit 0 : An error has occurred.
Bit 1 : A verification error has occurred. (The DI/DO size set in the bus parameter differs from that of the actual slave.)
Bit 2 : Reserved.
Bit 3 : An I/O communication error has occurred.
Bit 4, Bit 5 : Reserved.
Bit 6 : Communication with the maser is enabled.
Bit 7 : I/O communication is in progress.

DI DATA

This is input data of the DeviceNet master function. Data transferred from a slave is stored in the PMC area as input data (DI data).

NOTE
The following restrictions are imposed on the maximum size of DI data per slave.
<1> The maximum total size of DI data of all slaves is 320 bytes.
<2> When an odd number of bytes is set as the size of DI data, 1 byte is added and the size is assumed to be an even number of bytes. For this reason, the maximum total size of DI data of all slaves may be smaller than 320 bytes.

DO DATA

This is output data of the DeviceNet master function. The data stored in the PMC area is transferred to a slave as output data (DO data).

NOTE
The following restrictions are imposed on the maximum size of DO data per slave.
<1> The maximum total size of DO data of all slaves is 320 bytes.
<2> When an odd number of bytes is set as the size of DO data, 1 byte is added and the size is assumed to be an even number of bytes. For this reason, the maximum total size of DO data of all slaves may be smaller than 320 bytes.

SELECT NODE

When you press soft key [SELECT NODE] after entering the node number (MAC ID) of a slave with the MDI key, the SLAVE PARAMETER screen of the corresponding node number appears.

PREV NODE

When you press soft key [PREV NODE], the SLAVE PARAMETER screen of the number before the current node number appears.

NEXT NODE

When you press soft key [NEXT NODE], the SLAVE PARAMETER screen of the number next to the current node number appears.

1.2 MAINTENANCE SCREEN OF THE DeviceNet MASTER FUNCTION

The MAINTENANCE screen consists of the NODE INFORMATION screen and MONITOR screen. The NODE INFORMATION screen is required to check the status of the whole DeviceNet network. The MONITOR (FIRMWARE INFORMATION) screen is required to check the state of the DeviceNet master board. The MONITOR (ERROR RECORD) screen is required to check the error detected by the DeviceNet master board.

Procedure

1 Press function key 

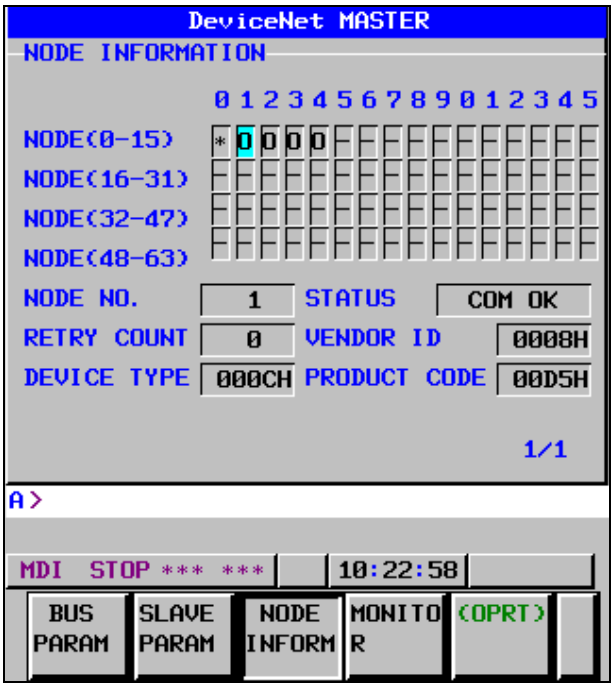
.

2 Soft key [DEVNET MASTER] appears. (When soft key [DEVNET MASTER] does not appear, press the continue key located at the right end of soft keys several times.)
3 If you press soft key [DEVNET MASTER], the BUS PARAMETER screen, SLAVE PARAMETER screen, NODE INFORMATION screen, or MONITOR screen appears.
4 Press soft key [NODE INFORM] or [MONITOR] to display the desired screen.

NODE INFORMATION screen

Procedure

1 Press soft key [NODE INFORM] to display the NODE INFORMATION screen (Screen 1-3).
2 When you move the cursor, detailed information on the selected node number (STATUS, RETRY COUNT, VENDOR ID, DEVICE TYPE, and PRODUCT CODE) is displayed.



Screen 1-3

3 Press soft key [(OPRT)] as needed and then use the following soft keys.

Display item

Item	Description
Node status list	The statuses of nodes are listed. * : Local node O : Node during I/O communication E : Node on which an I/O communication error occurs - : Node not added to the network
NODE NO.	The node number (MAC ID) is displayed. The display range is between 0 and 63.
STATUS	The node status is displayed. - - - : Local node COM OK : Node during I/O communication COM ERROR: Node on which an I/O communication error occurs DISABLE : Node not added to the network

Item	Description
RETRY COUNT	The cumulative number of retries of I/O communication made during occurrence of an I/O communication error is displayed. Counting up stops when the retry count reaches 255. For the local node (master), "---" is displayed. The display range is between 0 and 255.
VENDOR ID	The vendor ID is displayed. The display range is between 0000H and FFFFH. Example) 024FH:FANUC CORPORATION
DEVICE TYPE	The device type is displayed. The display range is between 0000H and FFFFH. Example) 000CH:Communication adaptor
PRODUCT CODE	The product code is displayed. The display range is between 0000H and FFFFH. Example) 0003H:A20B-8101-0330

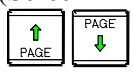
SELECT NODE

When you press soft key [SELECT NODE] after entering the node number (MAC ID) of a slave with the MDI key, the detailed information (STATUS, RETRY COUNT, VENDOR ID, DEVICE TYPE, and PRODUCT CODE) on the corresponding node number is displayed.

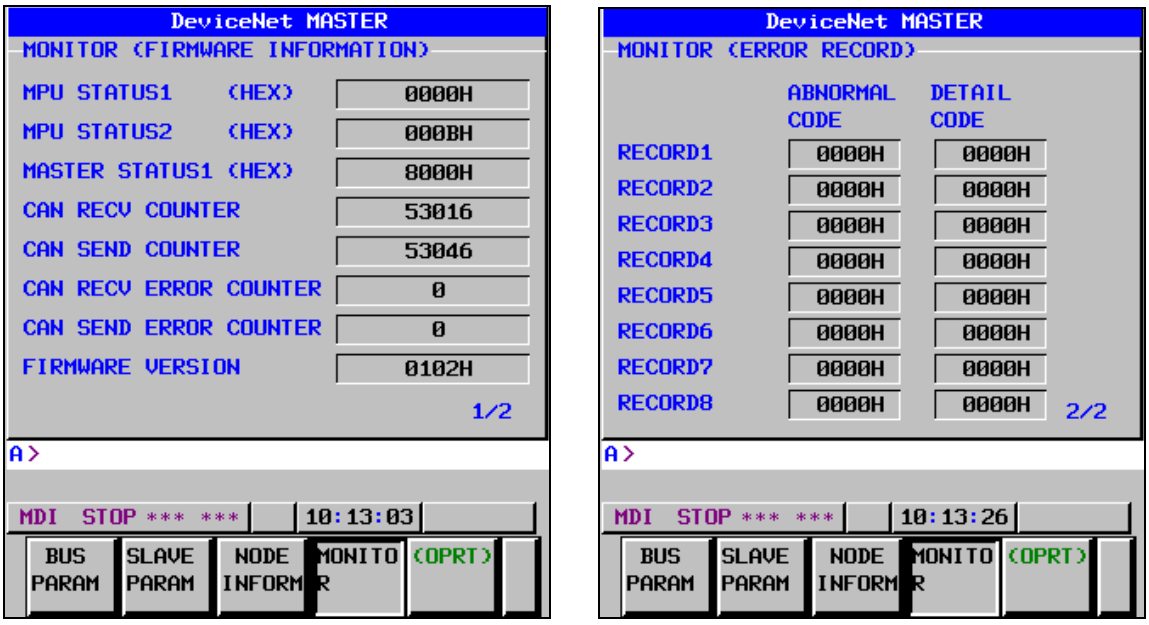
MONITOR screen

Procedure

1 Press soft key [MONITOR] to display the MONITOR screen (Screen 1-4).

2 To switch the pages on the MONITOR screen, use page keys 

.



Screen 1 - 4

3 Press soft key [(OPRT)] as needed and then use the following soft keys.

Display item

Item	Description
MPU STATUS1	DeviceNet MPU status 1 is displayed. This is the same as "DeviceNet MPU status 1" included in the common status on the BUS PARAMETER screen.
MPU STATUS2	DeviceNet MPU status 2 is displayed. This is the same as "DeviceNet MPU status 2" included in the common status on the BUS PARAMETER screen.
MASTER STATUS1	Master function status 1 is displayed. This is the same as "Master function status 1" included in the common status on the BUS PARAMETER screen.
CAN RECV COUNTER	The number of frames successfully received by the LSI on the DeviceNet master board is displayed. The display range is between 0 and 65535. (When this counter reaches 65535, it returns to 0.)
CAN SEND COUNTER	The number of frames successfully sent by the LSI on the DeviceNet master board is displayed. The display range is between 0 and 65535. (When this counter reaches 65535, it returns to 0.)
CAN RECV ERROR COUNTER	The number of error frames received by the LSI on the DeviceNet master board is displayed. This item is set to 0 upon recovery from the reception error state. The display range is between 0 and 65535. (When this counter reaches 65535, it returns to 0.)
CAN SEND ERROR COUNTER	The number of error frames received by the LSI on the DeviceNet master board is displayed. This item is set to 0 upon recovery from the transmission error state. The display range is between 0 and 65535. (When this counter reaches 65535, it returns to 0.)
FIRMWARE VERSION	The version information of the firmware on the DeviceNet master board is displayed. Example) 0102H : Version 1.02
RECORD N (N=1-8)	Records (abnormal code and detail code) are displayed.

NOTE
Controller Area Network (CAN) is a communication technology for signal control and media access control adopted in the DeviceNet standard.

ERROR RECORD, RECORD, ABNORMAL CODE, DETAIL CODE

An error detected by the firmware on the DeviceNet master board is saved as an error record. It is possible to save up to eight error records, each of which consists of an abnormal code and detail code. Record 1 is first saved and finally record 8 is saved. When the number of records exceeds 8, data is sequentially overwritten from record 1 and record 8 contains the latest error data.
The error record is cleared to 0 by the clear operation or power-off of the CNC.

ABNORMAL CODE	DETAIL CODE		Description
	Upper byte	Lower byte	
0211H	Local MAC ID	00H	**Duplicate MAC IDs** There is an MAC ID on the network that is the same as the local MAC ID.
0340H	00H	00H	**Busoff detection** Communication stopped because a communication error occurred frequently.
0341H	00H	00H	**Network power failure** Power for communication is not successfully supplied.
0342H	00H	00H	**Transmission error** A transmission timed out.

ABNORMAL CODE	DETAIL CODE		Description
	Upper byte	Lower byte	
0344H	01H, 05H, 06H, 07H	Slave MAC ID	**Verification error** Different values of the upper byte in the detail code indicate different error types. 01H: The power to the slave is not yet turned on. 05H: An attempt has been made to communicate with an unsupported slave. 06H: The DI/DO size set in the SLAVE PARAMETER screen differs from the DI/DO size of the actual slave. 07H: An attempt has been made to communicate with an unsupported slave. The value of the lower byte in the detail code identifies a slave on which an error occurred.
0345H	01H	Slave MAC ID	**I/O communication error** An I/O communication error occurred on the slave indicated by "Slave MAC ID."

CLEAR

When you press soft key [CLEAR], all records are cleared to 0.

1.3 COMMUNICATION HISTORY OF DeviceNet MASTER FUNCTION

The change of COMMON STATUS and ERROR RECORD can be kept as the communication history. In this case, the kept communication history is not cleared by the power-off of NC.

NOTE
This function is available for only Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F.

DeviceNet MASTER COMMUNICATION HISTORY screen

Procedure

1 Press function key 

.

2 Soft key [DNET M HISTRY] appears. (When soft key [DNET M HISTRY] does not appear, press the continue key located at the right end of soft keys several times.)

3 If you press soft key [DNET M HISTRY], the DeviceNet MASTER COMMUNICATION HISTORY screen appears.

4 Press the following soft keys as needed.

[(OPRT)] :

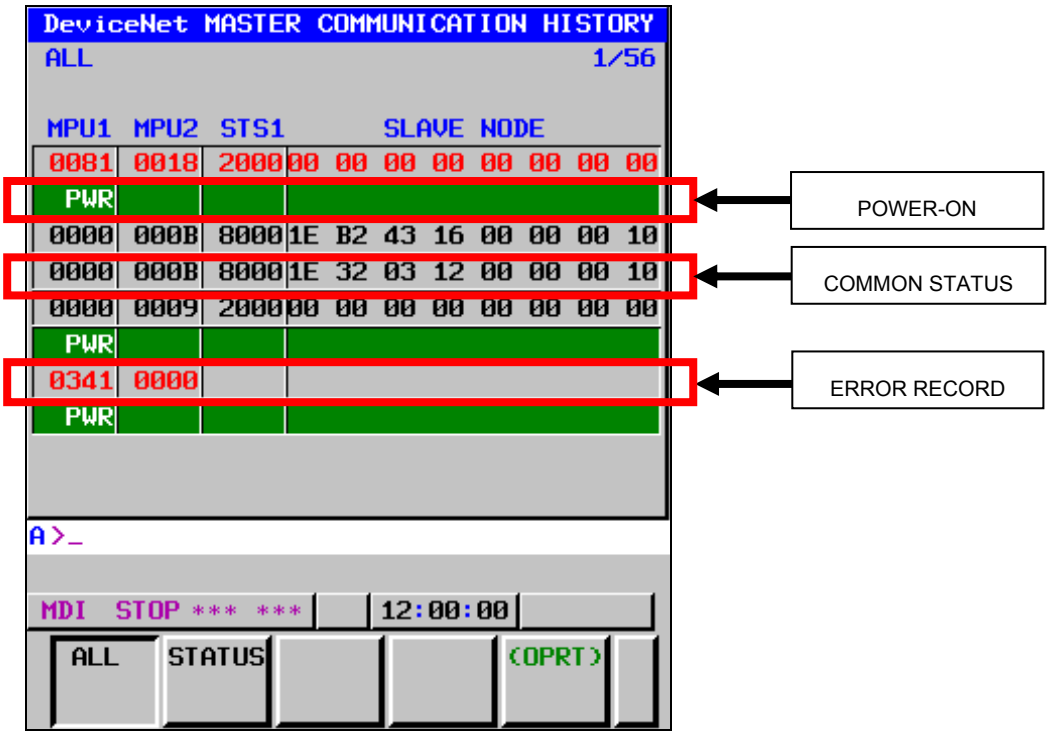
Contents of display

The communication history is displayed in the DeviceNet MASTER COMMUNICATION HISTORY.
The latest history information is displayed at the top of the screen.
The history information consists of "COMMON STATUS", "ERROR RECORD", and "POWER-ON".

Item	Description
COMMON STATUS	The change of DeviceNet MPU status 1, MPU status 2, Master function status 1, and the slave communication states is displayed. The contents of each item are same with the each item of the COMMON STATUS in the bus parameter screen. The state is displayed by black characters at the change with a normal state change. The state is displayed when judged the change with an abnormal state change in red characters.
ERROR RECORD	The abnormal history detected by DeviceNet hardware is displayed. The contents of the abnormal history are same with the ERROR RECORD in MONITOR screen. The abnormal code is displayed in MPU1 column and the detail code is displayed in MPU2 column in red characters.
POWER-ON	The time when the CNC has been turned on is displayed. "PWR" is displayed in MPU1 column in a green background color.

Display item

Item	Description
MPU1	When the contents of display are COMMON STATUS, MPU status 1 is displayed. When the contents of display are ERROR RECORD, abnormal code is displayed. When the contents of display are POWER-ON, "PWR" is displayed.
MPU2	When the contents of display are COMMON STATUS, MPU status 2 is displayed. When the contents of display are ERROR RECORD, detail code is displayed. In other case, nothing is displayed.
STS1	When the contents of display are COMMON STATUS, master function status 1 is displayed. In other case, nothing is displayed.
SALVE NODE	When the contents of display are COMMON STATUS, Slave communication states are displayed. In other case, nothing is displayed.
DAY/TIME	The time when the information of the communication history has been generated is displayed.



Screen 1 - 5

NOTE
If 9 or more errors occur simultaneously, up to 8 error records can be saved in the communication history.

The items displayed in the communication history can be changed by performing operation on the DeviceNet MASTER COMMUNICATION HISTORY screen.

ALL

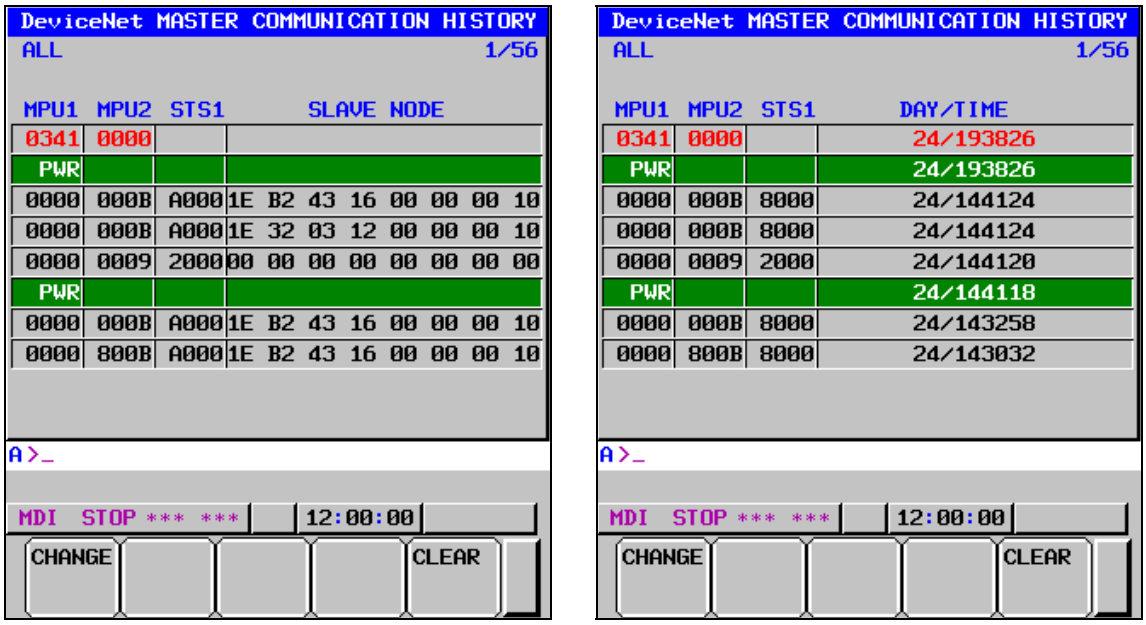
Press soft key [ALL] in order to display all communication histories in DeviceNet MASTER COMMUNICATION HISTORY screen.

STATUS

Press soft key [STATUS] in order to display only the information of COMMON STATUS and POWER-ON in DeviceNet MASTER COMMUNICATION HISTORY screen.

CHANGE

Press soft key [CHANGE] in order to interchange slave communication state and communication history time screens. The communication history time is shown with DD/HHMMSS format.



Display slave communication state **Display communication history time**

Screen 1 - 6

CLEAR

Press the soft key [CLEAR] in order to clear the communication history.

1.4 DeviceNet COMMUNICATION NORMAL SIGNAL

The DeviceNet master function can report whether the communication status is normal or an error occurs, using F signals as the interface between the CNC and PMC.

NOTE
This function is available for only Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F.

Related NC parameters

	#7	#6	#5	#4	#3	#2	#1	#0
11931						DTM		

[Input type] Parameter input
[Data type] Bit

#2 DTM Monitoring of the DeviceNet communication normal signal is
0: Not available.
1: Available.

NOTE
When this parameter is set, the power must be turned off.

11934	DeviceNet communication normal signal monitoring start time

[Input type] Parameter input
[Data type] Word
[Unit of data] sec
[Valid data range] 0 - 32767 (recommended value = 0)
Monitoring of the DeviceNet normal signal starts when the time set in this parameter elapses after power-on.
When this setting is 0 or negative value, monitoring of the signal starts after 60 seconds from power-on.

Signal

DeviceNet communication normal signal DNTCM<F0290.2>

[Classification] Output signal
[Function] This signal indicates that the DeviceNet communication status is normal.
[Output cond.] This signal is set to 1 when:
- The master can communicate with all slaves normally.

This signal is set to 0 when:
- "NETWORK" of the bus parameter is "OFFLINE".
- The parameter DTM(No.11931#2) is not available.
- The error has occurred on the DeviceNet network.

DeviceNet communication abnormal signal DNTER<F0545.4>

[Classification] Output signal
[Function] This signal indicates that the DeviceNet communication status was abnormal.
[Output cond.] This signal is set to 0 when the power is turned on. When the time specified in the parameter No.11934 "DeviceNet communication normal signal monitoring start time" elapses, this signal indicates the error status.
But, when "NETWORK" of the bun parameter is "OFFLINE" or when the parameter DTM(No.11931#2) is 0, this signal keeps 0.
This signal is set to 1 when:
- The DeviceNet communication status has been abnormal.

This signal is set to 0 when:
- The DeviceNet communication status is normal and DNTCLR "DeviceNet communication error clear signal" is set to 1.

When this signal changes into 1 detecting DeviceNet communication error, it keeps 1 even if the DeviceNet communication becomes normal afterwards.

If you clear this signal, DNTCLR "DeviceNet communication error clear signal" changes into 1 under the DeviceNet communication normal status.

NOTE
1 When the parameter DTM is set to 1 and the DeviceNet hardware is broken, the DNTER signal is set to 1 regardless of the parameter "DeviceNet communication normal signal monitoring start time".
2 Even if multi-path PMC is used, this signal is output in Path 1.
3 If DNTCLR is set to 1 for a very short time, the NC cannot detect the change, and DNTER may not be set to 0. Make sure that DNTER is set to 0, then set DNTCLR back to 0.

DeviceNet communication error clear signal DNTCLR<G0518.4>

[Classification] Input signal
[Function] It changes DNTER "DeviceNet communication abnormal signal" <F0545.4> to 0.
[Operation] When the DeviceNet communication status is normal and DNTCLR is set to 1, it changes DNTER to 0.

NOTE
1 When the DeviceNet communication status is abnormal, DNTER keeps 1 even if DNTCLR is set to 1.
2 Please input this signal in Path 1 even if multi-path PMC is used.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F0290						DNTCM		
F0545				DNTER				
G0518				DNTCLR				

1.5 NOTES ON CREATING A LADDER PROGRAM

The following provides notes on creating a ladder program required to construct a safety system in a system that uses DeviceNet.

Input and output signals

An input signal is sent from a slave and received by the DeviceNet master function. Refreshing of the DeviceNet master function writes the signal into the PMC register (DI area). Ladder program processing reads the signal.
An output signal is written into the PMC register (DO area) by ladder program processing. Refreshing of the DeviceNet master function reads the signal. The DeviceNet master function sends the signal and each slave receives it.

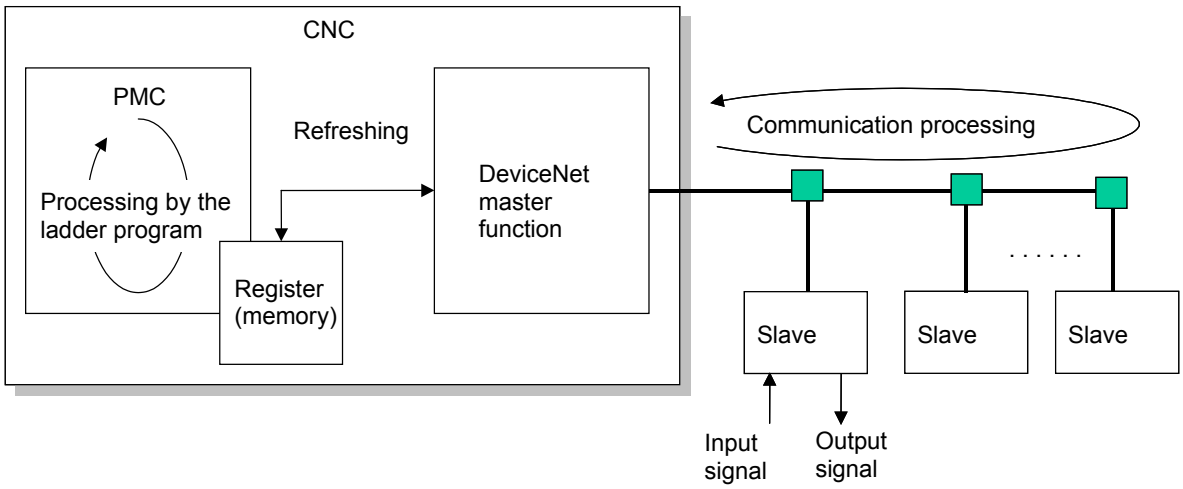


Fig. 1.6(a) Input signal and output signal viewed from the master

Input/output response time

The input/output response time is the amount time required for an input signal to be input to a slave, reported to the master, processed by the ladder program, and output as an output signal from the slave.

Input/output response time

$= T_{in1} + T_{in2} + T_{in3} + T_{in\text{-}out} + T_{out1} + T_{out2} + T_{out3}$

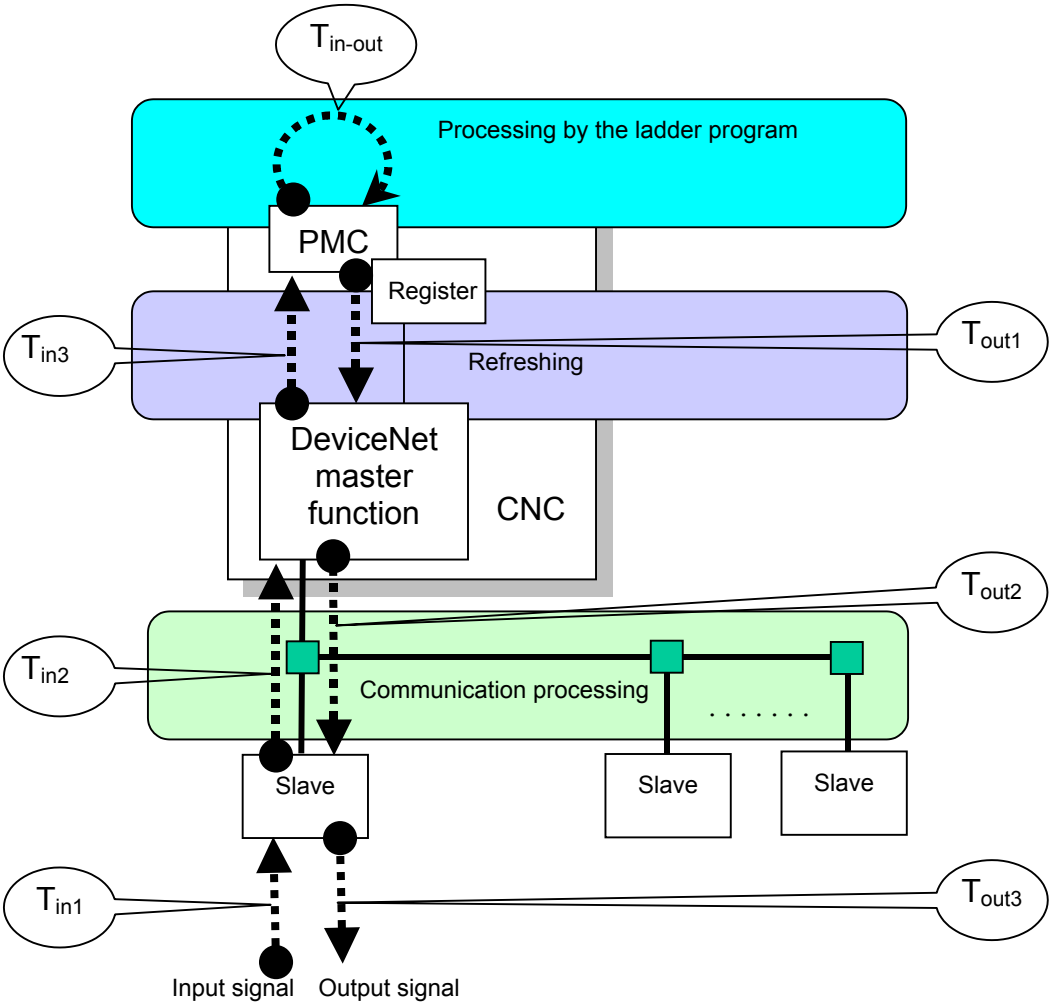


Fig. 1.6(b) Input/output response time

Ladder program processing time

Operates in a cycle that is a multiple of 4 ms or 8 ms depending on the size of the ladder program.
The actual time can be measured with SCAN TIME on the PMC STAUS screen.
This value is the maximum value of $T_{in\text{-}out}$.

Refreshing time

This is the time from when the DeviceNet master function updates all DeviceNet-related DI/DO data assigned to PMC registers until DI/DO data is updated again. The refreshing time varies with the sum of the size of DI/DO data of the slave to be communicated.
This value is the maximum value of T_{in3} and T_{out1}.

Sum of DI/DO data sizes	Refreshing time
1 to 80 bytes	8 ms
81 to 160 bytes	16 ms
161 to 240 bytes	24 ms
241 to 320 bytes	32 ms

Communication processing time

This is the time from when I/O data communication with the slave with a node number is completed until I/O data communication with the slave having the node number is completed again.
The actual time can be measured with CYCLE TIME (CURRENT), CYCLE TIME (MAXIMUM), and CYCLE TIME (MINIMUM) on the BUS PARAMETER screen
This value is the maximum value of T_{in2} and T_{out2}.

Slave processing time

This is the processing time until the signal input to a slave device is sent to the network or the processing time until a slave device outputs the output signal received from the network. Refer to the manual of the slave device.
This value is the maximum value of T_{in1} and T_{out3}.

Maximum input/output response time

The maximum input/output response time (T_{max}) is calculated as shown below.
T_{max} = ladder-program-processing-time +
(refreshing-time + communication-processing-time + slave-processing-time) × 2

Ladder program processing and refreshing by the DeviceNet master function

Processing by the ladder program and refreshing by the DeviceNet master function operate asynchronously with one another. Processing by the ladder program can operate independently of refreshing by the DeviceNet master function, so the ladder program can be repeatedly executed at high-speed.

Fig. 1.6 (c) shows a time chart of the internal operation of the CNC with signals output from the ladder program.

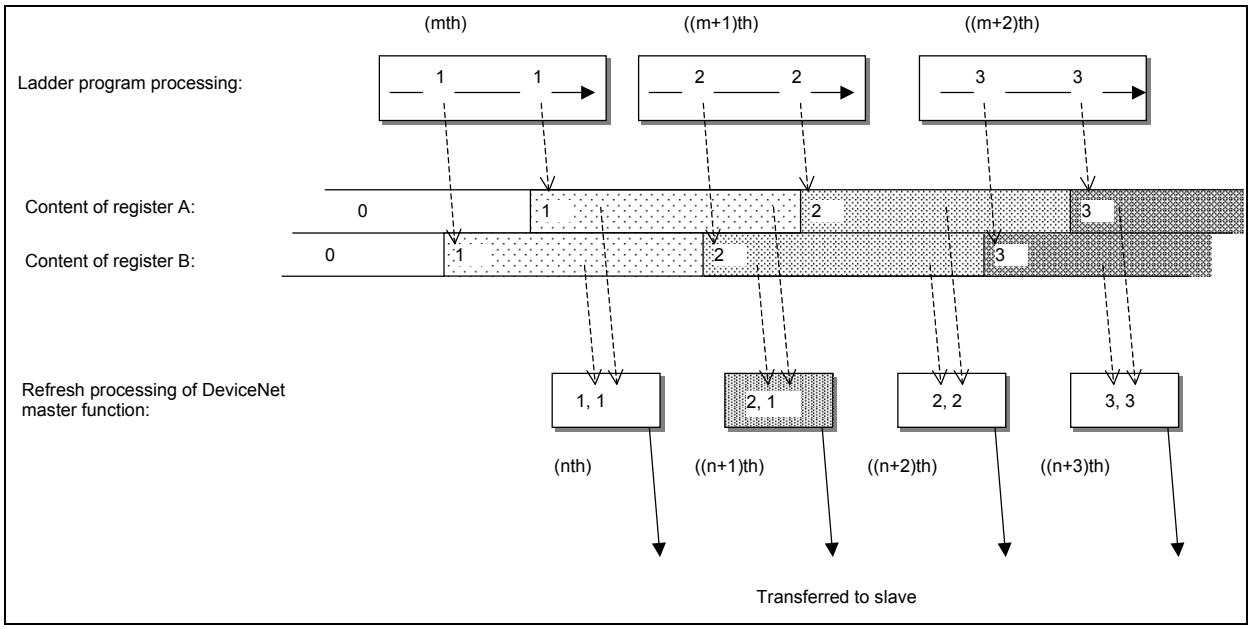


Fig. 1.6(c) Time chart

The upper part of the figure indicates that processing by the ladder program is performed periodically and writing to register A or register B in the PMC is performed in the ladder program.

The middle part indicates that how register A and register B are updated in this case. There are differences in the timing in which data is written to register A or register B even in the same execution cycle of the ladder program, so register A and register B are not updated at the same time.

The lower part indicates that refreshing by the DeviceNet master function is cyclically made to read data in register A and register B. Since register A and register B are not updated at the same time, for example, in the case of (n +1)-th refreshing, the data written by one execution of the ladder program cannot be read as one set.

Conversely, when input signals from a slave are processed in the ladder program, the data written by one execution of refreshing may not be read by one execution of the ladder program.

> ⚠ **CAUTION**
> Refreshing by the DeviceNet master function is made asynchronously with the execution of the ladder program. Therefore, keep the following in mind when creating a ladder program.
> <1> When a DeviceNet input signal set in the specified PMC address is read from two points in the ladder program, even if the ladder program can be executed in one cycle, there is no guarantee that the same value can be read.
> <2> When the ladder program writes an output signal to DeviceNet in the specified PMC address, the signal may be transferred to a slave device before the ladder program is completely executed.

Concurrency of data

When DI data or DO data is handled with the ladder program, the concurrency of long data (4-byte data), word data (2-byte data), and byte data (1-byte data) is guaranteed under the corresponding conditions described below.

> ⚠ **CAUTION**
> 1 If the following constraints are not satisfied, the concurrency of long data (4-byte data) or word data (2-byte data) is not guaranteed.
> 2 To ensure the concurrency of data longer than 4 bytes, use flags which indicate the completion of write and read operations independently of the data to make handshake processing.

Concurrency of long data (4-byte data)

To guarantee the concurrency of data, satisfy the following two conditions.

<1> In the ladder program, the following commands are used in units of four bytes.
Commands :
MOVD, MOVN, XMOVB, SETND, XCHGD, DSCHB, TBLRD, TBLWD, DSEQD, DSNED, DSGTD, DSLTD, DSGED, DSLED, DMAXD, DMIND, EQD, NED, GTD, LTD, GED, LED, RNGD, COMPB, EOR, AND, OR, NOT, EORD, ANDD, ORD, NOTD, SHLD, SHRD, ROLD, RORD, BSETD, BRSTD, BTSTD, BPOSD, BCNTD, CODB, DCNVB, DECB, TBCDD, FBCDD, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSD, SUBSD, MULSD, DIVSD, MODSD, INCSD, DECSD, ABSSD, NEGSD

<2> When DI/DO data is assigned to the PMC area on the SLAVE PARAMETER screen, an address is set for "DI ADDRESS" or "DO ADDRESS" in units of 4 bytes.
Example) 1:R0000, 2:R0004, 3:R0008, 1:E0000

Concurrency of word data (2-byte data)

To guarantee the concurrency of data, satisfy the following two conditions.

<1> In the ladder program, the following commands are used in units of two bytes.
Commands :
MOVW, MOVN, XMOVB, SETNW, XCHGW, DSCHB, TBLRW, TBLWW, DSEQW, DSNEW, DSGTW, DSLTW, DSGEW, DSLEW, DMAXW, DMINW, EQW, NEW, GTW, LTW, GEW, LEW, RNGW, COMPB, EOR, AND, OR, NOT, EORW, ANDW, ORW, NOTW, SHLW, SHRW, ROLW, RORW, BSETW, BRSTW, BTSTW, BPOSW, BCNTW, CODB, DCNVB, DECB, TBCDW, FBCDW, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSW, SUBSW, MULSW, DIVSW, MODSW, INCSW, DECSW, ABSSW, NEGSW

<2> When DI/DO data is assigned to the PMC area on the SLAVE PARAMETER screen, an address is set for "DI ADDRESS" or "DO ADDRESS" in units of 2 bytes.
Example) 1:R0000, 2:R0002, 3:R0004, 1:E0002

Concurrency of byte data (1-byte data)

There are no special constraints. The concurrency is always guaranteed in 1-byte data.

Actions upon detection of an error

To check whether I/O communication is normal, COMMON STATUS or DETAIL STATUS can be monitored with the ladder program. For details on each status, see BUS PARAMETER screen - COMMON STATUS and SLAVE PARAMETER screen - DETAIL STATUS ADDRESS in Section 1.1, "SETTING SCREEN OF THE DeviceNet MASTER FUNCTION".
Fig. 1.6 (d) shows a flowchart for detecting a failure by using "DeviceNet MPU status 1".

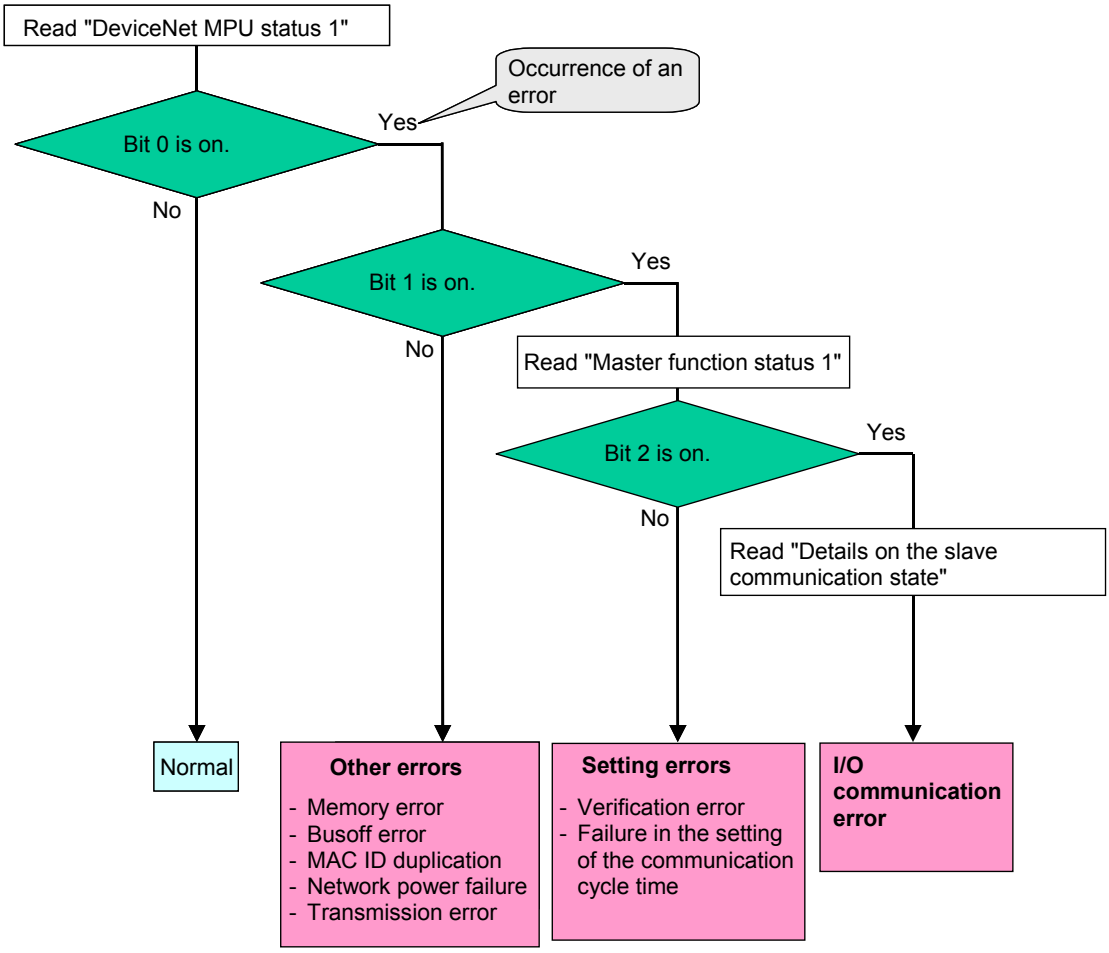


Fig. 1.6(d) Flowchart

> ⚠ **CAUTION**
> The time after the power is turned on until communication is actually started may vary depending on the connected device status and other factors. The "normal" state in the flowchart is determined when all slaves are recognized. When many slaves are connected, it may take time after the "normal" state is determined until data has been exchanged with all slaves. For this reason, if it is necessary to strictly determine whether communication starts, use not the time or status, but actual communication data.
> Before referencing DI data in the ladder program, make sure that communication is normal by monitoring COMMON STATUS or DETAIL STATUS with the ladder program. The DI DATA ON ABNORMAL and CLR(Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F only) setting on the BUS PARAMETER screen specifies whether DI data is restored to the previous status or cleared to 0 in the event of a communication failure. Create a ladder program so that the system operates safely even in the event of a communication failure with this setting carefully considered.

2 DeviceNet SLAVE FUNCTIONS

This chapter describes how to set the slave functions of DeviceNet

2.1 SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION

This section describes the SETTING screen of the DeviceNet slave function.

NOTE
1 Before changing a parameter on the SETTING screen, set the MDI mode or emergency stop state.
2 When a parameter is changed on the SETTING screen, "PW0000 POWER MUST BE OFF" appears on the CNC ALARM MESSAGE screen. For the changed parameters to take effect, turn the CNC power off and back on again.

SETTING screen

Procedure

1 Press function key 

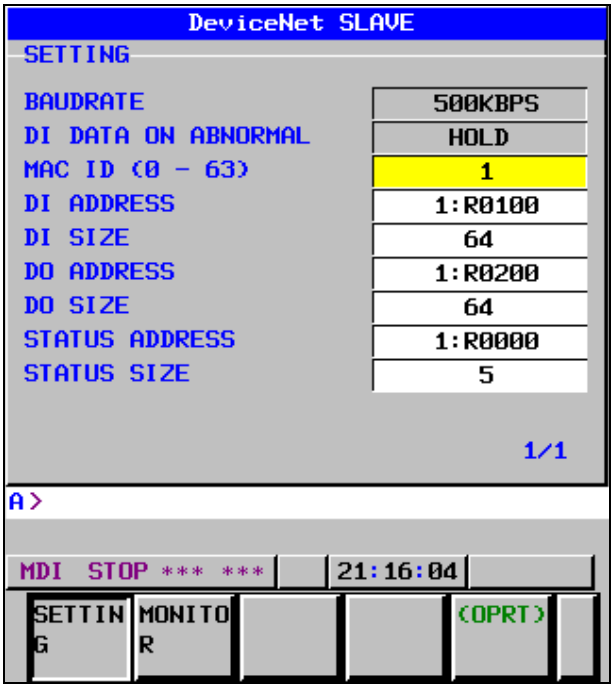
.

2 Soft key [DEVNET SLAVE] appears. (When soft key [DEVNET SLAVE] does not appear, press the continue key located at the right end of soft keys several times.)

3 If you press soft key [DEVNET SLAVE], the SETTING screen or MONITOR screen appears.

4 Press soft key [SETTING] to display the SETTING screen.

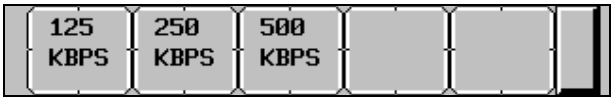
5 Move the cursor to the item to set and then enter the parameter.



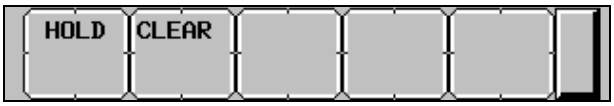
Screen 2-1

6 Press soft key [(OPRT)] as needed and then use the following soft keys.

[BAUDRATE] :



[DI DATA] :



Setting item

Item	Description
BAUDRATE	Sets the communication rate. The communication rate is limited by the maximum length or maximum total branch length of a network. For details, see Section 1.2, "CABLE LENGTH AND TRANSFER RATE" in Part IV, "CONNECTION." One of 125 Kbps, 250 Kbps, and 500 Kbps can be set.
DI DATA ON ABNORMAL	Sets whether DI data is restored to the value before occurrence of a communication error or cleared to 0 when communication stops due to a communication error. HOLD : DI data is restored to the value before occurrence of a communication error. CLEAR : DI data is cleared to 0.
MAC ID (0 - 63)	Sets the MAC ID of the DeviceNet master. The MAC ID must be unique on the network. The setting range is between 0 and 63.
DI ADDRESS (WARNING)	Sets the address of the PMC area in which the DI data (input data) is to be stored. When the DI data is not required, set " " (space). The setting range is the R or E area of PMC.
DI SIZE	Sets the size of the PMC area in which the DI data is to be stored. When the DI data is not required, set 0. The setting range is 0 to 64 (bytes).
DO ADDRESS (WARNING)	Sets the address of the PMC area in which the DO data (output data) is to be stored. When the DO data is not required, set " " (space). The setting range is the R or E area of PMC.
DO SIZE	Sets the size of the PMC area in which the DO data is to be stored. When the DO data is not required, set 0. The setting range is 0 to 64 (bytes).
STATUS ADDRESS (WARNING)	Sets the address of the PMC area in which the status is to be stored. When the status is not required, set " " (space). The setting range is the R or E area of PMC.
STATUS SIZE	Sets the size of the PMC area in which the status is to be stored. When the status is not required, set 0. The setting range is 0 to 5 (bytes).

> ⚠ **WARNING**
> Before allocating the PMC area, be sure to read Section 2.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

STATUS INFORMATION

The status information consists of the five bytes below.

	STATUS
STATUS ADDRESS	Status (1 byte)
STATUS ADDRESS + 1	DeviceNet MPU status (1 byte)
STATUS ADDRESS + 2	DeviceNet MPU status transition (1 byte)
STATUS ADDRESS + 3	DeviceNet MPU alarm code (1 byte)
STATUS ADDRESS + 4	DeviceNet MPU version information (1 byte)

These statuses are described below in detail.

- Status
  Indicates the communication status of the DeviceNet slave board.
  00H : Communication is under preparation and I/O communication is not in progress
  01H : I/O communication with the master station is in progress.
  03H : A communication error occurred.
  Check the DeviceNet MPU status transition and DeviceNet MPU alarm code.

- DeviceNet MPU status
  This is the MPU status reported from the DeviceNet slave board.
  Bit 0 : Initialization of the DeviceNet MPU has been completed. (Normal communication status)
  Bit 1 : Valid data is being received. (Normal communication status)
  Bit 2 : Busoff has been detected.
  (Communication stopped because a communication error occurred frequently.)
  Bit 3 to Bit 7 : Reserved.

- DeviceNet MPU status transition and DeviceNet MPU alarm code
  These are the MPU status transition and MPU alarm code reported from the DeviceNet slave board.

Status	DeviceNet MPU		Description and action
	Status transition	Alarm code	
00H	00H	00H	**Onboard MPU being initialized** The MPU on the DeviceNet slave board is being initialized.
	01H	00H	
	02H	00H	**Line baud rate being checked** The baud rate of the line frame is being checked. When the system stops in this status, confirm that: → Cable looseness or breaks are not present. → The baud rate settings of all nodes are the same. → The power for communication is correctly supplied.
		0DH	**Network power failure** A network power failure occurred. When the system stops in this status, confirm that: → The power for communication is correctly supplied.
	03H	00H	**Duplicate MAC IDs being checked** Duplicate MAC IDs are being checked.
	04H	00H	**Waiting for I/O communication to be established** The system is waiting for I/O communication from the master to be established. When the system stops in this status, confirm that: → There is no difference in I/O sizes between the master and this slave. → The MAC ID of the master is different from that of this slave.
01H	05H	00H	**I/O communication normal** I/O communication is being performed normally.

Status	DeviceNet MPU		Description and action
	Status transition	Alarm code	
03H	06H	00H	**I/O communication timeout** Upon establishment of I/O communication, a line break occurred. When the system stops in this status, confirm that: → Cable looseness or breaks are not present.
	07H	00H	**I/O communication idle** When the DI size is set to a non-zero value, a 0-byte frame is being received.
	00H to 07H	0DH	**Network power failure** A network power failure occurred. (The value of status transition at the detection of a network power failure is set.) When the system stops in this status, confirm that: → The power for communication is correctly supplied.
	82H	0BH	**MAC ID duplicate** There is the same MAC ID as the local ID on the network. When the system stops in this status, confirm the following and then turn the slave power off and back on again. → Confirm that the MAC IDs of all nodes are unique by checking them.
03H	83H	0CH	**Busoff detected** Frequent communication errors occurred and communication stopped. When the system stops in this status, confirm the following and then turn the slave power off and back on again. → The baud rate settings of all nodes are the same. → The cable length is appropriate. → Cable looseness or breaks are not present. → Terminals are present only at both ends of the trunk. → There is not much noise.
	Others	Others	**Other unrecoverable errors** Any of other unrecoverable failures occurred on the DeviceNet slave board. When the system stops in this status, remove the noise factor and then turn the slave power off and back on again. When the error persists even after removal of the noise factor, replace the DeviceNet slave board.

- DeviceNet MPU version information
  This is the version of the software for the DeviceNet slave board.

2.2 MAINTENANCE SCREEN THE DeviceNet SLAVE FUNCTION

This section describes the maintenance screen of the DeviceNet slave function.

MONITOR screen

Procedure

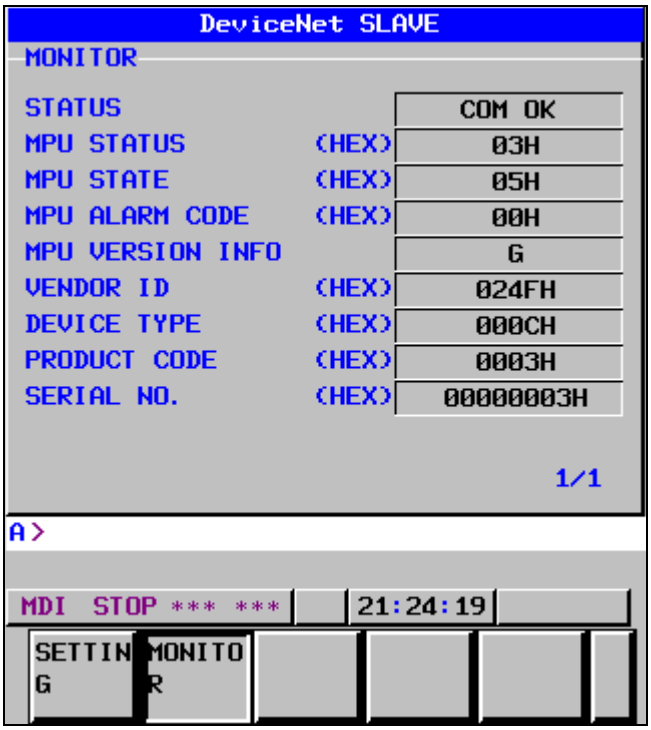
1 Press function key 

.

2 Soft key [DEVNET SLAVE] appears. (When soft key [DEVNET SLAVE] does not appear, press the continue key located at the right end of soft keys several times.)

3 If you press soft key [DEVNET SLAVE], the SETTING screen or MONITOR screen appears.

4 Press soft key [MONITOR] to display the MONITOR screen.



Screen 2 - 2

Display item

Item	Description
STATUS	Indicates the communication status. - COM CHECK (00H) I/O communication is not performed since communication is under preparation. - COM OK (01H) I/O communication with the master station is in progress. - COM ERROR (03H) A communication error occurred.
MPU STATUS MPU STATE MPU ALARM CODE MPU VERSION INFO	Indicates information about the MPU on the DeviceNet slave board. The description is similar to "DeviceNet MPU status", "DeviceNet MPU alarm code", "DeviceNet MPU status transition", and "DeviceNet MPU version information" in Section 2.1, "SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION" in this Part For details, see the corresponding section.
VENDOR ID	The vendor ID is displayed. The display range is between 0000H and FFFFH. 024FH: FANUC CORPORATION
DEVICE TYPE	The device type is displayed. The display range is between 0000H and FFFFH. 000CH: Communication adaptor
PRODUCT CODE	The product code is displayed. The display range is between 0000H and FFFFH. 0003H: A20B-8101-0330
SERIAL NO.	Serial number is displayed. This is a unique value assigned to each product. The display range is between 00000000H and FFFFFFFFH.

2.3 COMMUNICATION HISTORY of DeviceNet SLAVE FUNCTION

The change of STATUS INFORMATION of the DeviceNet slave function can be kept as the communication history.
In this case, the kept communication history is not cleared by the power-off of CNC.

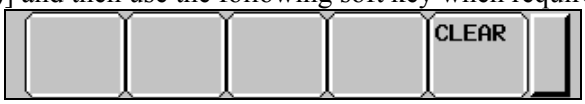
NOTE
This function is available for only Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F.

DeviceNet SLAVE COMMUNICATION HISTORY screen

Procedure

1 Press function key 

.
2 Soft key [DNET S HISTRY] appears. (When soft key [DNET S HISTRY] does not appear, press the continue key located at the right end of soft keys several times.)
3 If you press soft key [DNET S HISTRY], the DeviceNet SLAVE COMMUNICATION HISTORY screen appears.
4 Press soft key [(OPRT)] and then use the following soft key when required:



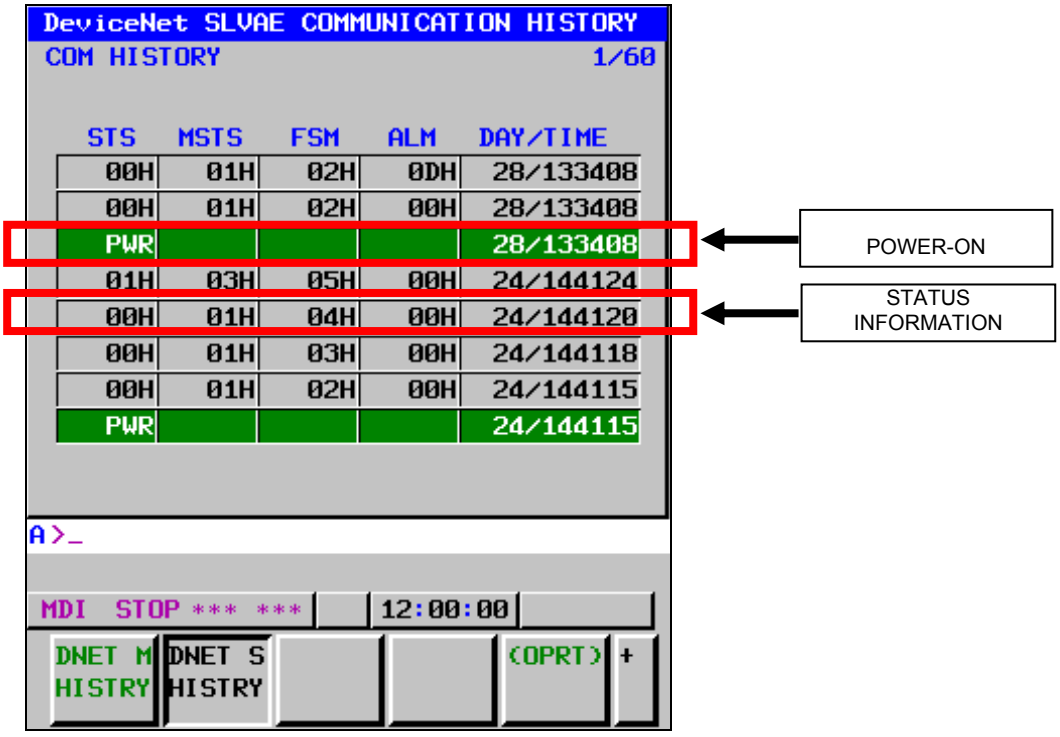
Contents of display

The communication history is displayed in the DeviceNet SLAVE COMMUNICATION HISTORY.
The latest history information is displayed at the top of the screen. The history information consists of "STATUS INFORMATION" and "POWER-ON". For both items, day/hours-minutes-seconds (2 digits each) when the communication history is recorded are displayed in the rightmost field of each line.

Item	Description
STATUS INFORMATION	The change of status, DeviceNet MPU status, DeviceNet MPU state transition, and the DeviceNet MPU alarm code is displayed. The meaning of each displayed item is the same as that of each item in the status information described in Section 2.1, "SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION". The state is displayed by black characters at the change with a normal state change. The state is displayed when judged the change with an abnormal state change in red characters.
POWER-ON	The time when the CNC has been turned on is displayed. "PWR" is displayed in STS column in a green background color.

Display item

Item	Description
STS	When the contents of display are STATUS INFORMATION, status is displayed. When the contents of display are POWER-ON, "PWR" is displayed.
MSTS	When the contents of display are STATUS INFORMATION, DeviceNet MPU status is displayed. In other case, nothing is displayed.
FSM	When the contents of display are STATUS INFORMATION, DeviceNet MPU state transition is displayed. In other case, nothing is displayed.
ALM	When the contents of display are STATUS INFORMATION, DeviceNet MPU alarm code is displayed. In other case, nothing is displayed.
DAY/TIME	The time when the information of the communication history has been generated is displayed.



Screen 2 - 3

CLEAR

Press the soft key [CLEAR] in order to clear the communication history.

2.4 NOTES ON CREATING A LADDER PROGRAM

The following provides notes on creating a ladder program required to construct a safety system in a system that uses DeviceNet.

Input signal and output signal viewed from the master

An output signal from the master is sent from the master and received by the DeviceNet slave function. Refreshing of the DeviceNet slave function writes the signal in the PMC register (DI area) and ladder program processing reads it.
An input signal to the master is written in the PMC register (DO area) by ladder program processing. Refreshing of the DeviceNet slave function reads the signal. The DeviceNet slave function sends the signal and the master receives it.

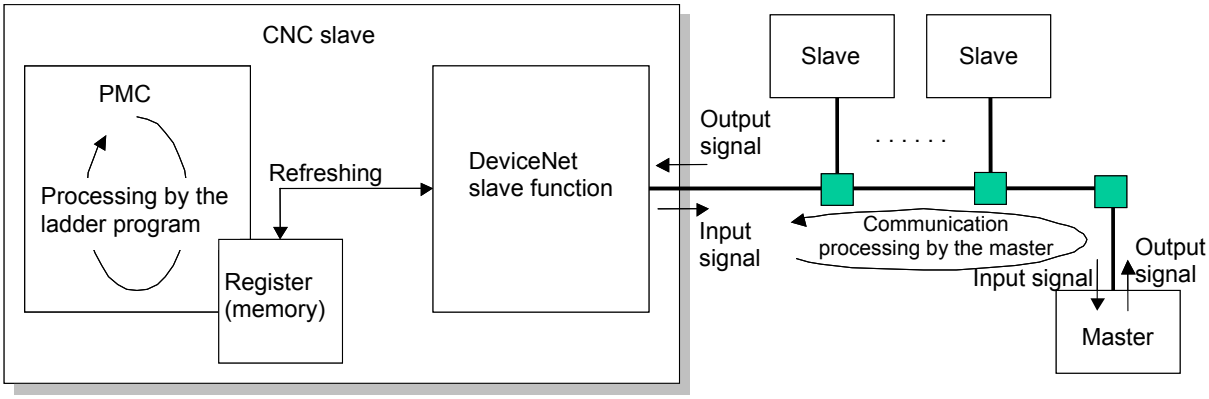


Fig. 2.5(a) Input signal and output signal viewed from the master

Input/output response time viewed from the master

Suppose that input/output signals are processed by the ladder program in the master, as shown in the figure below.
In this case, the input/output response time in terms of the master is the time from when the output signal is set by the master ladder program through when the slave ladder program performs input/output processing to when the master ladder program recognizes it as the input program.
Input/output response time viewed from the master
$= T_{in1} + T_{in2} + T_{in3} + T_{in\text{-}out} + T_{out1} + T_{out2} + T_{out3}$

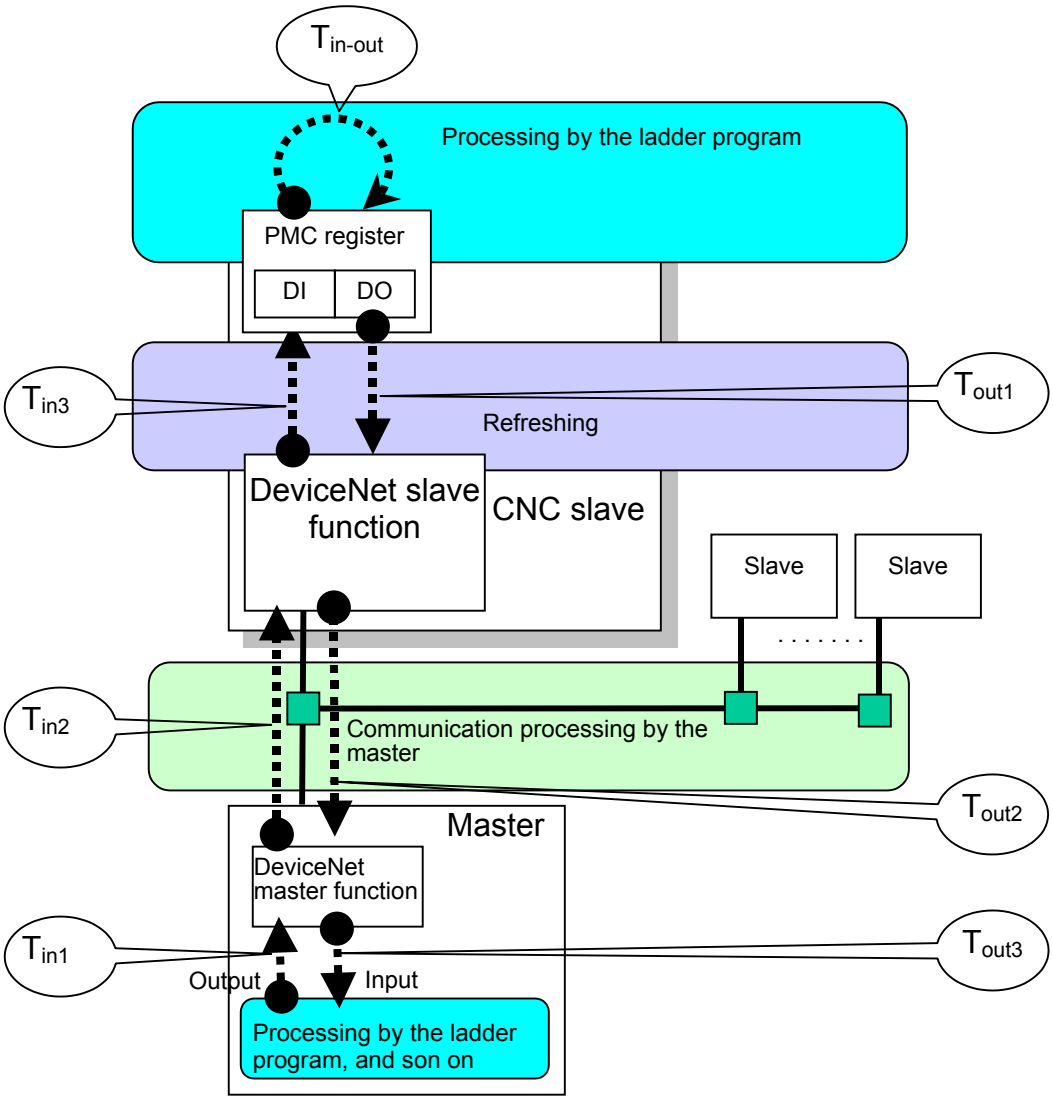


Fig. 2.5(b) Input/output response time viewed from the master

Ladder program processing time (CNC slave)

Operates in a cycle that is a multiple of 4 ms or 8 ms depending on the size of the ladder program. The actual time can be measured with SCAN TIME on the PMC STAUS screen.
This value is the maximum value of $T_{in\text{-}out}$.

Refreshing time

This is the time from when the DeviceNet slave function updates all DeviceNet-related DI/DO data assigned to PMC registers until DI/DO data is updated again.
This value is the maximum value of T_{in3} and T_{out1}.

NOTE
For this DeviceNet slave function, the refresh time is 8 msec. When a DI/DO address assigned on the setting screen is not set in units of 4 bytes, a refresh time of 8 msec is not guaranteed.
Sample addresses set in units of 4 bytes) 1:R0000, 2:R0004, 3:R0008, 1:E0000

Communication processing time by the master

This is the time in terms of the master from when I/O data communication to the slave with a certain node number is processed to when I/O data communication to the slave with the same node number is processed again. Since this time depends on the DeviceNet bus parameters of the master devices, the number of connected devices, I/O transfer size, refer to the manuals of the master devices for details.
This value is the maximum value of T_{in2} and T_{out2}.

Master processing time

This is the time in terms of the master from when the output signal is set by input/output processing (by the ladder program etc.) to when the signal is sent to a network or the time until input/output processing recognizes the input signal received from a network. For details, refer to the manual of the master device.
This value is the maximum value of T_{in1} and T_{out3}.

Maximum input/output response time viewed from the master

The maximum input/output response time (T_{max}) viewed from the master is calculated as shown below.
T_{max} = ladder-program-processing-time (CNC slave) +
(refreshing-time + communication-processing-time-by-the-master + master-processing-time) × 2

Ladder program processing (CNC slave) and refreshing by the DeviceNet slave function

Processing by the ladder program and refreshing by the DeviceNet slave function operate asynchronously with one another. Processing by the ladder program can operate independently of refreshing by the DeviceNet slave function, so the ladder program can be repeatedly executed at high-speed.

Fig. 2.5 (c) shows a time chart of the internal operation of the CNC with signals output from the ladder program.

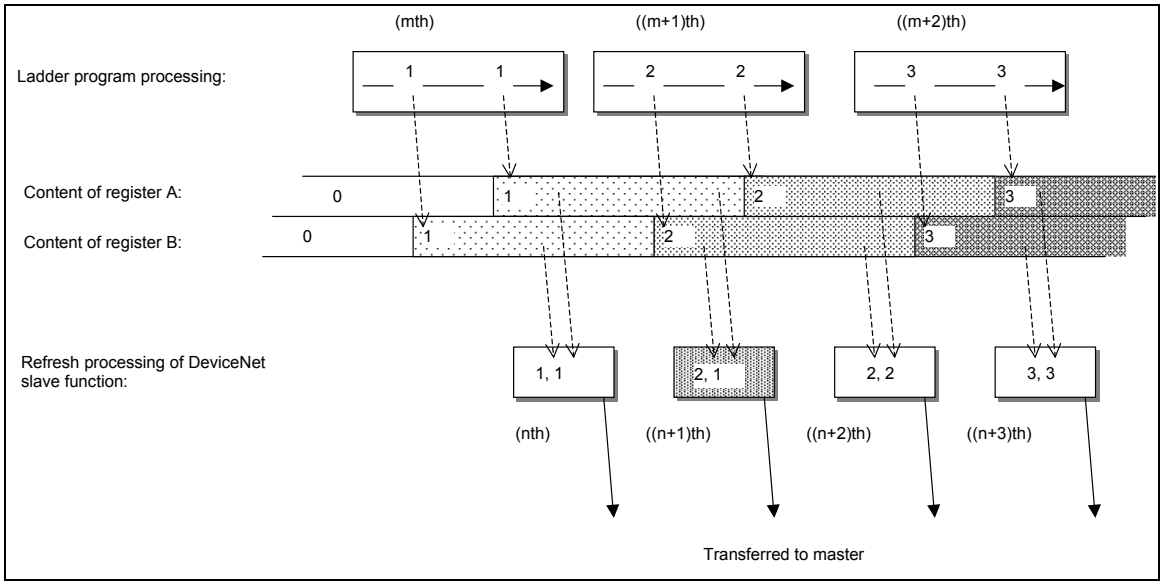


Fig. 2.5(c) Time chart

The upper part of the figure indicates that processing by the ladder program is performed periodically and writing to register A or register B in the PMC is performed in the ladder program.

The middle part indicates that how register A and register B are updated in this case. There are differences in the timing in which data is written to register A or register B even in the same execution cycle of the ladder program, so register A and register B are not updated at the same time.

The lower part indicates that refreshing by the DeviceNet slave function is cyclically made to read data in register A and register B. Since register A and register B are not updated at the same time, for example, in the case of (n +1)-th refreshing, the data written by one execution of the ladder program cannot be read as one set.

Conversely, when input signals from a master are processed in the ladder program, the data written by one execution of refreshing may not be read by one execution of the ladder program.

⚠ CAUTION
Refreshing by the DeviceNet slave function is made asynchronously with the execution of the ladder program. Therefore, keep the following in mind when creating a ladder program.
<1> When a DeviceNet input signal set in the specified PMC address is read from two points in the ladder program, even if the ladder program can be executed in one cycle, there is no guarantee that the same value can be read.
<2> When the ladder program writes an output signal to DeviceNet in the specified PMC address, the signal may be transferred to a slave device before the ladder program is completely executed.

Concurrency of data

When DI data or DO data is handled with the ladder program, the concurrency of long data (4-byte data), word data (2-byte data), and byte data (1-byte data) is guaranteed under the corresponding conditions described below.

⚠ CAUTION
1 If the following constraints are not satisfied, the concurrency of long data (4-byte data) or word data (2-byte data) is not guaranteed.
2 To ensure the concurrency of data longer than 4 bytes, use flags which indicate the completion of write and read operations independently of the data to make handshake processing.

Concurrency of long data (4-byte data)

To guarantee the concurrency of data, satisfy the following two conditions.

<1> In the ladder program, the following commands are used in units of four bytes.
Commands :
MOVD, MOVN, XMOVB, SETND, XCHGD, DSCHB, TBLRD, TBLWD, DSEQD, DSNED, DSGTD, DSLTD, DSGED, DSLED, DMAXD, DMIND, EQD, NED, GTD, LTD, GED, LED, RNGD, COMPB, EOR, AND, OR, NOT, EORD, ANDD, ORD, NOTD, SHLD, SHRD, ROLD, RORD, BSETD, BRSTD, BTSTD, BPOSD, BCNTD, CODB, DCNVB, DECB, TBCDD, FBCDD, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSD, SUBSD, MULSD, DIVSD, MODSD, INCSD, DECSD, ABSSD, NEGSD

<2> When DI data or DO data is assigned to the R address or E address of PMC, the R address or E address is aligned with 4-byte boundaries.
Example) 1:R0000, 2:R0004, 3:R0008, 1:E0000

Concurrency of word data (2-byte data)

To guarantee the concurrency of data, satisfy the following two conditions.

<1> In the ladder program, the following commands are used in units of two bytes.
Commands :
MOVW, MOVN, XMOVB, SETNW, XCHGW, DSCHB, TBLRW, TBLWW, DSEQW, DSNEW, DSGTW, DSLTW, DSGEW, DSLEW, DMAXW, DMINW, EQW, NEW, GTW, LTW, GEW, LEW, RNGW, COMPB, EOR, AND, OR, NOT, EORW, ANDW, ORW, NOTW, SHLW, SHRW, ROLW, RORW, BSETW, BRSTW, BTSTW, BPOSW, BCNTW, CODB, DCNVB, DECB, TBCDW, FBCDW, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSW, SUBSW, MULSW, DIVSW, MODSW, INCSW, DECSW, ABSSW, NEGSW

<2> When DI data or DO data is assigned to the R address or E address of PMC, the R address or E address is aligned with 2-byte boundaries.
Example) 1:R0000, 2:R0002, 3:R0004, 1:E0002

Concurrency of byte data (1-byte data)

There are no special constraints. The concurrency is always guaranteed in 1-byte data.

Actions upon detection of an error

Whether I/O communication is normal can be determined by monitoring the first byte of the status information with the ladder program.
For details on the status information, see "SETTING screen" - "STATUS INFORMATION" in Section 2.1, "SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION".

⚠ CAUTION

The time after the power is turned on until communication is actually started may vary depending on the connected device status and other factors. For this reason, to perform I/O communication depending on the communication start timing, it is necessary not to wait for the specified time, but to check each signal received from the communication destination.
Before referencing DI data in the ladder program, make sure that communication is normal by monitoring STATUS INFORMATION with the ladder program.
The DI DATA ON ABNORMAL setting on the SETTING screen specifies whether DI data is restored to the previous status or cleared to 0 in the event of a communication failure. Create a ladder program so that the system operates safely even in the event of a communication failure with this setting carefully considered.

NOTE

When DI DATA ON ABNORMAL is set to CLEAR on the SETTING screen, if the first byte of the status information is not 01H, DI data is cleared.

IV. CONNECTION

1 CONNECTING THE DeviceNet

This chapter provides an explanation of how to connect the DeviceNet.

> ⚠ **CAUTION**
> The following provides descriptions of the DeviceNet connection devices below, which are not supplied by FANUC. Please purchase these connection devices complying with the DeviceNet standard as needed from other companies.
> - Communication cable
> - Power supply for communication
> - Terminator
> - T-branch tap
> - Power tap
> - Crimp terminal

1.1 DeviceNet CABLES

DeviceNet cables include thick-wire and thin-wire cables. A thick-wire cable is normally used as a long main line. Since a thin-wire cable is more flexible than a thick-wire cable, it is normally used as a branch line or can also be used as a short main line.

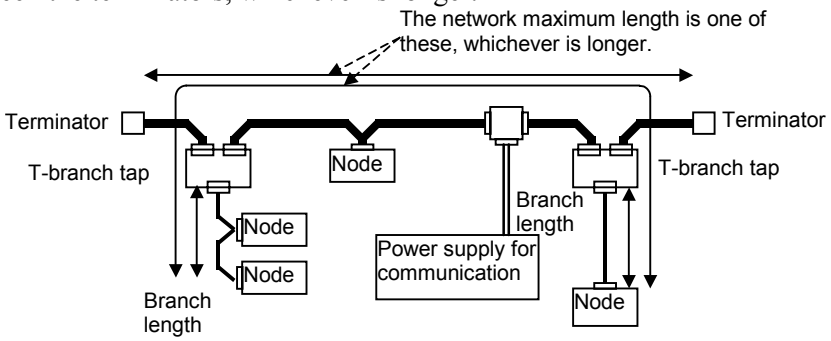
These cables must comply with the DeviceNet standards.

1.2 CABLE LENGTH AND TRANSFER RATE

The maximum network length, branch length, and total branch length are restricted by the network configuration. These lengths are limited by the transfer rate.

Maximum network length

The maximum network length is the distance between two nodes that are most distant from one another or the distance between the terminators, whichever is longer.



As shown below, the maximum cable length varies with the type of a cable.

Cable type	Maximum network length
Thick-wire cable (five wires)	500 m
Thin-wire cable (five wires)	100 m

NOTE
When the maximum network length is 100 m or less, a thin-wire cable can be used as a main line. In this case, prevent the limit values from being exceeded while keeping the maximum current capacity of the cable in mind.

The maximum network length is also restricted by the communication rate.

Communication rate	Maximum network length when using only thick-wire cables	Maximum network length when using only thin-wire cables
500 K bits/sec	100m	100m
250 K bits/sec	250m	
125 K bits/sec	500m	

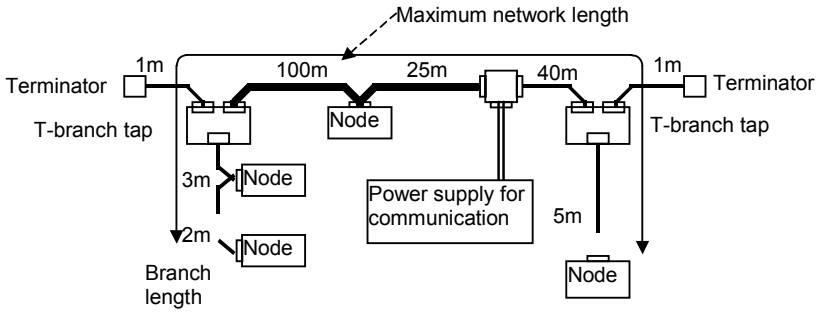
NOTE
When thick-wire cables and thin-wire cables are mixed:
Thick-wire cables and thin-wire cables can be mixed for connection between two nodes that are most distant. In this case, however, the lengths of the cables must satisfy the following expression. The maximum network length is shorter as compared with the case where only thick-wire cables are used.

In addition, the maximum current capacity of each cable must not be exceeded.

Communication rate	Maximum network length
500 K bits/sec	Lthick + Lthin ≤ 100m
250 K bits/sec	Lthick + 2.5 × Lthin ≤ 250m
125 K bits/sec	Lthick + 5 × Lthin ≤ 500m

Lthick : Length of a thick-wire cable
Lthin : Length of a thin-wire cable

Example)

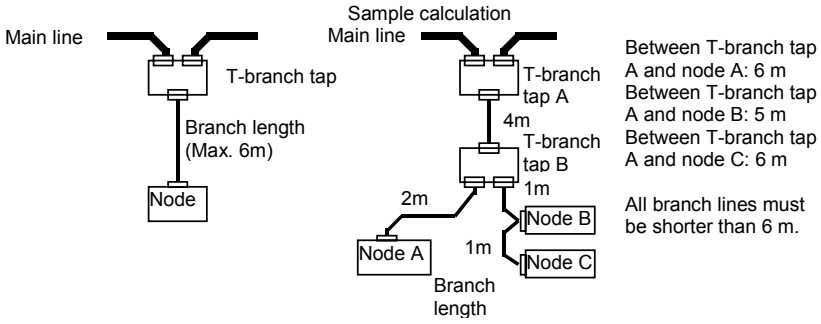


Communication rate	Maximum network length	Enabled/Disabled
500 K bits/sec	Lthick + Lthin=175 ≤ 100m	Disabled
250 K bits/sec	Lthick+2.5 × Lthin=125+2.5 × 50=250 ≤ 250m	Enabled
125 K bits/sec	Lthick + 5 × Lthin=125+5 × 50=375 ≤ 500m	Enabled

According to the above calculation, communication at a speed of 250 K bits/sec and 125 K bits/sec is enabled in this case. Even when the above conditions are satisfied, however, a network cannot be configured if the maximum allowable current capacity is exceeded.

Branch line length

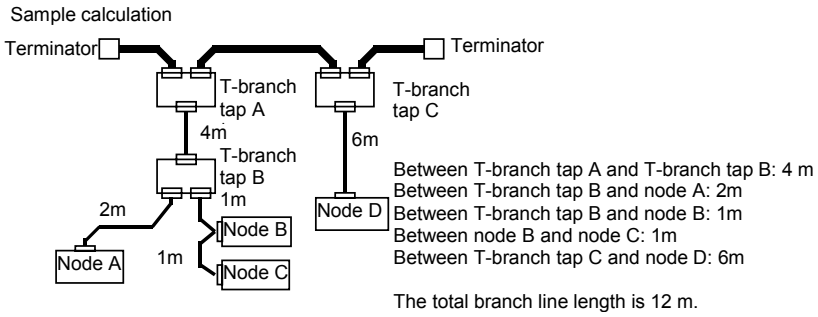
The branch line length is the maximum distance between a T-branch tap on a main line from which a branch line extends and a node to which a branch line is connected. The branch line length must be 6 m or less.
Another branch line can be branched from a branch line.



Total branch line length

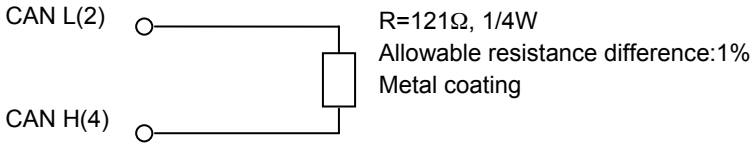
The total branch line length is the sum of the lengths of all branch lines. Even when each branch line is shorter than 6 m, the total branch line length may be exceeded. The total branch line length varies with the communication rate.

Communication rate	Maximum total branch line length
500 K bits/sec	39m
250 K bits/sec	78m
125 K bits/sec	156m



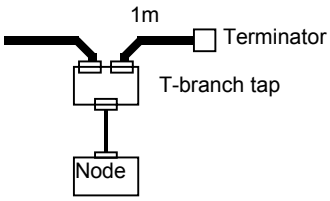
1.3 TERMINATOR

Be sure to attach a terminator to each end of a main line. The end of a branch line does not need to be terminated, so do not attach a terminator. A terminator is required only both ends of a main line.
The specifications and connection method of terminators are shown below.



NOTE
A number enclosed in parentheses is a connector pin number.

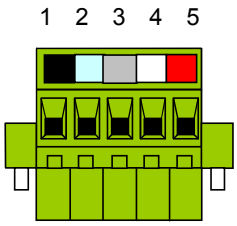
A terminators must be attached within 1 m from the end (node or T-branch tap) of a main line.



1.4 CONNECTORS

Connector

DeviceNet interface connector

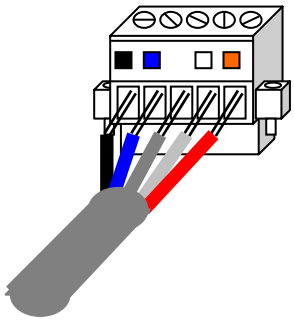


Terminal number	Signal name	Color code	Signal type
1	V-	Black	Power cable - side
2	CAN L	Blue	Communication data Low side
3	SHIELD	Bare	Shield
4	CAN H	White	Communication data High side
5	V +	Red	Power cable + side

Cable side connector:

Phoenix Contact
MVSTBW2,5/5-STF-5,08AU M (This is supplied with the product.)
Applicable wire: AWG24-12

Connection of a communication cable



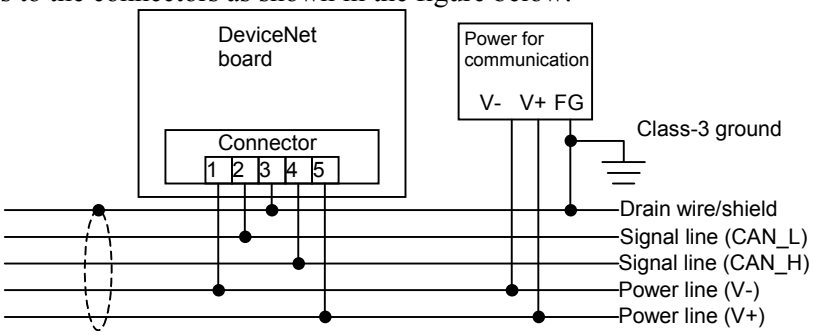
Connect a communication cable to the DeviceNet interface connector, as described below.

(1) Remove the supplied connector from the DeviceNet board.
(2) Strip off the sheath of the cable about 30 mm and remove the unnecessary shield.
(3) Remove the aluminum tape covering the signal and power lines and strip off the sheaths of the signal and power lines according to the length of a crimp terminal.
(4) Twist each of the stripped signal and power lines and attach a crimp terminal to it.
The following crimp terminal is recommended.
- Phoenix Contact AI Series (special tool ZA3)
(5) Loosen the cable fixing screw of the connector so a wire can easily be inserted.
(6) Insert the shield line, signal lines, and power lines into the holes of the connector terminal block so that the colors of the sheaths of the shield line, signal lines, and power lines match those indicated on the connector.
(7) Fix the lines by tighten the cable fixing screws of the connector.
(8) Attach the connector to the DeviceNet board.

Two thin-wire cables can be connected to the connector through multi-dropped connection. In this case, two cables are inserted into one hole of a terminal block. However, multi-dropped connection cannot be used for thick-wire cables. Please use a T-branch tap.

1.5 CABLE CONNECTION AND GROUNDING

Connect the cables to the connectors as shown in the figure below.

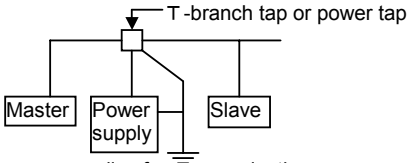


Grounding of a network

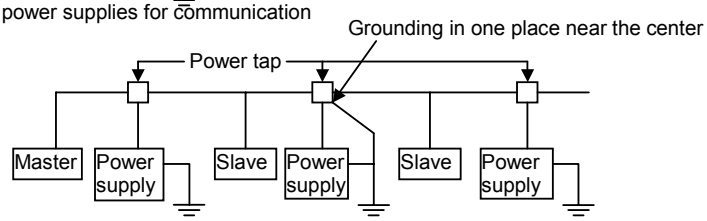
It is recommended in the DeviceNet standard that grounding be performed only in one place on a network to prevent a ground loop from being formed and that grounding be performed in about the center of a network. As shown above, connect the shield line of the cable to the ground terminal (FG) of the power supply for communication and perform class-3 ground.

When using multiple power supplies for communication, connect the shield line to the ground terminal of the power supply that locates near the center of a network and perform class-3 ground for the frame ground terminals of the other power supplies without connecting to the shield line. In addition, when using multiple power supplies for communication, use the special power tap from other companies.

One power supply for communication



Multiple power supplies for communication



Drawing the ground line

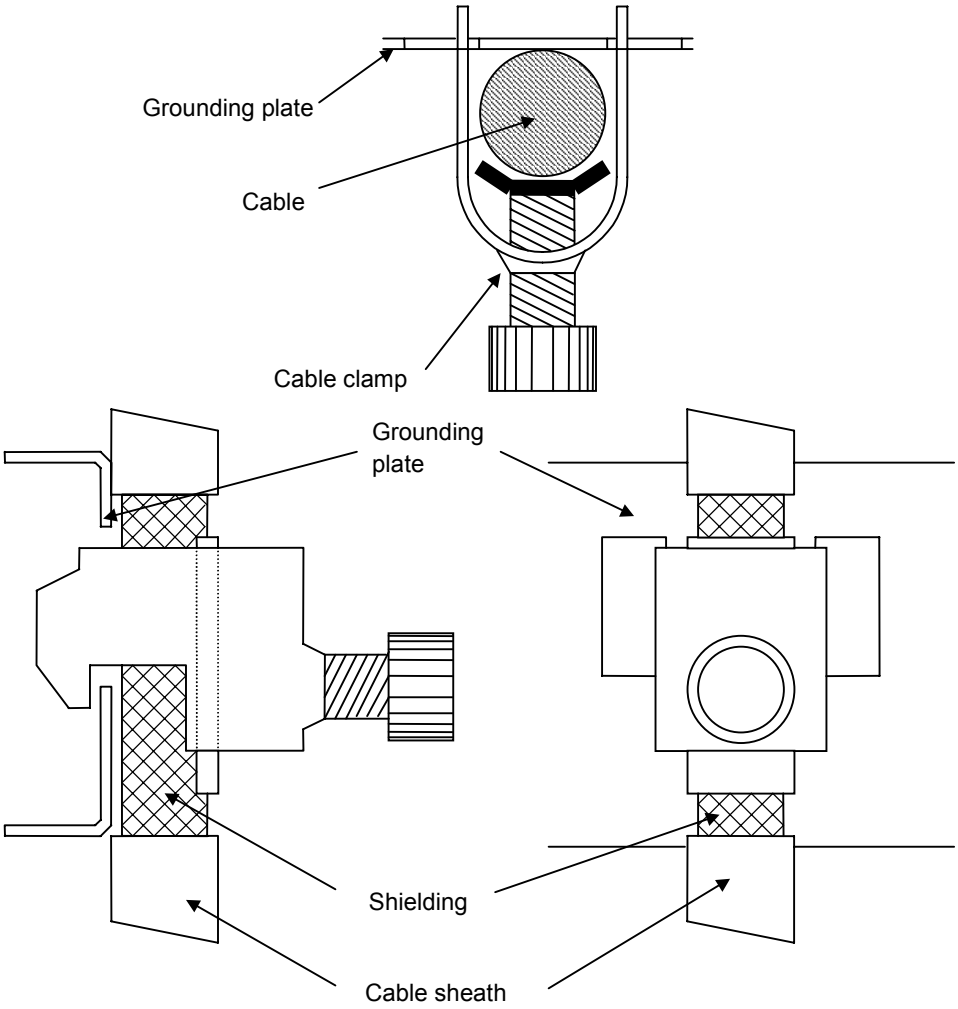
The ground line can be drawn:

- From the connector to which the communication cable is connected.
  Insert the ground line into the hole to which the shield line is inserted and fix them together.
- From a T-branch tap.
  Connect only the ground line to one connector on a T-branch tap.
- By using a cable clamp.
  Ground the shield of a communication cable with a cable clamp and use the same clamp panel for grounding of the power supply for communication.

> ⚠ **CAUTION**
> Be sure to connect the shield line of each communication cable. If all shield lines are not connected, the shielding effect of the whole network will be reduced.

1.6 CABLE CLAMP

A cable clamp has a shielding effect in addition to supporting a cable.
As shown below, remove part of the cable sheath to expose the shielding conductor, and clamp the exposed shielding portion against the grounding plate with the clamping fixture.



1.7 POWER SUPPLY FOR COMMUNICATION

In DeviceNet, a power supply is required for communication. The power supply must satisfy the following specifications and its AC input and DC output must be insulated. The power supply must have a capacity greater than the sum of power consumption of all nodes to which power is supplied.

Specifications of a power supply for communication

Item	Specification
Output voltage	24VDC±1%
Output current	16A or less
Input fluctuation	Max. 0.3%
Load fluctuation	Max. 0.3%
Effect of ambient temperature	Max. 0.03%/°C
Output ripple	250mVp-p
Output side capacity	Max. 7000μF

Item	Specification
Ambient temperature	Use : 0 to 58°C Storage : -40 to 85°C
Instantaneous maximum output current	Less than 65 A (peak)
Protection against overvoltage	Enabled
Protection against overcurrent	Enabled (maximum current 125%)
Startup time	250 ms until 5% of the final output current is achieved
Overshoot at startup	Max. 0.2%
Insulation	Between output and AC power and between output and cabinet ground
Complying standard	Required : UL Recommended : FCC Class B, CSA, TUV, VDE
Ambient humidity	30 to 90% (non-condensing)
Surge current	10%

Power must be supplied from the main line to nodes. The maximum current capacity of a communication cable is 8 A for thick-wire cables or 3 A for thin-wire cables.
The power supply for communication can be connected in various layouts depending on the power requirement of the user.

The current capacity of a branch line varies with the branch line length. The maximum power capacity of a branch line is reduced as the branch length increases. This is the same when either a thick-wire cable or a thin-wire cable is used. The capacity of current "I" that can pass through one branch line (sum of current used for each branch line) can be obtained with the following expression.

$I = 4.57/L$ I : Allowable current (A)
L : Branch length (m)

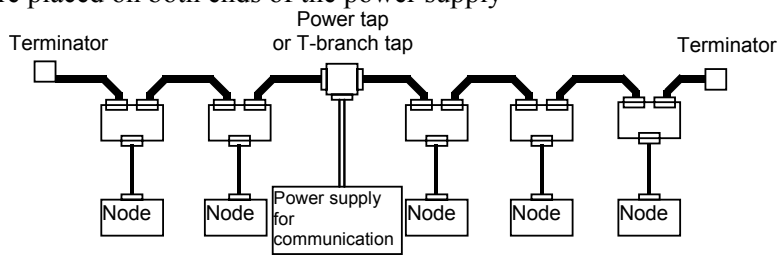
1.7.1 How to Design the Connection Layout of the Power Supply

Follow the procedure below to design the connection layout of the power supply.
(1) Temporarily determine the position of a power supply.
(2) Calculate the sum of the power consumption of all nodes to be placed.
(3) Calculate the length of the main line in the temporary layout and use the graph to roughly obtain the capacity of current that can be supplied to cables.
(4) Verify that the power supply capacity is greater than the power consumption.
(5) Make verification after changing the layout of the power supply.
(6) When the conditions are not satisfied in the rough calculation from the graph in step (3), calculate the amount of power to be supplied with the expression and then make verification again.
(7) When the conditions are not satisfied in the calculation in step (6), install multiple power supplies, provide multiple power systems, and check whether the amount of current supplied from each power supply satisfies the conditions.

1.7.2 Determining the Position of the Power Supply

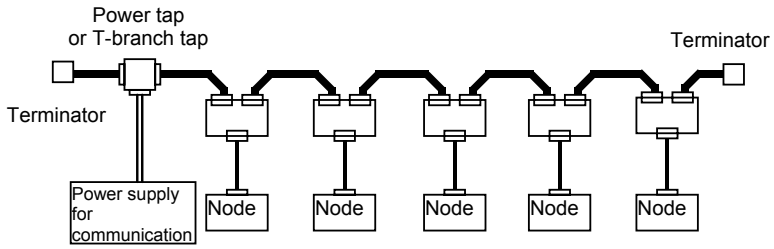
The power supply can be positioned as shown below.
Normally, select configuration (l) or (2).
If configuration (1) or (2) cannot satisfy the power supply conditions, consider configuration (3). When redundant power supplies (simultaneous supply of power) are required, configuration (4) can also be selected.

(1) When nodes are placed on both ends of the power supply

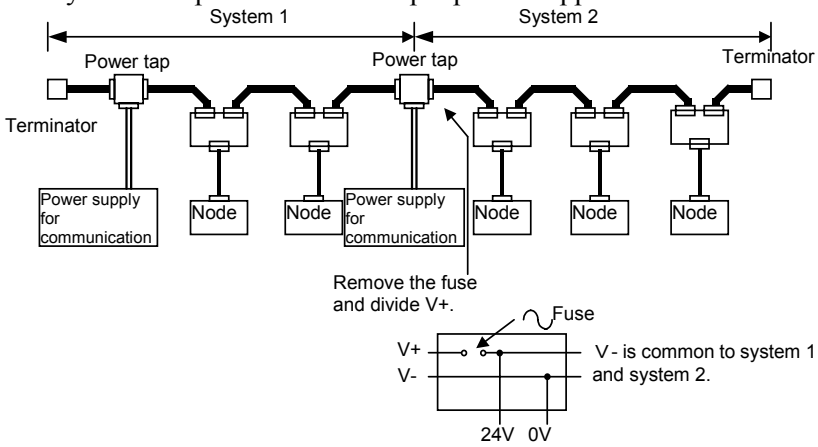


NOTE
Configuration (1) is recommended when power is supplied to many nodes by one power supply.

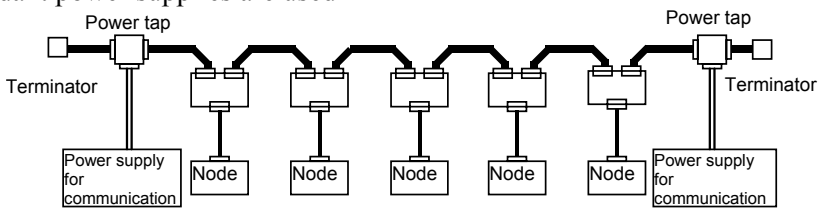
(2) When nodes are placed on one end of the power supply



(3) When the power system is separated with multiple power supplies



(4) When redundant power supplies are used



NOTE
When the amount of current passing through thick-wire cables are more than 8 A even if the position of the power supply for communication is changed, use multiple power supplies to satisfy the power supply conditions.
When thick-wire cables are used in configuration (1), up to 8 A of current can be supplied to the main line on either side of the power supply. Therefore, a configuration that uses current of up to 16 A is allowed.
When a thin-wire cable is used as the main line, if the amount of current passing through the thin-wire cable is more than 3 A, consider replacement with a thick-wire cable to satisfy the conditions.

Factors for determining the position of the power supply

The factors for checking if power can be successfully supplied are the amount of current required by nodes and the voltage drop by a cable. Calculate the following values in advance.

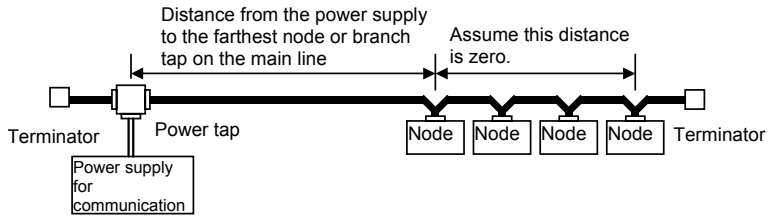
- Amount of current required by nodes
- Distance from the power supply

How to calculate the power capacity

The following two methods can be used to calculate the power capacity of main lines.

(1) Rough calculation by the graph
(2) Calculation by the expression (calculating the voltage drop by using the resistance of a communication cable and the power consumption)

NOTE
For each branch line, it is necessary to satisfy the conditional expression for obtaining the current capacity of the branch line using the branch length.



Even when the power supply conditions are not satisfied by rough calculation by the graph, the conditions may be satisfied by calculation by the expression. In this case, the assumed power supply layout has no problem.

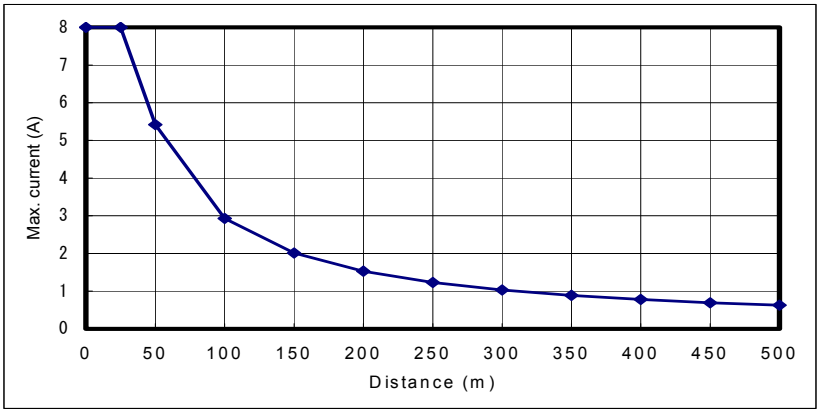
NOTE
When the power supply for communication also supplies power to the CNC, rough calculation by the graph cannot be used. Use the expression.

1.7.3 Verification Using Rough Calculation by the Graph

A voltage drop occurs when a current passes through a communication cable. The longer a communication cable is or the larger the amount of current is, the larger a voltage drop becomes.
In addition, the voltage of the power supply for communication on each node must be 11 VDC or higher.
The following shows, for various cable lengths, the maximum current values for supplying a sufficient voltage to the power supply for communication even when a voltage drop occurs.

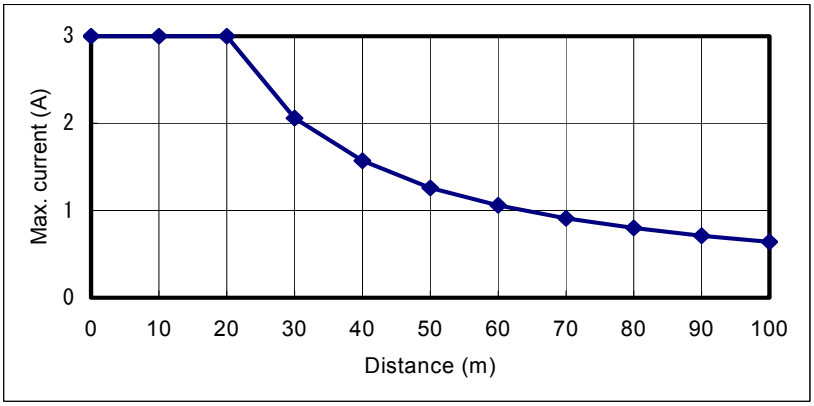
- For thick-wire cables

Distance (m)	0	25	50	100	150	200	250	300	350	400	450	500
Max. current (A)	8.00	8.00	5.42	2.93	2.01	1.53	1.23	1.03	0.89	0.78	0.69	0.63



- For thin-wire cables

Distance (m)	0	10	20	30	40	50	60	70	80	90	100
Max. current (A)	3.00	3.00	3.00	2.06	1.57	1.26	1.06	0.91	0.80	0.71	0.64



Rough calculation by the graph

Check items (1) to (3) for each of the nodes placed on the same side of the power supply.
When nodes are placed on both sides of the power supply, check the items for each side.

(1) For each side, calculate the sum of power consumption (A) of the nodes placed on the side.
(2) Obtain the maximum amount of current (B) that can pass through a cable based on the type of the cable (thin-wire or thick-wire cable) and the distance between the power supply and the farthest end of the main line.
(3) If the sum of power consumption (A) calculated in (1) is less than or equal to the maximum amount of current (B) obtained from the graph in (2) ($A \leq B$), the power supply conditions are satisfied for all nodes.

NOTE
The graph referenced depends on the type of a cable (thick-wire or thin-wire cable) used as the main line.

Action

If the sum of power consumption (A) calculated in (1) is greater than the maximum amount of current (B) obtained from the graph in (2) ($A > B$), try to take the following actions.

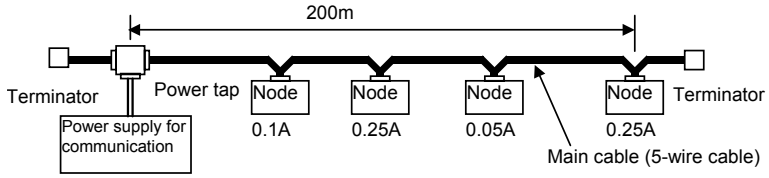
- Move the power supply in the central direction so that it is placed in the middle of nodes.

- If nodes are already placed on both sides of the power supply, move the power supply in the direction where larger amount of current is required.
- When using a thin-wire cable, replace it with a thick-wire cable.

Even after taking any of the above actions, A > B is satisfied, change the configuration using the expression that takes the actual node layout into consideration.

- When the power supply is placed at the end (example 1)

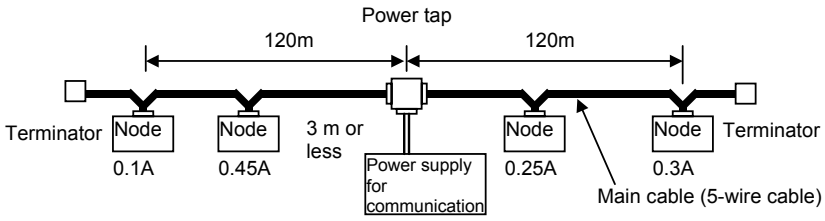
The following provides an example of placing the power supply for communication at the end of a network using a thick-wire cable (THICK cable) with a total extended length of 200 m for supplying power.
Power consumption for each node is assumed as shown below.



Total length of the power supply line = 200 m
Total power consumption = 0.1 A＋0.25 A＋0.05 A＋0.25 A＝0.65A
Maximum amount of current that can pass through a thick-wire cable obtained from the table = 1.53A
Since "Total power consumption < Maximum amount of current" is satisfied, power can be supplied to all nodes.

- When the power supply is placed in the center (example 2)

The following provides an example of placing the power supply for communication in the center of a network using a thick-wire cable (THICK cable) with a total extended length of 240 m for supplying power.
The maximum amount of current can be supplied to the right and lift lines separately if the power supply for communication is placed in the center, so it is possible to supply the maximum current more than twice, as compared with the case where the power supply is placed at the end.
Power consumption for each node is assumed as shown below.



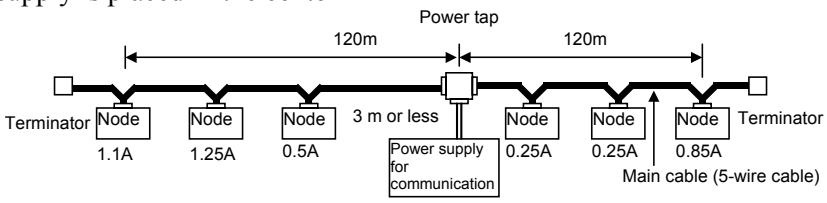
Total extended length of power supply line (left side) = Total extended length of power supply line (right side) = 120 m
Total power consumption (left side) = 0.1 A + 0.45 A = 0.55 A
Total power consumption (right side) ＝0.25A＋0.3A＝0.55A
Maximum current obtained from the table for thick-wire cables (left side) = Approx. 2.5 A
Maximum current obtained from the table for thick-wire cables (right side) = Approx. 2.5A
(These values are obtained by linear approximation between 100 and l50 m.)

Since "Total power consumption (left side) < Maximum current (left side)" and "Total power consumption (right side) < Maximum current (right side)" are satisfied, power can be supplied to all nodes.

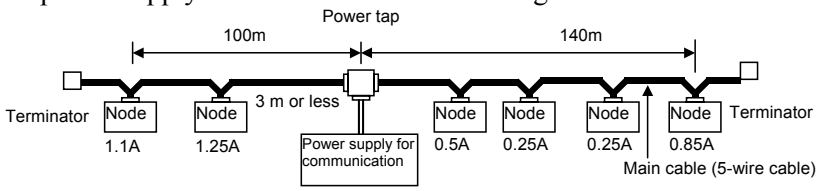
- **When there are differences in total power consumption between the left side and the right side (example 3)**

The following provides an example of placing the power supply for communication at a point slightly displaced from the center of a network using a thick-wire cable (THICK cable) with a total extended length of 240 m for supplying power.
Power on one side may become insufficient even though the power supply for communication is placed in the center. This is because there are differences in total power consumption between the left and the right. In this case, try to displace the power supply slightly from the center to satisfy the conditions.
Power consumption for each node is assumed as shown below.

When the power supply is placed in the center



Total extended length of power supply line (left side) = Total extended length of power supply line (right side) = 120 m
Total power consumption (left side) = 1.1A＋1.25A＋0.5A＝2.85A
Total power consumption (right side) ＝0.25A＋0.25A＋0.85A＝1.35A
Maximum current obtained from the table for thick-wire cables (left side) = Approx. 2.5 A
Maximum current obtained from the table for thick-wire cables (right side) = Approx. 2.5A
(These values are obtained by linear approximation between 100 and l50 m.)
Since "Total power consumption (left side) > Maximum current (left side)" is satisfied, power on the left side becomes insufficient.
Therefore, move the power supply to the left as shown in the figure below.

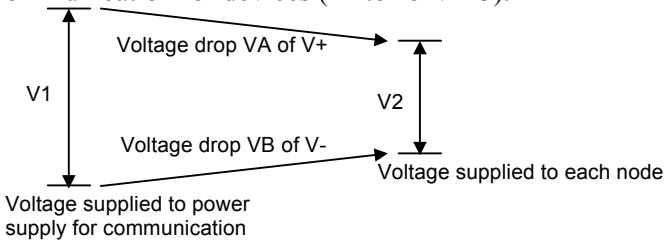


Total extended length of power supply line (left side) = 100 m
Total extended length of power supply line (right side) = 140 m
Total power consumption (left side) = 1.1A＋1.25A＝2.35A
Total power consumption (right side) ＝0.5A＋0.25A＋0.25A＋0.85A＝1.85A
Maximum current obtained from the table for thick-wire cables (left side) = Approx. 2.93A
Maximum current obtained from the table for thick-wire cables (right side) = Approx. 2.1A
(On the right side, these values are obtained by liner approximation between 100 m and 150 m.)
This satisfies "Total power consumption < Maximum current" on both ends and power can be supplied to all nodes.

1.7.4 Verification Using the Expression

When rough calculation by the graph cannot be satisfied, make a verification based on the actual layout of nodes and the power supply for communication.
In DeviceNet, the maximum voltage drop allowed in the system is defined as 5 V for each of the voltage lines (V+ and V-) according to the voltage specifications of the power supply for communication (24 VDC) and the input voltage specifications of power supplies for communication for devices (11 to 25 VDC).
Of 5 V, the voltage drop allowed for the main line is 4.65 V and that allowed for branch lines is 0.35 V.
A voltage drop by a cable is considered as follows.

In the DeviceNet standard, a voltage drop by a cable is defined as 5 V or less including a margin according to the specifications of the power supply for communication (24 VDC) and the specifications of power supplies for communication for devices (11 to 25 VDC).



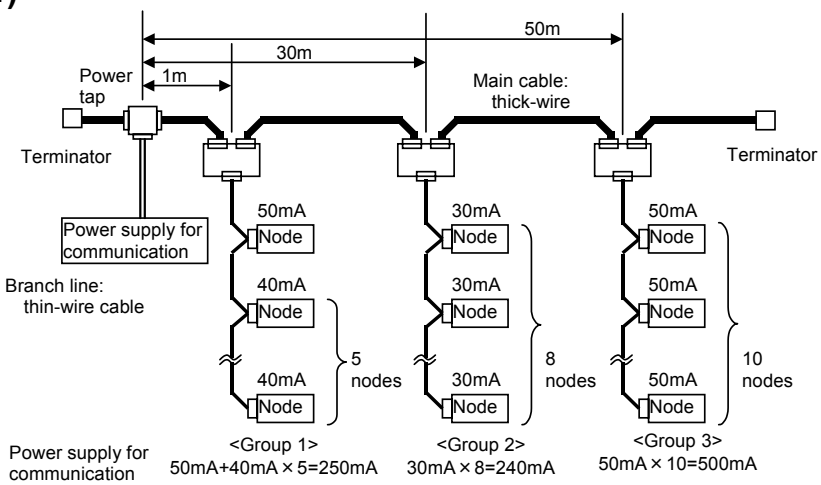
Vl: Voltage supplied to power supply for communication. V1 is 23V with the fluctuation range of the power voltage considered.
V2: Voltage supplied to each node. V2 must be greater than or equal to 13 V with a margin considered.
VA: Voltage drop by the power cable (V+)
VB: Voltage drop by the power cable (V-)
In DeviceNet, VA and VB must be less than or equal to 5 V.
The voltage drop by communication cables is defined as 5 V or less for each of power lines (V+ and V-). Of 5 V, the voltage drop allowed for main lines is 4.65 V and that allowed for branch lines is 0.35V.

Expression

First, measure the distances between the power supply and the nodes and the current consumption of communication units of the nodes.
Check whether the following expression is satisfied. If it is satisfied, the conditions for supplying power for each node are satisfied. However, be careful not to exceed the maximum current capacity of a cable (8 A for thick-wire cables or 3 A for thin-wire cables).
This expression cannot be used when the same power supply is used for communication and the CNC, so make another review.

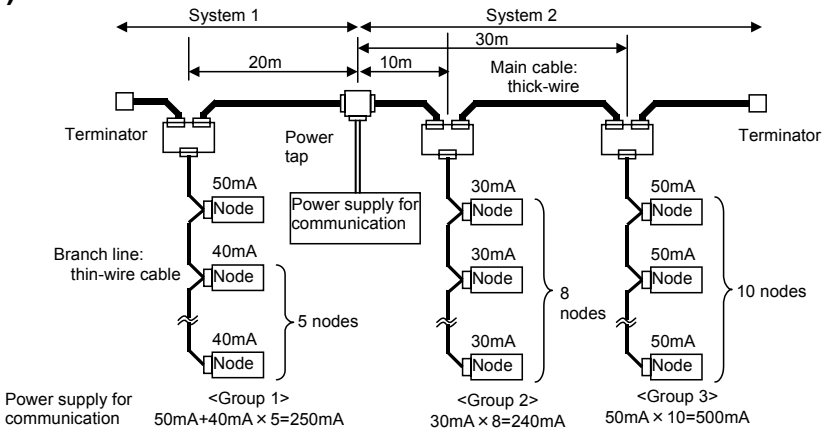
- Conditional expression (summation of voltage drops by main lines)
  $\Sigma (Ln \times Rc + Nt \times 0.005) \times In \leq 4.65V$
  Ln: Distance between the power supply and the nodes (excluding the branch length)
  Rc: Maximum cable resistance (0.015 Ω/m for thick-wire cables or 0.069 Ω/m for thin-wire cables)
  Nt: Number of taps between nodes and the power supply
  In: Current consumption required by the communication units of nodes
  0.005 Ω = Contact resistance of a tap

When nodes are placed on only one side of the power supply (sample configuration 1)



Calculate the voltage drop for each group.
Group 1: (1×0.015＋1×0.005)×0.25=0.005V
Group 2: (30×0.015＋2×0.005)×0.24=0.1104V
Group 3: (50×0.015＋3×0.005)×0.50=0.3825V
Sum of the voltage drops =0.005 + 0.1104 + 0.3825 = 0.4979 V ≤ 4.65 V
Therefore, the conditional expression is satisfied in both systems.

When nodes are places on both sides of the power supply (sample configuration 2)



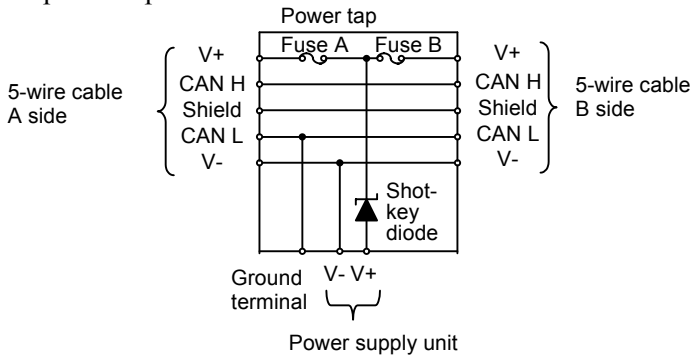
Calculate the voltage drop for each group for each system.
Group 1 in system 1: (20×0.015+1×0.005)×0.25＝0.07625 V
Group 2 in system 2: (10×0.015+1×0.005)×0.24＝0.0372V
Group 3 in system 2: (30×0.015+2×0.005)×0.50＝0.23V
Voltage drop in system 1 = 0.07625 V ≤ 4.65 V
Sum of voltage drops in system 2 = 0.0372 V+0.23=0.2672 V ≤ 4.65V
Therefore, the conditional expression is satisfied in both systems.

1.7.5 Method of Supplying Power Using Multiple Power Systems

When the conditions cannot be satisfied even if calculation is performed with the expression, separate the power system by using multiple power supplies for communication.

Method of separating the power system

Since multiple power supplies are present, use the power tap for each power supply. The power tap is not supplied by FANUC, so purchase the power tap that conforms to the DeviceNet standards from other companies.
The internal circuit of the power tap is shown below.



To disconnect the power system on the cable A side, remove fuse A. To disconnect the power system on the cable B side, remove fuse B.

1.7.6 Sharing the Power Supply with the CNC

Basically, the power supply for communication cannot also be used for the CNC. Prepare a separate power supply for each unit. However, when it is inevitable to share one power supply for cost or space reasons, keep the following in mind.

The minimum voltage in the input voltage specification of an CNC power supply (24 VDC input type) is 21.6 V, which is higher than that of the power supply for communication. The input voltage specification must be satisfied while considering loss due to a voltage drop by cables. In addition, if a communication cable is broken or a ground fault occurs when one power supply is shared, the control unit of the CNC will be powered off.

When a power supply is prepared for each unit, turn on or off the power of the units in the order specified below.

- Turn of the power supply for communication before or concurrently with the CNC power supply.
- Turn off the power supply for communication after or concurrently with the CNC power supply of the master station.

If only the power supply for communication is turned off during operation of a network, an error may occur on another node being communicated.

2 DeviceNet BOARD

This chapter describes the specifications, installation, and mounting of the DeviceNet master board, DeviceNet master card, and DeviceNet slave board.

2.1 SPECIFICATION

DeviceNet master board (common to stand-alone type / LCD-mounted type)

Item	Specification	
Specification drawing number	A02B-0303-J301	Series 30*i*/31*i*/32*i*-A
	A02B-0323-J301	Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A
	A02B-0338-J301	Series 0*i*-F
Hardware drawing number	A20B-8101-0220	
Power supply for communication	11 to 24VDC (supplied from the communication connector)	
	Power consumption: Max. 0.05 A	
Power supply for CNC	Power consumption: Max. 0.1 A (24VDC ±10%)	
Calorific value	3W	
Weight	150g or less	

DeviceNet slave board (common to stand-alone type / LCD-mounted type)

Item	Specification	
Specification drawing number	A02B-0303-J302	Series 30*i*/31*i*/32*i*-A
	A02B-0323-J302	Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A
	A02B-0338-J302	Series 0*i*-F
Hardware drawing number	A20B-8101-0330	
Power supply for communication	11 to 24VDC (supplied from the communication connector)	
	Power consumption: Max. 0.05 A	
Power supply for CNC	Power consumption: Max. 0.1 A (24VDC ±10%)	
Calorific value	3.5W	
Weight	100g	

Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A

In case of using the DeviceNet master function for LCD mounted type CNC(8.4" LCD unit and 10.4" LCD unit A), it is possible to select the DeviceNet master card.
DeviceNet master card and DeviceNet master board cannot be specified at the same time.

DeviceNet master card

Item	Specification	
Specification drawing number	A02B-0323-J303	Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A (LCD-mounted type: 8.4" LCD unit or 10.4" LCD unit A)
Hardware drawing number	A20B-3200-0020	
Power supply for communication	11 to 24VDC (supplied from the communication connector)	
	Power consumption: Max. 0.05 A	
Power supply for CNC	Power consumption: Max. 0.1 A (24VDC ±10%)	
Calorific value	3.5W	
Weight	60g	

2.2 INSTALLATION

2.2.1 Environmental Conditions

When using the DeviceNet master board, DeviceNet master card, and DeviceNet slave board, satisfy the installation conditions (environmental conditions in the cabinet) of the CNC control unit in which the board is included.

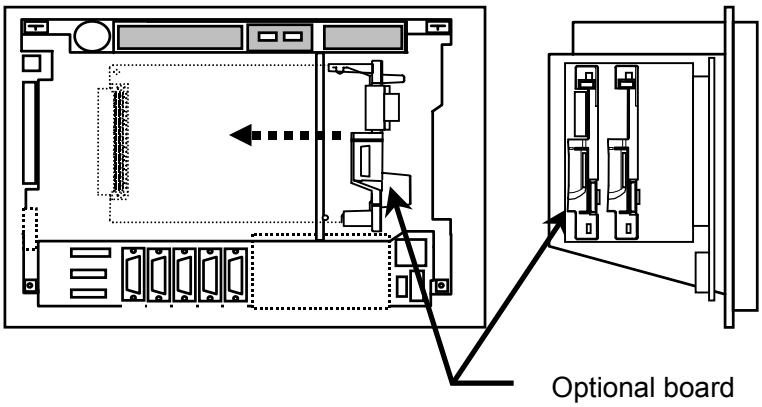
2.3 MOUNTING

Only one DeviceNet master board (DeviceNet master card) and DeviceNet slave board can be installed in the CNC control unit.

NOTE
The DeviceNet master board and DeviceNet master card cannot be installed simultaneously.

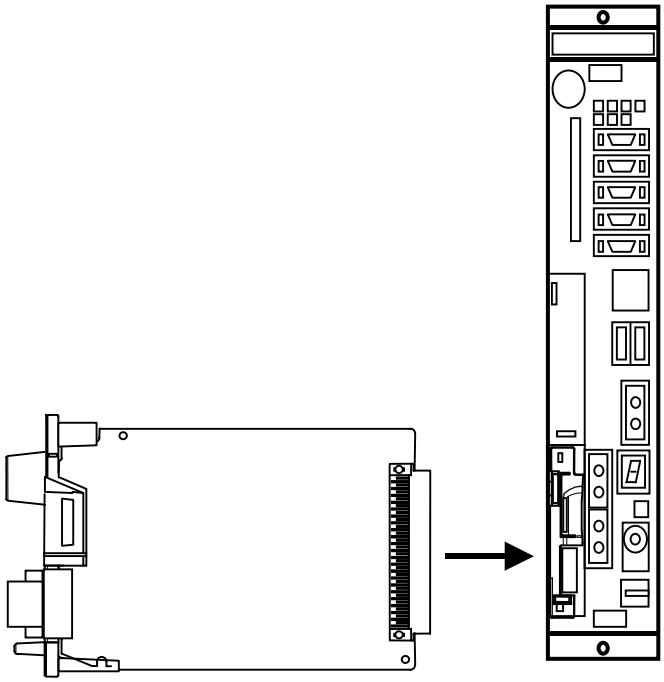
2.3.1 Mounting into the LCD-mounted Type Unit

The optional board is mounted into an optional slot of the control unit. Each of the DeviceNet master board and DeviceNet slave board occupies one slot. The optional slot does not have limitations of mounting location.



2.3.2 Mounting into the Stand-alone Type Unit

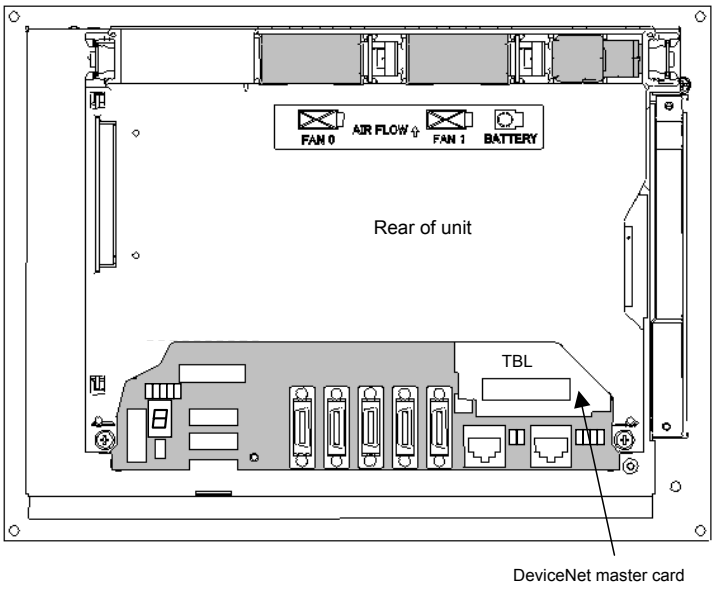
The optional board is mounted into an optional slot of the control unit. Each of the DeviceNet master board and DeviceNet slave board occupies one slot. The optional slot does not have limitations of mounting location.



2.3.3 Mounting the DeviceNet master card

Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A

In case of LCD-mounted type unit (8.4" LCD unit and 10.4" LCD unit A), DeviceNet master card mounting into the main board.



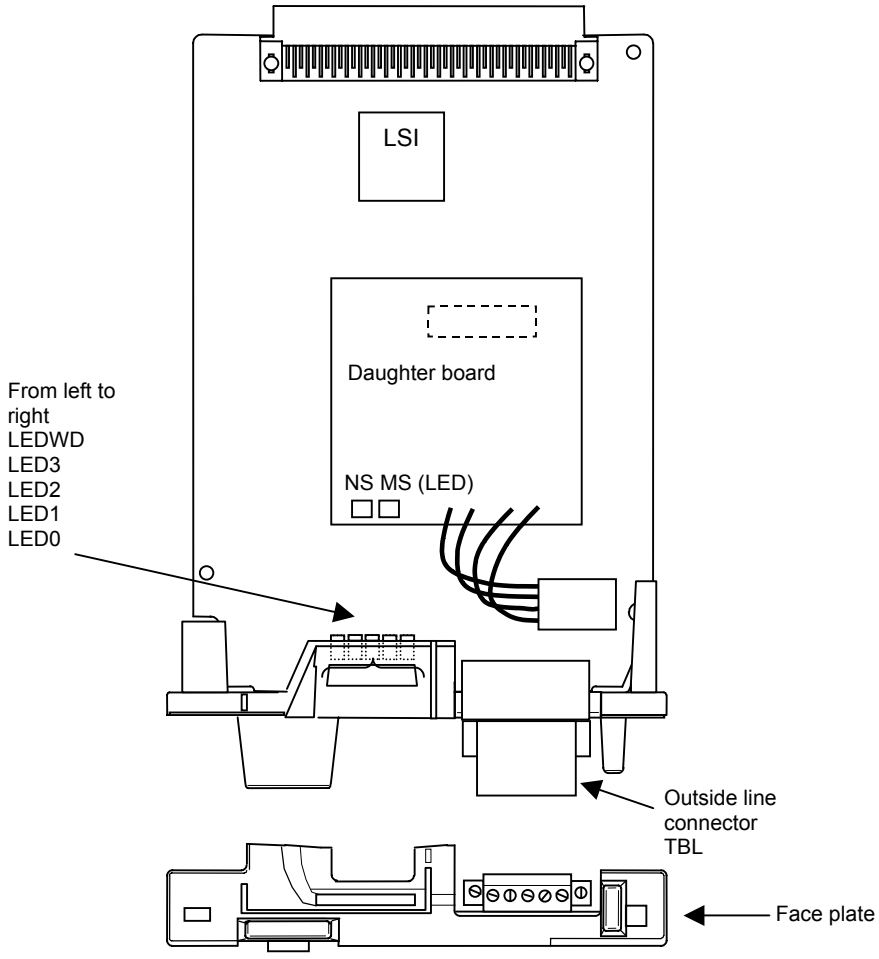
V. MAINTENANCE

1 HARDWARE

This chapter provides maintenance information on the DeviceNet master board, DeviceNet master card and DeviceNet slave board.

1.1 COMPONENT LAYOUT

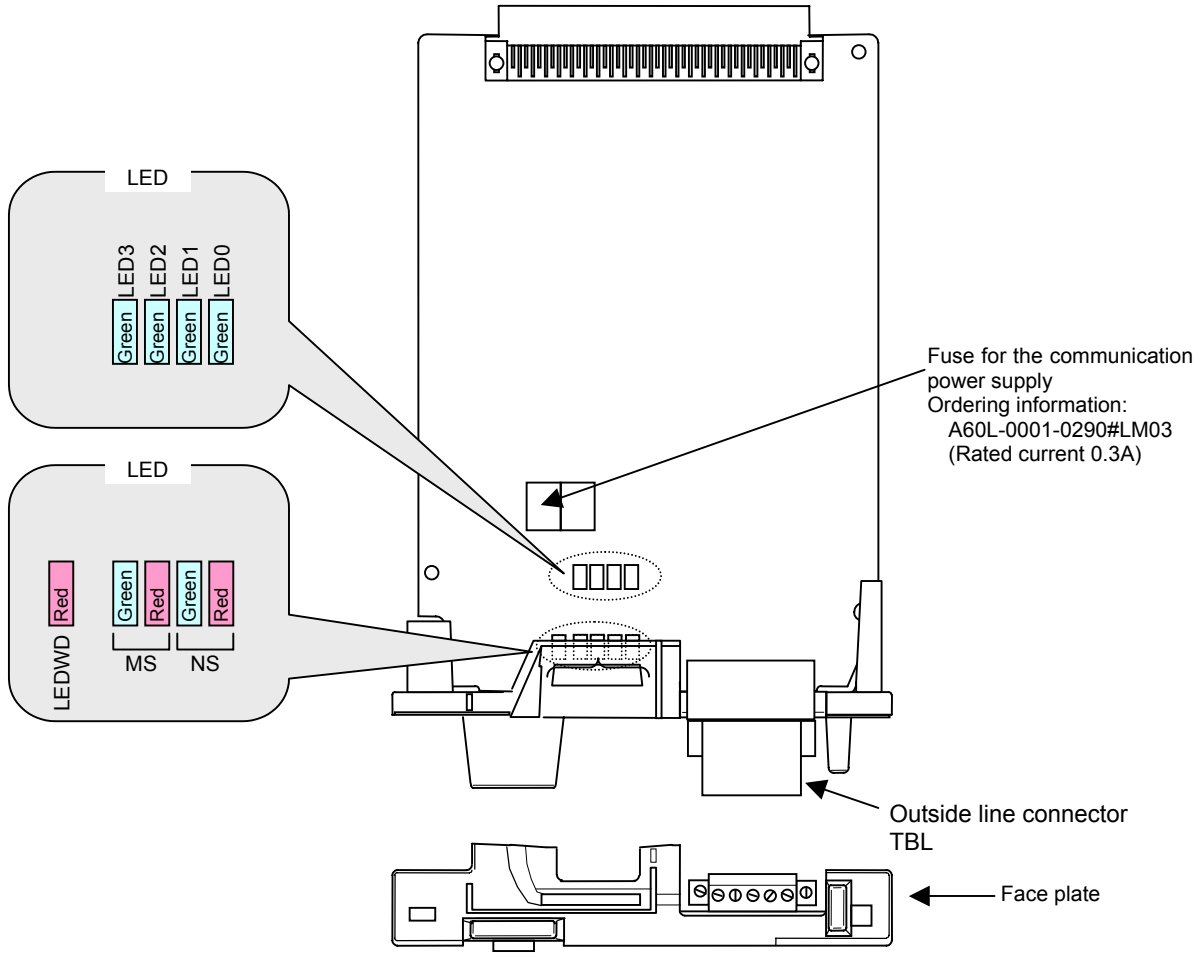
1.1.1 Part Layout on the DeviceNet Master Board



Ordering information

Name	Specification	Remarks
DeviceNet Master board	A20B-8101-0220	

1.1.2 Part Layout on the DeviceNet Slave Board

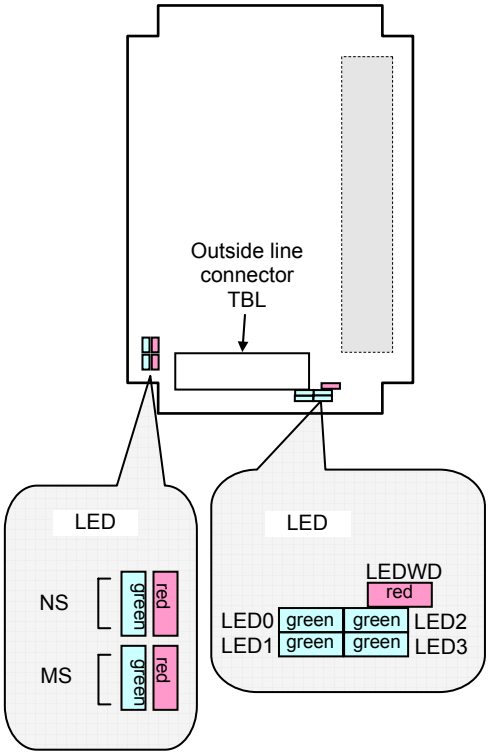


Ordering information

Name	Specification	Remarks
DeviceNet Slave board	A20B-8101-0330	

1.1.3 Part Layout on the DeviceNet Master Card

Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A



Ordering information

Name	Specification	Remarks
DeviceNet Master card	A20B-3200-0020	

1.2 LED INDICATORS AND THEIR MEANINGS

1.2.1 LED Indication on the DeviceNet Master Board (Master Card)

DeviceNet master board (or card) provides four green LEDs (LED0 to LED3) and one red LED (LEDWD) for status indication.
In addition, the internal daughter board has two LEDs (MS and NS) that emit red and green light.

Name	Color	Description
LED0 to LED3	Green	Indicates the activation state of the DeviceNet application software.
LEDWD	Red	Indicates an error on the DeviceNet master board (or card).
MS	Red/Green	Indicates the module status, which is the status of the local node.
NS	Red/Green	Indicates the network status, which is the status of the entire network including the local node.

In the following explanations, the LED lighting states are expressed as follows:
☐: Off ■: On ☆: Blinking ◊: Don't care

LED display transition for LED0, LED1, LED2, and LED3 (during power-on)

LED display L3L2L1L0	State and cause when stopped after power-on	Action when stopped after power-on
□□□□	Power-off	
■■■■	After power-on, the DeviceNet application software does not start.	Store the DeviceNet application software in the Flash ROM of the CNC.
□□□□	Initializing the firmware on the board (or card).	Replace the DeviceNet master board (or card).
□□□■	Checking memory on the board (or card).	
□□■□	Recognizing the firmware on the board (or card).	
□□■■	Reading DeviceNet parameters.	Confirm that the DeviceNet master function (software option) has been purchased.
□■□□	Verifying that DeviceNet parameter "NETWORK" is set to "ONLINE."	Set DeviceNet parameter "NETWORK" to "ONLINE."
□■□■	Setting the bus parameter in DeviceNet parameters.	Replace the DeviceNet master board (or card).
□■■□	Setting the slave parameter in DeviceNet parameters.	Set the slave parameter in DeviceNet parameters correctly. When the setting is correct, replace the DeviceNet master board (card).
□■■■	Checking duplicate MAC IDs.	Check duplication with the MAC ID of a slave device. Check if cables are connected correctly. Check if power for communication is correctly supplied. Check if slave devices are turned on.
■□□□	The DeviceNet application software has been initialized and I/O communication starts.	

LED display for LED0, LED1, LED2, and LED3 (during occurrence of an error)

LED L3L2L1L0	Status	Description
□□□□ ↑ ↓ ■■■■ (Repetition)	Board (or card) failure	The board (or card) failed. Replace the DeviceNet master board (or card).

LED display of LEDWD

LED display	Status	Description
■	Board (or card) failure	The board (or card) failed. Replace the DeviceNet master board (or card).

LED display of MS and NS (during normal operation)

In the "during normal operation" status, when communication is normally established, a transition to the "I/O communication in advance" status is made.

LED display	Status	Description
MS □ NS □	Immediately after power-on	The MPU on the board (or card) is being reset.
MS ☆ Green NS □	Initializing	The firmware on the board (or card) is making a initialization.
MS ■ Green NS □	Checking duplication of MAC IDs	The firmware on the board (or card) is checking duplicated MAC IDs.

LED display	Status	Description
MS ■ Green NS ☆ Green	I/O communication stopped	The firmware on the board (or card) is stopping I/O communication.
MS ■ Green NS ■ Green	I/O communication in advance	The firmware on the board (or card) is successfully performing I/O communication.

LED display of MS and NS (during occurrence of an error)

LED display	Status	Error and action
MS ☆ Red NS ◊	Board (or card) failure	The board (or card) failed. When the setting is correct, replace the DeviceNet master board (card).
MS ■ Red NS ☐	Board (or card) failure	The board (or card) failed. Replace the DeviceNet master board (or card).
MS ◊ NS ■ Red	Duplicate MAC IDs	MAC IDs are duplicate. Verify the following: → MAC IDs are not duplicate by check the MAC IDs of all nodes.
	Busoff detection	Communication stopped because a communication error occurred frequently. Verify the following: → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There is not much noise.
MS ◊ NS ☐	Network power failure	Power for communication is not supplied. Verify the following: → Power for communication is properly supplied.
	Transmission error	Transmission cannot be performed normally. Verify the following: → All slaves are turned on. → There is no other master on the network. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There is not much noise.
MS ◊ NS ☆ Red	Slave not present	No slaves are present. Verify the following: → The slave is turned on. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There is not much noise.
	Slave I/O size mismatch	The slave I/O size setting does not match the setting of the actual slave. Verify the following: → The slave I/O size setting matches the setting of the actual slave.
	I/O communication error	I/O communication timed out. Verify the following: → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There is not much noise.

1.2.2 LED Indication on the DeviceNet Slave Board

This DeviceNet slave board provides four green LEDs (LED0 to LED3) and one red LED (LEDWD) for status indication.
In addition, there are two LED (MS and NS) sets that consist of one red LED and one green LED.

Name	Color	Description
LED0 to LED3	Green	Indicates the activation state of the DeviceNet application software.
LEDWD	Red	Indicates an error on the DeviceNet slave board.
MS	Red / green	Indicates the module status, which is the status of the local node.
NS	Red / green	Indicates the network status, which is the status of the entire network including the local node.

In the following explanations, the LED lighting states are expressed as follows:
□: Off ■: On ☆: Blinking ◊: Don't care ?: Undefined

LED display transition for LED0, LED1, LED2, and LED3 (during power-on)

LED display L3L2L1L0	State and cause when stopped after power-on	Action when stopped after power-on
□□□□	Power-off	
■■■■	After power-on, the DeviceNet application software does not start. Or, the DeviceNet slave function (software option) is disabled.	Store the DeviceNet application software in the Flash ROM of the CNC. Or, confirm that the DeviceNet slave function (software option) has been purchased.
□□□□	Initializing the firmware on the board.	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.
□□□■	The board firmware has been initialized.	
□□■□	A line baud rate check is in progress.	These faults are recoverable. When communication is normally established, the status changes to "I/O communication is normal". Each status corresponds to DeviceNet MPU status transition NOTE).
□□■■	A MAC ID duplication check is in progress.	
□■□□	Waiting for I/O communication to be established.	
□■□■	I/O communication is normal.	
□■■□	I/O communication has timed out.	
□■■■	I/O communication is idle.	

NOTE
For details on DeviceNet MPU status transition, see DeviceNet MPU status transition and DeviceNet MPU alarm codes in Section 2.1, "SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION" in Part III, "SETTING".
When a transition to the "I/O communication normal" status is not made, confirm that the power for communication is correctly supplied because a network power failure may have occurred.

LED display of LEDWD

LED display	Status	Description
■	Board failure	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.

LED display of MS and NS (during normal operation)

In the "during normal operation" status, when communication is normally established, a transition to the "I/O communication normal" status is made.

LED display	Status	Description
MS ☐ Green MS ☐ Red NS ☐ Green NS ☐ Red	Immediately after power-on	The onboard firmware is being initialized when the onboard MPU is in the reset status or reset release status.
MS ■ Green MS ☐ Red NS ☐ Green NS ☐ Red	Communication under preparation	The onboard firmware performs processing in the order below. <1>Waits for the DeviceNet application software to be initialized. <2>Checks the baud rate. <3>Checks MAC ID duplication.
MS ■ Green MS ☐ Red NS ☆ Green NS ☐ Red	Waiting for establishment of I/O communication to be established	Each status corresponds to DeviceNet MPU status transition NOTE).
MS ■ Green MS ☐ Red NS ■ Green NS ☐ Red	I/O communication normal	
MS ◇ Green MS ◇ Red NS ■ Green NS ☆ Red	I/O communication timeout	

NOTE

For details on DeviceNet MPU status transition, see DeviceNet MPU status transition and DeviceNet MPU alarm codes in Section 2.1, "SETTING SCREEN OF THE DeviceNet SLAVE FUNCTION" in Part III "SETTING".
When a transition to the "I/O communication normal" status is not made, confirm that the power for communication is correctly supplied because a network power failure may have occurred.

LED display of MS and NS (during occurrence of an unrecoverable failure)

In the "during occurrence of an unrecoverable failure" status, once an error occurred, recovery is not performed unless this slave station is powered off and back on again.

LED display	LED display L3L2L1L0	Status	Error and action
MS ◇ Green MS ◇ Red NS ☐ Green NS ■ Red	■☐☐☐ ↑↓ ☐☐■☐ (Repetition)	Duplicate MAC IDs	Check the following and then turn the slave power off and back on again. → MAC IDs are not duplicate by check the MAC IDs of all nodes.
	■☐☐☐ ↑↓ ☐☐■■ (Repetition)	Busoff detection	Check the following and then turn the slave power off and back on again. → The communication rates of all nodes are set to the same value. → The cable length is appropriate. → The cable is not loose or broken. → A terminal is placed on only both ends of the main line. → There are not much noise.

LED display	LED display L3L2L1L0	Status	Error and action
MS ☐ Green MS ■ Red NS ◇ Green NS ◇ Red	■☐☐☐ ↑ ↓ ☐ ? ? ? (Repetition)	Other unrecoverable onboard failures	Remove the noise factor and then turn the slave power off and back on again. When the error persists, replace the DeviceNet slave board.
MS ◇ Green MS ◇ Red NS ◇ Green NS ◇ Red	☐☐☐☐ ↑ ↓ ■■■■ (Repetition)	An unrecoverable failure occurred on the CNC side.	Contact FANUC.

APPENDIX

A INSTALLATION INFORMATION OF FANUC DEVICES

Appendix A provides installation information of FANUC DeviceNet master and slave devices.

A.1 DEVICE PROFILE OF THE DeviceNet MASTER FUNCTION

General data	Applicable DeviceNet specifications	Volume I-Release 2.0 Volume II-Release 2.0
	Vendor ID	$024F_H$
	Device type	$000C_H$
	Product code	0002_H
Physical conformance data	Network power consumption	24VDC 50mA
	Connector type	Open plug
	Presence or absence of insulation of physical layer	Presence
	Supported LEDs	Module Network
	Setting the MAC ID	Parameter
	Default MAC ID	0
	Setting the transmission baud rate	Parameter
	Supported transmission baud rates	125 Kbps 250 Kbps 500 Kbps
Communication data	Predefined master/ slave connection set	Group 2 client Group 2 only client
	Dynamic connection support (UCMM)	Enabled
	Explicit message fragmentation	Enabled

A.2 OBJECTS OF THE DeviceNet MASTER FUNCTION

Identity object (01_H)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance					
Attribute	ID	Description	GET	SET	Value
	1	Vendor	O	X	591
	2	Device Type	O	X	12
	3	Product code	O	X	2
	4	Revision	O	X	1.2
	5	Status (bits supported)	O	X	
	6	Serial number	O	X	Per board
	7	Product name	O	X	A20B-8101-0220
	8	State	X	X	
	9	Configuration Consistency Value	X	X	
	10	Heartbeat Interval	X	X	

Object instance		
Service	DeviceNet service	Parameter option
	5 Reset	None
	14 Get_Attribute_Single	None

Message router object (02H)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance	
Attribute	Not supported.
Service	Not supported.

Addition of vendor-specific specifications
None

DeviceNet object (03H)

Object class				
Attribute	ID	Description	GET SET	Value
	1	Revision	O X	2
Service	DeviceNet service		Parameter option	
	14	Get_Attribute_Single	None	

Object instance				
Attribute	ID	Description	GET SET	Value
	1	MAC ID	O X	
	2	Baud rate	O X	
	3	BOI	O X	0
	4	Bus-off counter	O X	0
	5	Allocation information	O X	
	6	MAC ID switch changed	X X	
	7	Baud rate switch changed	X X	
	8	MAC ID switch value	X X	
	9	Baud rate switch value	X X	
Service	DeviceNet service		Parameter option	
	14	Get_Attribute_Single	None	
	75	Allocate_Master / Slave_Connection Set	None	
	76	Release_Master / Slave_Connection Set	None	

Connection object (05H)

Object class	
Attribute	Not supported.
Service	Not supported.
Maximum number of instances	203

Object instance					
Section		Information			Maximum number of instances
	Instance type	Explicit Message			1
	Production trigger	Cyclic			
	Transport type	Server			
	Transport class	3			
Attribute		ID	Description	GET SET	Value
		1	State	O X	
		2	Instance_type	O X	0
		3	Transport_class_trigger	O X	131
		4	Produced_connection_ID	O X	
		5	Consumed_connection_ID	O X	
		6	Initial_comm_characteristics	O X	33
		7	Produced_connection_size	O X	533
		8	Consumed_connection_size	O X	555, 556, 557
		9	Expected_packed_rate	O O	
		12	Watchdog_timeout_action	O X	1, 3
		13	Produced_connection_path_length	O X	0
		14	Produced_connection_path	O X	Blank
		15	Consumed_connection_path_length	O X	0
		16	Consumed_connection_path	O X	Blank
		17	Production_inhibit_time	O O	
Service		DeviceNet service			Parameter option
		5	Reset		None
		14	Get_Attribute_Single		None
		16	Set_Attribute_Single		None

A.3 DEVICE PROFILE OF THE DeviceNet SLAVE FUNCTION

General data	Applicable DeviceNet specifications	Volume I-Release 2.0 Volume II-Release 2.0
	Vendor ID	$024F_H$
	Device type	$000C_H$
	Product code	0003_H
Physical conformance data	Network power consumption	24VDC 50mA
	Connector type	Open plug
	Presence or absence of insulation of physical layer	Presence
	Supported LEDs	Module Network
	Setting the MAC ID	Parameter
	Default MAC ID	0
	Setting the transmission baud rate	Parameter
	Supported transmission baud rates	125 Kbps 250 Kbps 500 Kbps
Communication data	Predefined master/ slave connection set	Group 2 only server
	Dynamic connection support (UCMM)	None
	Explicit message fragmentation	Enabled

A.4 OBJECTS OF THE DeviceNet SLAVE FUNCTION

Identity object (01_H)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance					
Attribute	ID	Description	GET	SET	Value
	1	Vendor	O	X	591
	2	Device Type	O	X	12
	3	Product code	O	X	3
	4	Revision	O	X	1.1
	5	Status (bits supported)	O	X	bit0 bit10
	6	Serial number	O	X	Per board
	7	Product name	O	X	A20B-8101-0330
	8	State	X	X	
	9	Configuration Consistency Value	X	X	
	10	Heartbeat Interval	X	X	
Service	DeviceNet service		Parameter option		
	5	Reset	None		
	14	Get_Attribute_Single	None		

Message router object (02_H)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance	
Attribute	Not supported.
Service	Not supported.

Addition of vendor-specific specifications
None

DeviceNet object (03_H)

Object class					
Attribute	ID	Description	GET	SET	Value
	1	Revision	O	X	2
Service	DeviceNet service		Parameter option		
	14	Get_Attribute_Single	None		

Object instance					
Attribute	ID	Description	GET	SET	Value
	1	MAC ID	O	O	
	2	Baud rate	O	O	
	3	BOI	O	X	0
	4	Bus-off counter	O	X	
	5	Allocation information	O	X	
	6	MAC ID switch changed	X	X	
	7	Baud rate switch changed	X	X	
	8	MAC ID switch value	X	X	
	9	Baud rate switch value	X	X	
Service	DeviceNet service		Parameter option		
	14	Get_Attribute_Single	None		
	16	Set_Attribute_Single	None		
	75	Allocate_Master / Slave_Connection Set	None		
	76	Release_Master / Slave_Connection Set	None		

Assembly object (04_H)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance (*)			
Section		Information	Maximum number of instances
	Instance type	Static I/O	1
Attribute	ID	Description	GET SET Value
	1	Number of Members in List	X X
	2	Member List	X X
	3	Data	O O
Service	DeviceNet service		Parameter option
	14	Get_Attribute_Single	None
	16	Set_Attribute_Single	None

* The object instance number is 100 in the case of IN or 101 in the case of OUT.

Connection object (05_H)

Object class	
Attribute	Not supported.
Service	Not supported.
Maximum allowable number of active connections	1

Object instance 1			
Section		Information	Maximum number of instances
	Instance type	Explicit Message	1
	Production trigger	Cyclic	
	Transport type	Server	
	Transport class	3	

Object instance 1					
Attribute	ID	Description	GET	SET	Value
	1	State	O	X	
	2	Instance_type	O	X	0
	3	Transport_class_trigger	O	X	131
	4	Produced_connection_ID	O	X	
	5	Consumed_connection_ID	O	X	
	6	Initial_comm_characteristics	O	X	33
	7	Produced_connection_size	O	X	100
	8	Consumed_connection_size	O	X	100
	9	Expected_packed_rate	O	O	
	12	Watchdog_time-out_action	O	O	One of 1, 3
	13	Produced_connection_path_length	O	X	0
	14	Produced_connection_path	O	X	
	15	Consumed_connection_path_length	O	X	0
	16	Consumed_connection_path	O	X	
	17	Production_inhibit_time	O	X	
Service	DeviceNet service		Parameter option		
	5	Reset	None		
	14	Get_Attribute_Single	None		
	16	Set_Attribute_Single	None		

Object instance 2					
Section		Information	Maximum number of instances		
	Instance type	Polled I/O	1		
	Production trigger	Cyclic			
	Transport type	Server			
	Transport class	2			
Attribute	ID	Description	GET	SET	Value
	1	State	O	X	
	2	Instance_type	O	X	1
	3	Transport_class_trigger	O	X	130(Poll) 130(With CyclicACK) 146(With COSACK) 128(Without CyclicACK) 144(Without COSACK)
	4	Produced_connection_ID	O	X	
	5	Consumed_connection_ID	O	X	
	6	Initial_comm_characteristics	O	X	1
	7	Produced_connection_size	O	X	*1
	8	Consumed_connection_size	O	X	*2
	9	Expected_packed_rate	O	O	
	12	Watchdog_time-out_action	O	X	0
	13	Produced_connection_path_length	O	X	0(Without IN) 6(With IN)
	14	Produced_connection_path	O	X	No data(Without IN) 20_04_24_64_30_03(With IN)
	15	Consumed_connection_path_length	O	X	0(Without OUT) 6(With OUT)
	16	Consumed_connection_path	O	X	No data(Without OUT) 20_04_24_65_30_03(With OUT)
	17	Production_inhibit_time	O	X	

Service	DeviceNet service	Parameter option
	5 Reset	None
	14 Get_Attribute_Single	None
	16 Set_Attribute_Single	None

*1 The number of IN bytes used with the specified path in the case of "Poll"
When COS/Cyclic is not combined with "Poll", OUT (Consumed connection) of Instance2 can be used. When using OUT, set "Produced connection size" to 0.

*2 The number of OUT bytes used with the specified path

Object instance 3					
Section		Information		Maximum number of instances	
	Instance type	Bit Strobed I/O		1	
	Production trigger	Cyclic			
	Transport type	Server			
	Transport class	2			
Attribute		ID Description		GET SET	Value
		1 State		O X	
		2 Instance_type		O X	1
		3 Transport_class_trigger		O X	130
		4 Produced_connection_ID		O X	
		5 Consumed_connection_ID		O X	
		6 Initial_comm_characteristics		O X	2
		7 Produced_connection_size		O X	*1
		8 Consumed_connection_size		O X	2048
		9 Expected_packed_rate		O O	
		12 Watchdog_timeout_action		O X	0
		13 Produced_connection_path_length		O X	0(Without IN) 6(With IN)
		14 Produced_connection_path		O X	20_04_24_64_30_03
		15 Consumed_connection_path_length		O X	0
		16 Consumed_connection_path		O X	No data
		17 Production_inhibit_time		O X	
Service		DeviceNet service		Parameter option	
		5 Reset		None	
		14 Get_Attribute_Single		None	
		16 Set_Attribute_Single		None	

*1 The number of IN bytes used with the specified path. When the number of In bytes exceeds 8 bytes, this value is 08H.

Object instance 4			
Section		Information	Maximum number of instances
	Instance type	Change Of State / Cyclic	1
	Production trigger	Cyclic	
	Transport type	Server	
	Transport class	2	

Object instance 4					
Attribute	ID	Description	GET	SET	Value
	1	State	O	X	
	2	Instance_type	O	X	1
	3	Transport_class_trigger	O	X	2(With CyclicACK) 34(With COSACK) 0(Without CyclicACK) 16(Without COSACK)
	4	Produced_connection_ID	O	X	
	5	Consumed_connection_ID	O	X	65535(Without ACK)
	6	Initial_comm_characteristics	O	X	1(With ACK) 15(Without ACK)
	7	Produced_connection_size	O	X	*1
	8	Consumed_connection_size	O	X	0
	9	Expected_packed_rate	O	O	
	12	Watchdog_timeout_action	O	X	0
	13	Produced_connection_path_length	O	X	0(Without IN) 6(With IN)
	14	Produced_connection_path	O	X	Setting value
	15	Consumed_connection_path_length	O	X	4(With ACK) 0(Without ACK)
	16	Consumed_connection_path	O	X	20_0B_24_01(With ACK) No data(Without ACK)
	17	Production_inhibit_time	O	X	
Service	DeviceNet service		Parameter option		
	5	Reset	None		
	14	Get_Attribute_Single	None		
	16	Set_Attribute_Single	None		

*1 The number of IN bytes used with the specified path

NOTE
Object instance 4 of the Connection object is not supported.

Acknowledge Handler object ($2B_H$)

Object class	
Attribute	Not supported.
Service	Not supported.

Object instance 1					
Attribute	ID	Description	GET	SET	Value
	1	Acknowledge Timer	O	O	
	2	Retry Timer	O	O	
	3	COS Producing Connection Instance	O	O	4
Service	DeviceNet service		Parameter option		
	14	Get_Attribute_Single	None		
	16	Set_Attribute_Single	None		

NOTE
The Acknowledge Connection object is not supported.

B SETTING EXAMPLES

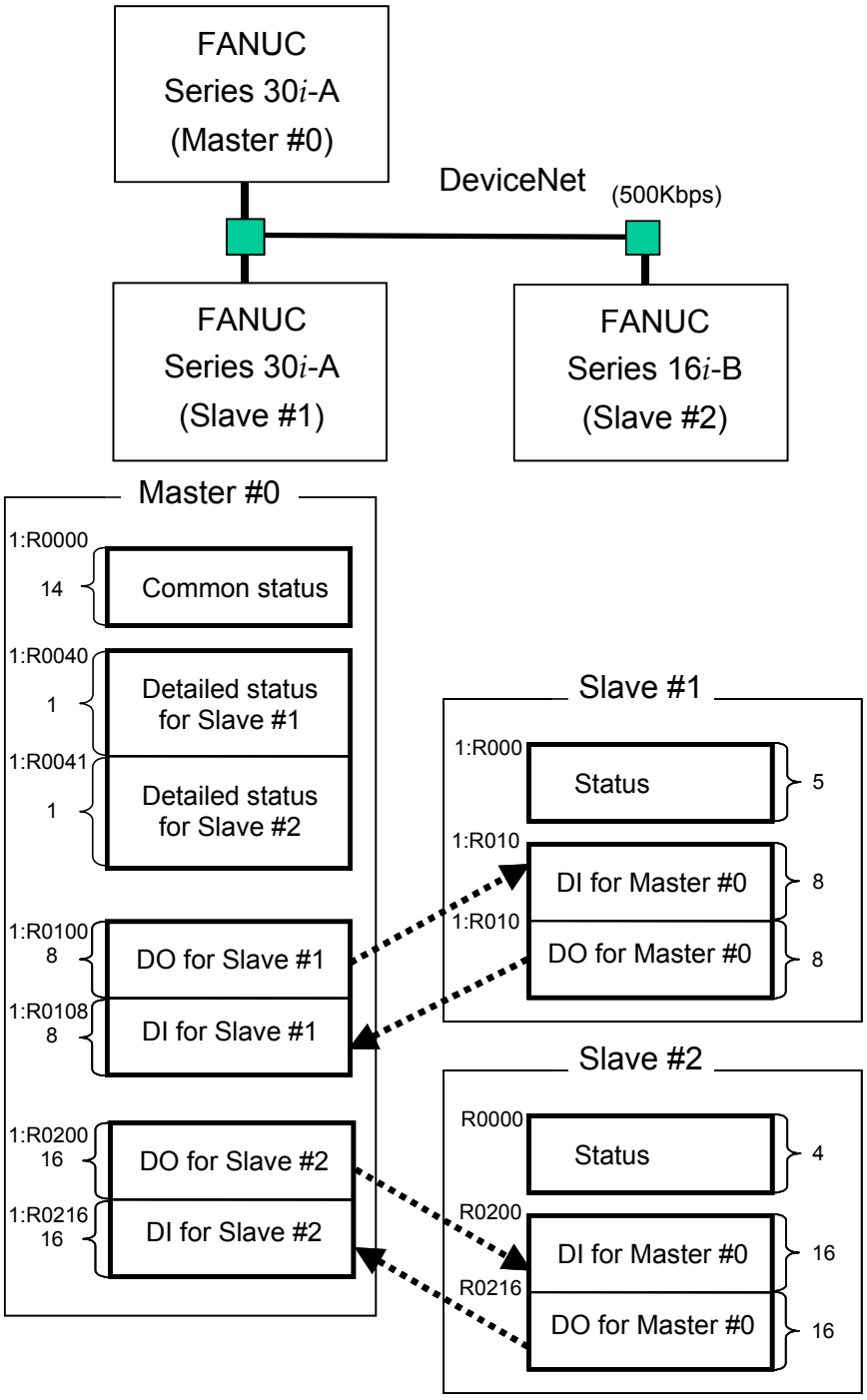
Appendix B provides setting examples to connect FANUC DeviceNet master devices and DeviceNet slave devices to other companies' devices.

B.1 EXAMPLE OF CONFIGURING A NETWORK

NOTE

In the following examples of configurations and settings, screens of the Series 30*i*/31*i*/32*i*-A are used. The Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F also has similar screens.

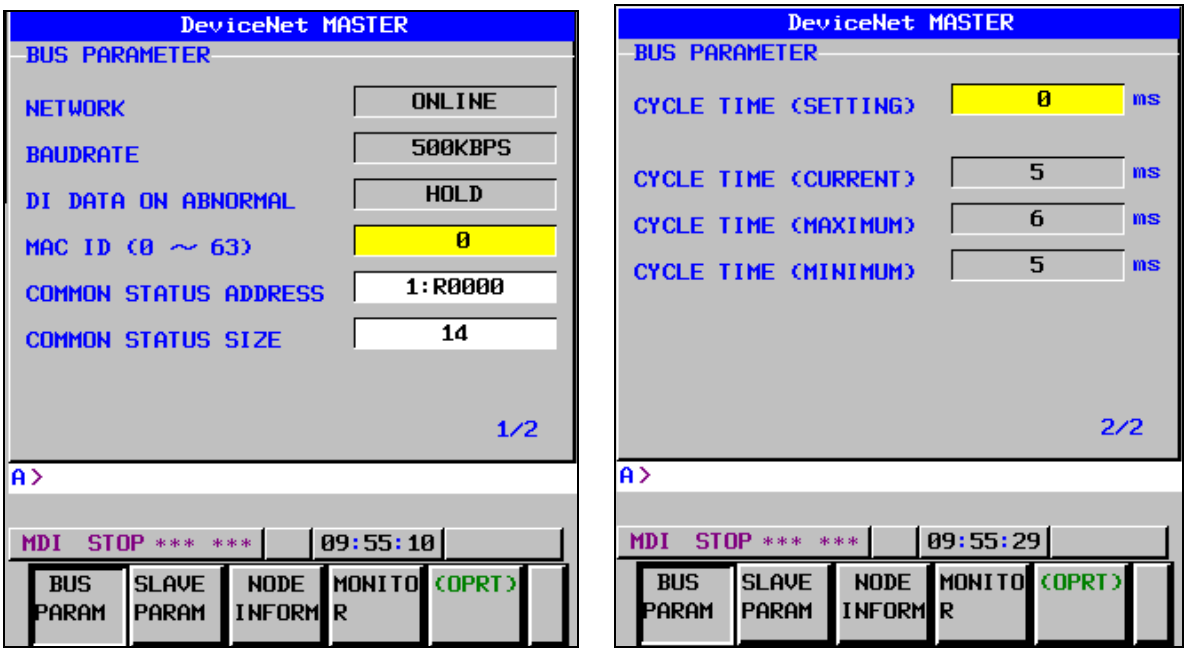
The BUS PARAMETER screen of the DeviceNet master function slightly differs between the Series 30*i*/31*i*/32*i*-A and Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, Series 0*i*-F however. For details, see Section 1.1, “SETTING SCREEN OF THE DeviceNet MASTER FUNCTION” in Part III, “SETTING”.



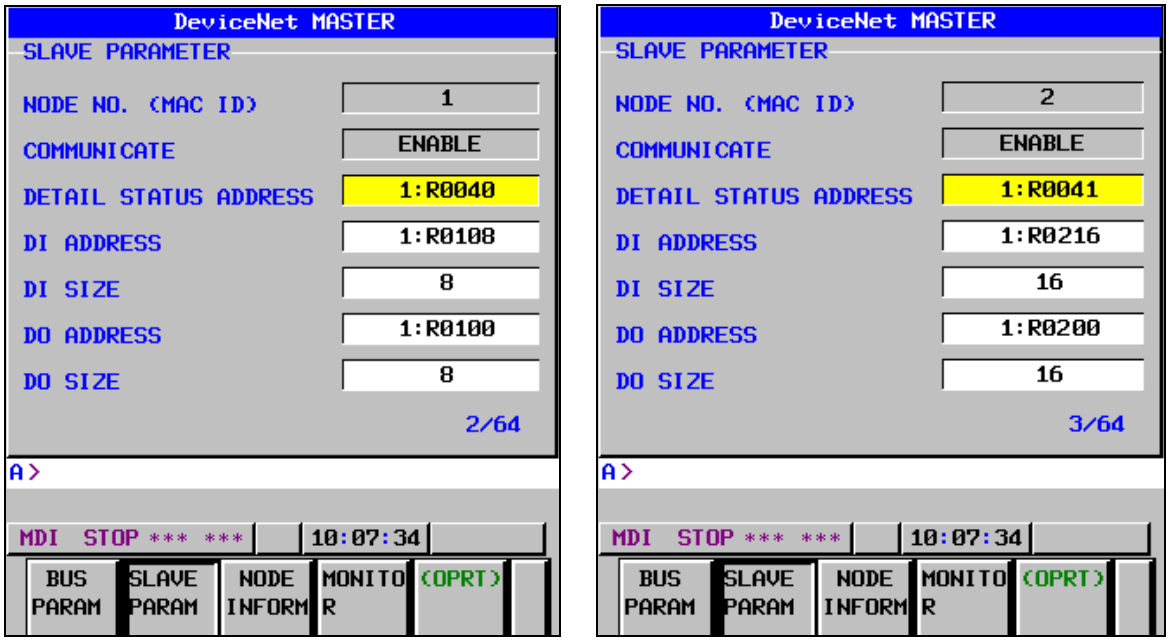
The following describes setting examples based on the above network configuration.

Setting example for Master #0 (Series 30*i*-A)

Make settings as shown below on the BUS PARAMETER screen.

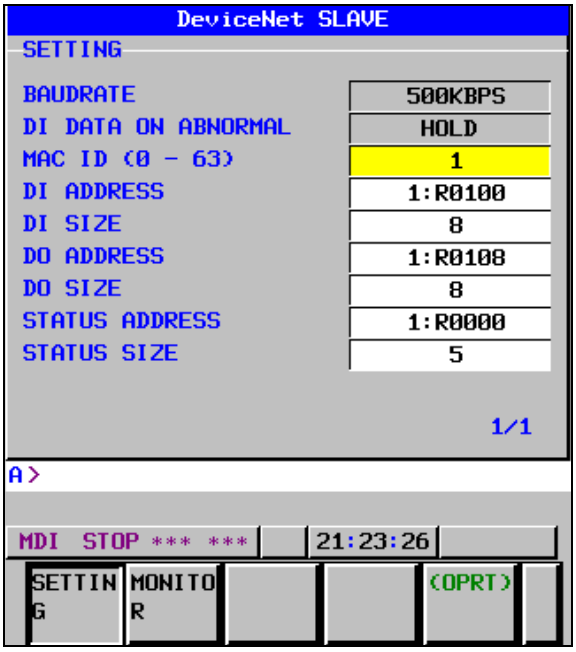


Make settings as shown below on the SLAVE PARAMETER screen.



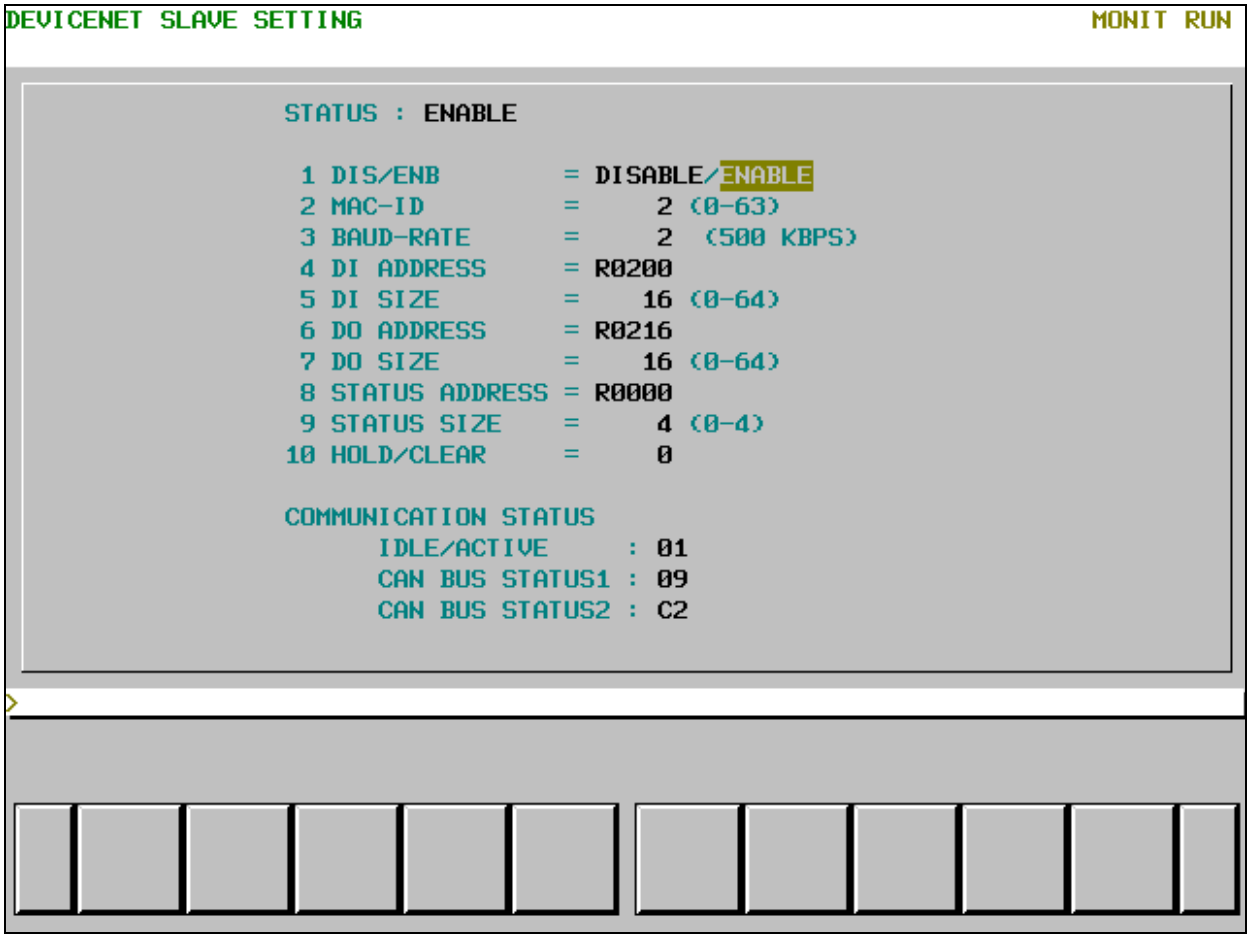
Setting example for Slave #1 (Series 30*i*-A)

The following a setting example for a slave with a MAC ID of 1.



Setting example for Slave #2 (Series 16*i*-B)

The following a setting example for a slave with a MAC ID of 2.



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REVISION RECORD

Edition	Date	Contents
04	Sep., 2015	• Applied to Series 0*i*-F • Correction of errors
03	Mar., 2014	• Applied to Power Motion *i*-A • Addition of warnings to "Safety Precautions" • Addition of Part II, “COMMON” • Correction of errors
02	Oct., 2010	• Applied to Series 30*i*/31*i*/32*i*/35*i*-B • Correction of errors
01	Jan., 2009	Changing of manual name and specification number New: FANUC Series 30*i*/300*i*/300*i*s, 31*i*/310*i*/310*i*s, 32*i*/320*i*/320*i*s-MODEL A (DeviceNet Board) CONNECTION MANUAL (B-64043EN) Old: FANUC DeviceNet Board For FANUC Series 30*i*/300*i*, 31*i*/310*i*, 32*i*/320*i*-MODEL A OPERATOR’S MANUAL (B-64044EN)