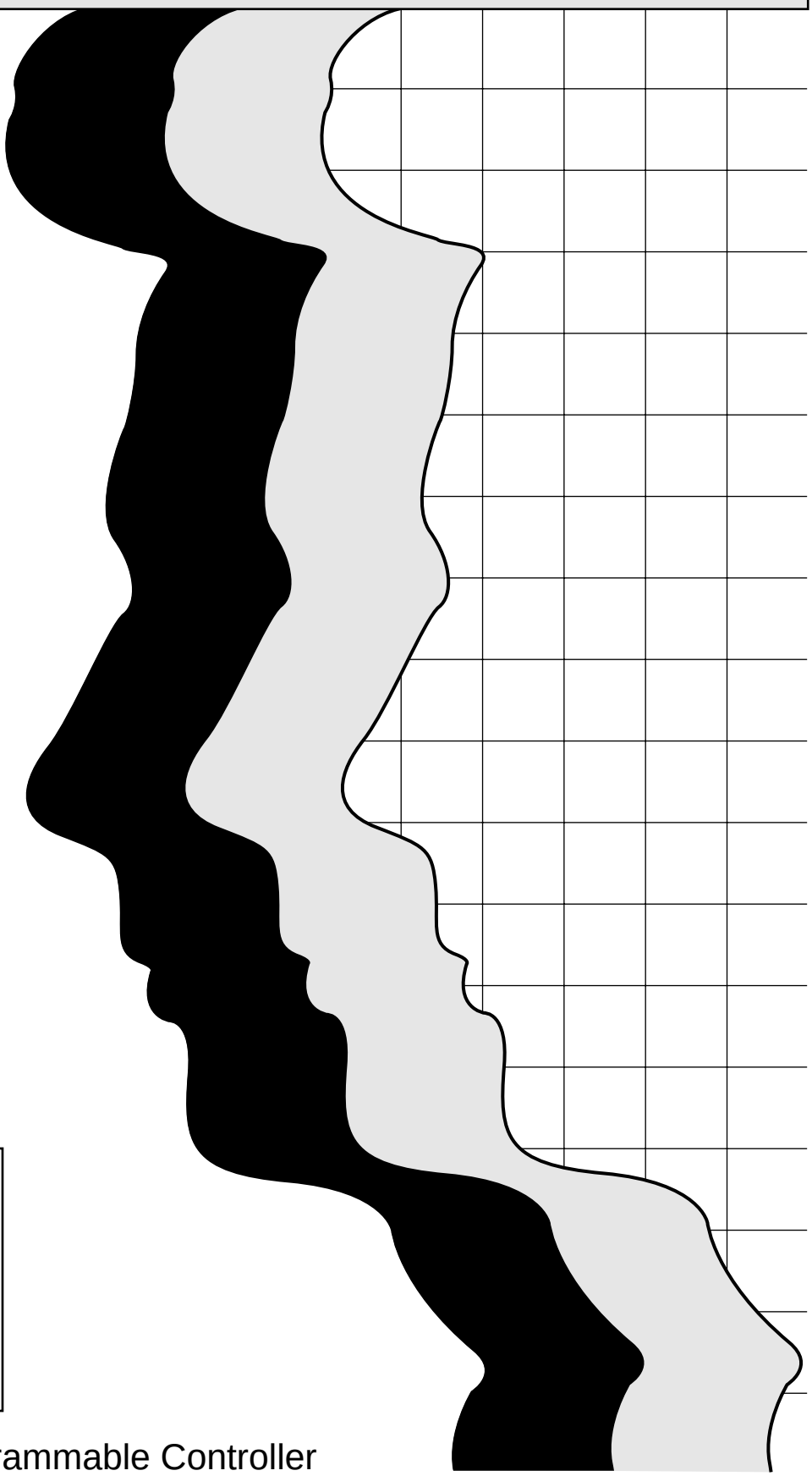
MITSUBISHI

Model AJ71DN91/A1SJ71DN91 DeviceNet Master Module

User's Manual



MELSEC

Mitsubishi Programmable Controller

• SAFETY PRECAUTIONS •

(Read these precautions before using.)

Before using this product, read this manual and the relevant manuals introduced in this manual carefully and handle the product correctly with full attention to safety.
Note that these precautions apply only to this product. Refer to the user's manual of the CPU module for the PLC system safety precautions.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠ DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that failure to observe the ⚠CAUTION level instructions may lead to serious results depending on the circumstances.
Be sure to observe the instructions of both levels to ensure personal safety.
Please keep this manual in an accessible place and be sure to forward it to the end user.

[Design Precautions]

⚠ DANGER

- If a communication error occurs in the network of the DeviceNet, the communication error station enters the state shown below.
  (1) The master station (AJ71DN91, A1SJ71DN91) holds the data that was input from a slave station before the occurrence of a communication error.
  (2) Whether the output signal of the slave station goes OFF or is retained depends on the slave station specifications or the parameter setting at the master station.
  Create the interlock circuit on a sequence program which uses the communication state of the slave stations so that the system operation is secured. At the same time, a safety system must be provided outside the slave station.

⚠ CAUTION

- Do not bundle the control wires and communication cables with the main circuit or power wires, or install them close to each other. They should be installed at least 100 mm (3.94 in.) away from each other. Failure to do so may generate noise that may cause malfunctions.

[Installation Precautions]

⚠ CAUTION

- Use the PLC in the operating environment that meets the general specifications given in the manual.
  Using the PLC in any other operating environment may cause an electric shock, fire or malfunction, or may damage or degrade the product.
- Insert the module fixing tab into the fixing hole in the base unit until it stops.
  Then, securely mount the module with the fixing hole as a supporting point.
  If the module is not installed properly, it may cause the module to malfunction, fail or fall off.
  Secure the module with screws especially when it is used in an environment where constant vibrations or strong impact may be expected.
  Be sure to tighten the screws using the specified torque. If the screws are loose, it may cause the module to malfunction or fall off. If the screws are tightened excessively, it may damage the screws and/or the module, and cause the module to malfunction or fall off.
- Before mounting or dismounting the module, make sure to shut off all phases of the external power supply. Failure to do so may damage the product.
- Do not directly touch the conducting parts and electronic parts of the module. This may cause the module to malfunction or fail.

[Wiring Precautions]

⚠ DANGER

- Switch off all phases of the power supply outside the PC before starting installing or wiring work.
  If all phases are not switched off, there will be a danger of electric shock or damage to the product.

⚠ CAUTION

- Always earth the FG terminal to the protective earth conductor.
  Failure to do so may cause a malfunction.
- Tighten the terminal screws with the specified torque. If the terminal screws are loose, it could result in short circuits or erroneous operation. Tightening the terminal screws too far may cause damages to the screws or the module, resulting in fallout, short circuits, or malfunction.
- Make sure that no foreign matter such as chips or wire offcuts gets inside the module.
  It will cause fire, failure, or malfunction.
- The communication cables and power cables connected to the unit must be enclosed in a duct or fixed with clamps.
  Failure to do this can result in malfunction due to damage to the unit or cables or defective cable contact caused by looseness or movement of the cables or accidental pulling on the cables.
- When disconnecting a communication cable and power cable from the unit, do not pull on the cable itself.
  If the cable has a connector, pull on the connector to disconnect it from the unit.
  If the cable has no connector, loosen the screw where the cable attaches to the unit before disconnecting the cable.
  Pulling on a cable while it is connected to the unit can damage the unit or cable, or cause malfunctions due to defective cable contact.
  Always turn off all external power supply phases before touching any terminals.
  Failure to do this may result in malfunction.

[Setup and Maintenance Precautions]

⚠ CAUTION
• Do not touch the terminals while the power is on. Doing so may cause malfunctions. • Always turn off all external power supply phases before cleaning or tightening the terminal screws. Failure to do this may result in malfunction. If the screws are loose, it may cause the module to short-circuit, malfunction or fall off. If the screws are tightened excessively, it may damage the screws and cause the module to short circuit, malfunction or fall off. • Do not disassemble or modify any module. This will cause failure, malfunction, injuries, or fire. • Always turn off all external power supply phases before mounting or dismounting the unit. Failure to do this may result in malfunction or damage to the unit. • Before handling the module, always touch grounded metal, etc. to discharge static electricity from the human body. Failure to do so can cause the module to fail or malfunction.

[Disposal Precautions]

⚠ CAUTION
• To dispose of this product, treat it as an industrial waste.

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Oct., 1998	SH (NA) -4004-A	First edition
Oct., 1999	SH (NA) -4004-B	Correction Section 1.2.1, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 3.1, 3.2, 3.4.2, 5.6.1, 7.2, 7.3, 7.4, 7.5.1, 7.6, 8.2.2, 8.3.1, APPENDICES, APP2, APP3 Addition Section 4.1.1
Jul., 2001	SH (NA) -4004-C	Correction Section 1.2.1, 2.1.3, 3.4.2, 5.3, 5.5, APPENDICES1.1, APP1.2
Jul., 2004	SH (NA) -4004-D	Correction Safty Precautions, Section 1.2.3 (2), 2.2.3, 3.1, 3.2, 3.3.2, 4.2, Chapter 7 Addition Section 1.2.3 (2) (d), 4.2.4, 4.2.5

Japanese Manual Version SH-3312-D

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-A-series.
Before using the equipment, please read the manual carefully to develop full familiarity with the functions and performance of MELSEC-A-series you have purchased, so as to ensure correct use.
Please forward a copy of this manual to the end user.

CONTENTS

MEMO

1. OUTLINE

This manual gives information including the specifications and descriptions of parts of the AJ71DN91/A1SJ71DN91 DeviceNet Master Unit (hereafter AJ71DN91, A1SJ71DN91, or DN91), which is used in combination with the MELSEC-A/QnA Series PLC CPU.
DN91 is the DeviceNet master station which controls the DeviceNet devices.
See the DeviceNet Specifications (Release 2.0) Volume 1 and Volume 2 for details about the DeviceNet Specifications.
DeviceNet is a registered trademark of the Open DeviceNet Vendor Association, Inc.

POINT
While it is considered connectable with most commercially available Device-Net products, we cannot guarantee the connectivity with products of other manufacturers.

1.1 Features

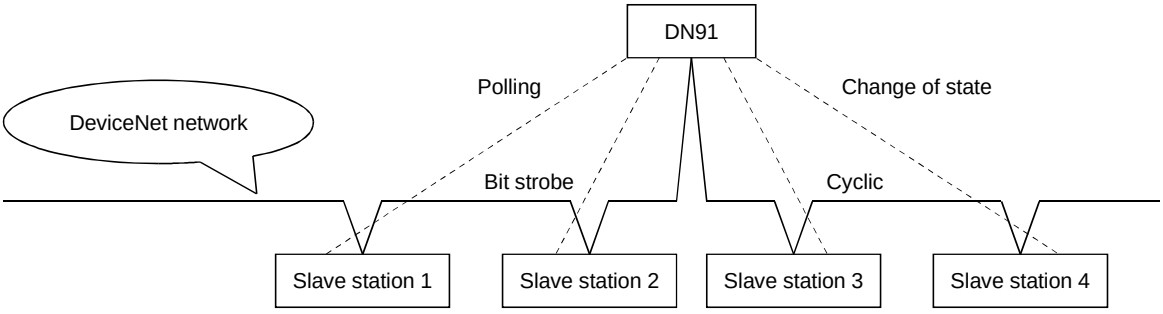
This section describes the features of DN91.

(1) Conforms to the DeviceNet specifications (Release 2.0).

(2) DN91 operates as the DeviceNet master station to permit I/O and message communications with the DeviceNet slave stations.

(3) Each master unit can communicate with up to 63 slave stations.

(4) The communication method for I/O communication can be selected independently for each slave station from the following four methods prescribed for DeviceNet: polling, bit strobe, change of state, and cyclic.
However, only one communication method can be selected for each slave station.



(5) I/O communication permits communication of 256 bytes of inputs (2048 points) and 256 bytes of outputs (2048 points) in the edit mode.

(6) Each message communication can communicate 240-byte message data.

(7) Any of the following two methods may be used to set the DN91 parameters:
- Use TO command of the sequence program to set the parameters.
- Use the configuration software to set the parameters. (Refer to the Section 2.2.3 for the configuration software.)

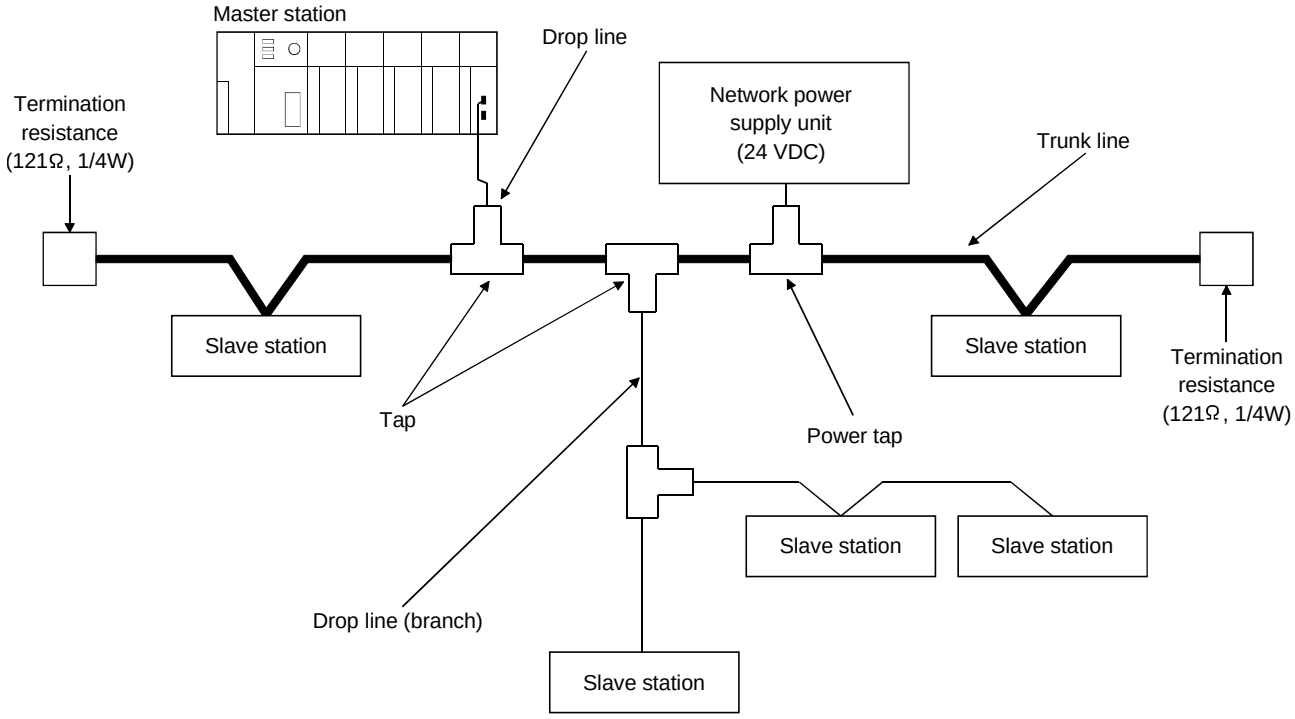
REMARK

When a network analyzer is connected to monitor the DeviceNet network, DN91 is recognized as a product of the Hilscher company.

1.2 Communication Outline

1.2.1 Network configuration

The DN91-based DeviceNet network is configured as shown below.



1) Up to 64 units can be connected including the master station (DN91) and slave stations.

2) The positions of the master station and slave stations are not fixed. They can be arranged at any position on the network.

3) The network comprises trunk lines and drop lines.
A termination resistance must be connected to each end of a trunk line.

4) A network power supply must be connected to supply power to the network communication circuits in each station.

5) Prepare the termination resistances on the user side.

(1) Network Specifications

This section describes the network specifications of a DeviceNet using DN91.

(a) Communication Speed

The communication speed can be selected as 125, 250, or 500 kbaud using a sequence program or a configuration software.

The maximum cable length depends on the communication speed. See 3.2 Performance Specifications for details.

(b) Network Power Supply Methods

The following methods are available to supply network power to each station:

1) Connect a dedicated power tap to the trunk line cable and connect a network power supply unit to it.

2) Supply power from the network power supply unit through network cables to each station.

REMARK

Contact ODVA or the ODVA Japan office for inquiries about the following devices required for the DeviceNet network configuration:

- Network power supply unit
- Power tap
- Tap
- Termination resistance
- Cable

Contact Details for ODVA

Open DeviceNet Vender Association, Inc.

Address

20423 State Road 7 - Suite 499 - Boca Raton, FL 33498 U.S.A.

TEL.+1-954-340-5412

FAX.+1-954-340-5413 or +1-561-477-6621

ODVA Japan Office

Address

The Japan Chapter of ODVA

Kyoto Research Park 17, Chudoji Minami-Machi, Shimogyo Kyoto 600-8813 Japan

TEL.075-315-9175 FAX.075-315-2898

1.2.2 Outline of parameter settings

Parameter setting is required in advance to communicate with slave stations.
The parameters include DeviceNet communication speed, station number (MAC ID) of DN91, the number of I/O points of slave stations etc.
They are set in any of the following methods and stored in separate areas of E^2PROM inside DN91.

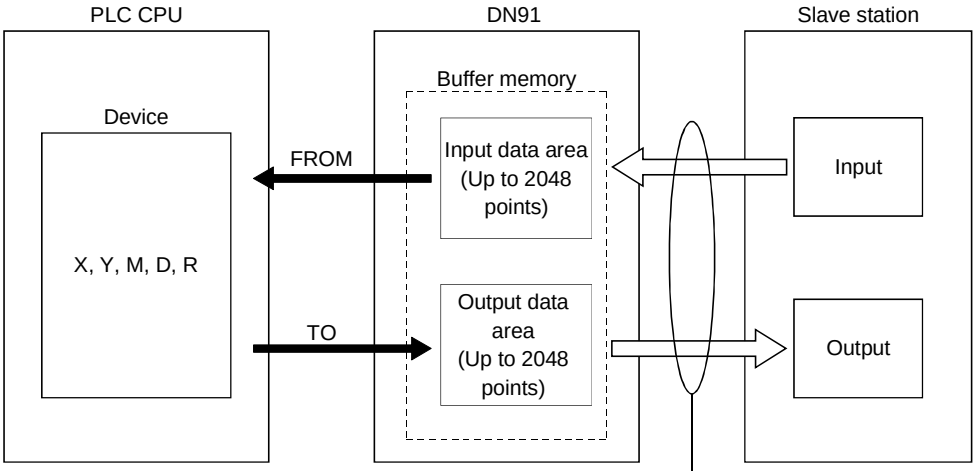
- Use the sequence program.
- Use the configuration software.

1.2.3 Outline of DN91 - slave station communication

Communication between the DN91 and slave stations is outlined below.

(1) Outline of I/O Communication

I/O communication is a function to communicate I/O data with slave stations.
An outline of I/O communication is shown below.
See 4.1 I/O Communication Functions for details.



The following four I/O communication methods are available:
1) Bit strobe
2) Polling
3) Change of state
4) Cyclic

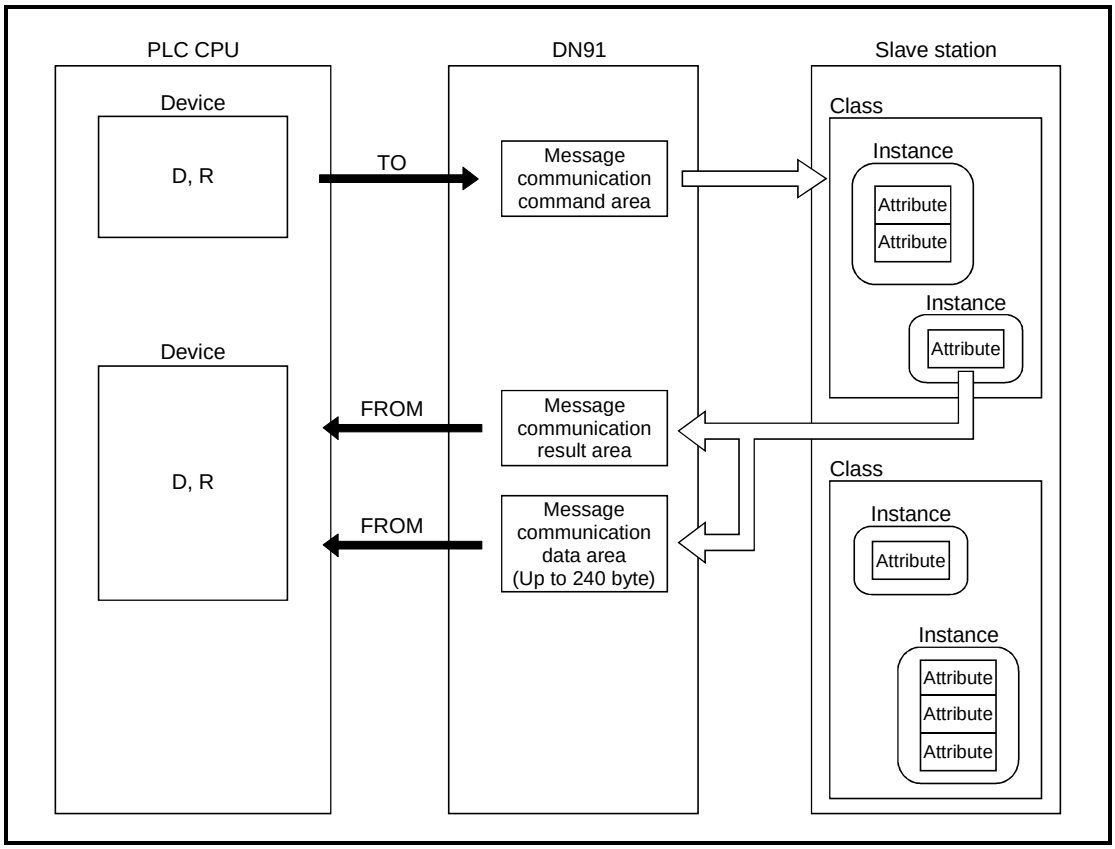
One of these four communication methods can be chosen to match the specification of each slave station.

(2) Outline of Message Communication

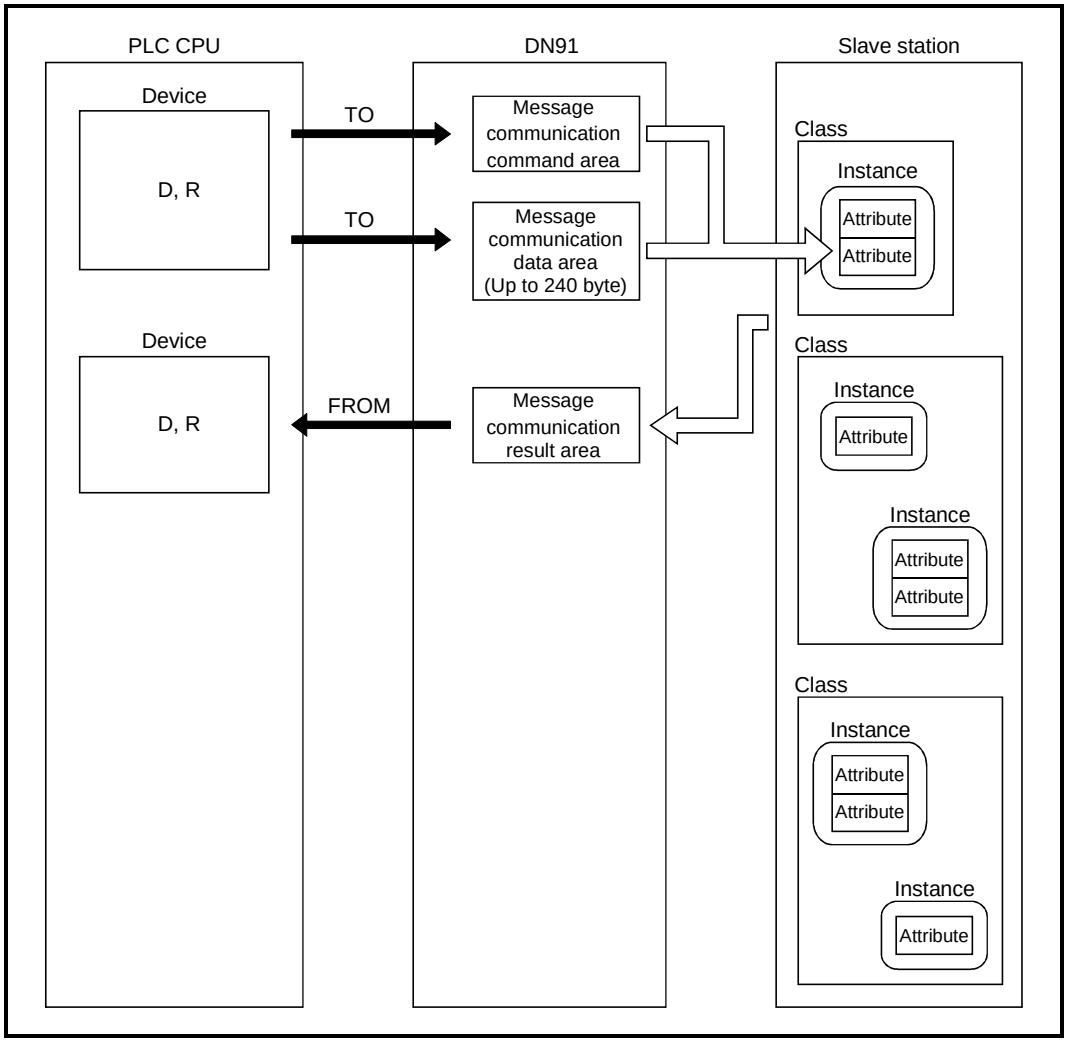
The message communication functions read/write attribute data from/to the specified slave station, read communication error information from that slave station, and reset its class/instance.

An outline of message communication is shown below. See 4.2 Message Communication Functions for details.

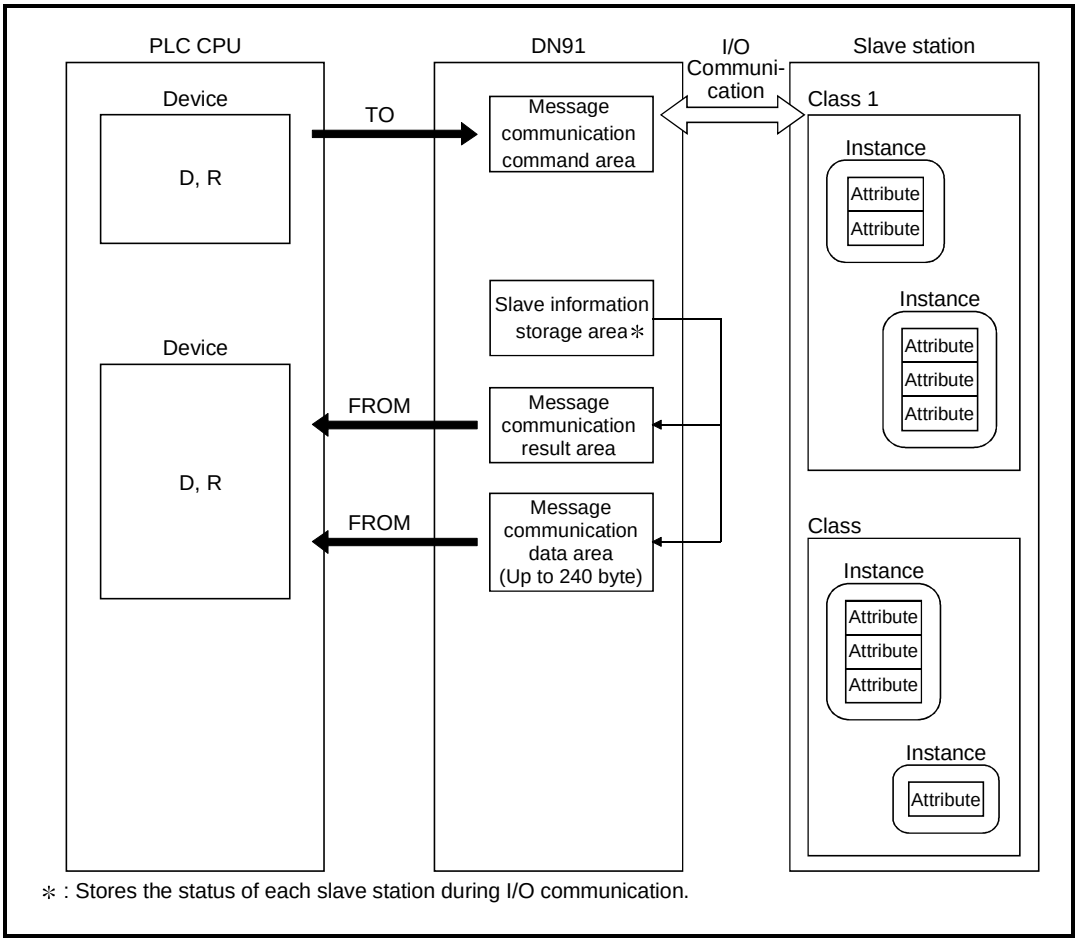
(a) Reading attributes



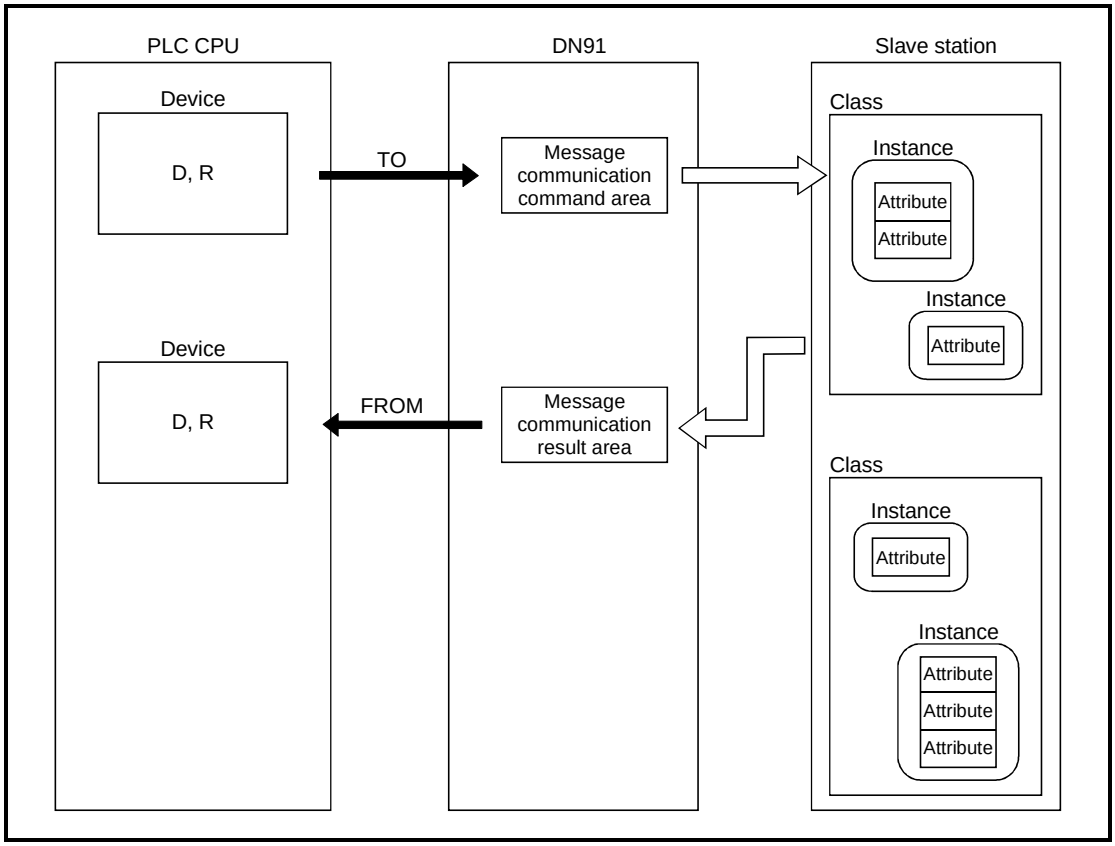
(b) Writing attributes



(c) Reading communication error information



(d) Reset


PLC CPU
DN91
Slave station
Device
D, R
TO
Message communication command area
Class
Instance
Attribute
Attribute
Instance
Attribute
Device
D, R
FROM
Message communication result area
Class
Instance
Attribute
Instance
Attribute
Attribute
Attribute

MEMO

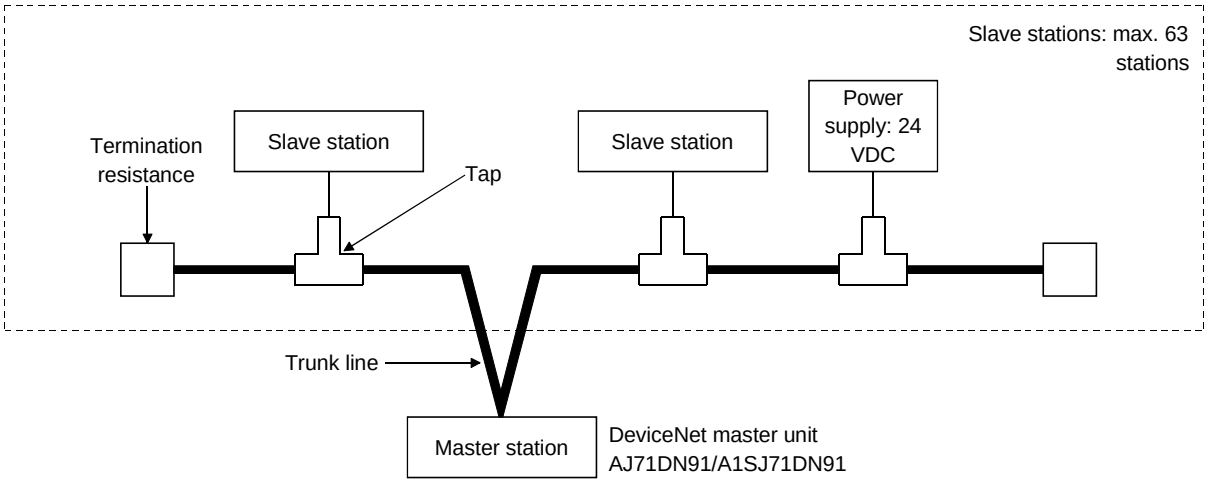
2. SYSTEM CONFIGURATION

This section describes the system configuration on DeviceNet.

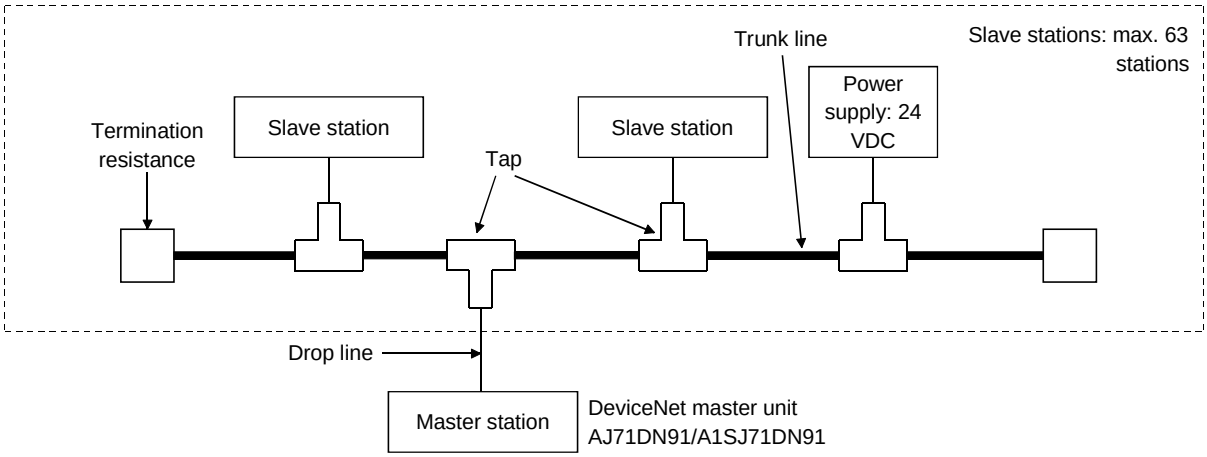
2.1 Overall Configuration

A master station can communicate with up to 63 slave stations.
Each station is connected via a tap on the trunk line or is directly connected to the trunk line.
The system configuration using AJ71DN91/A1SJ71DN91 as the master station is described below.

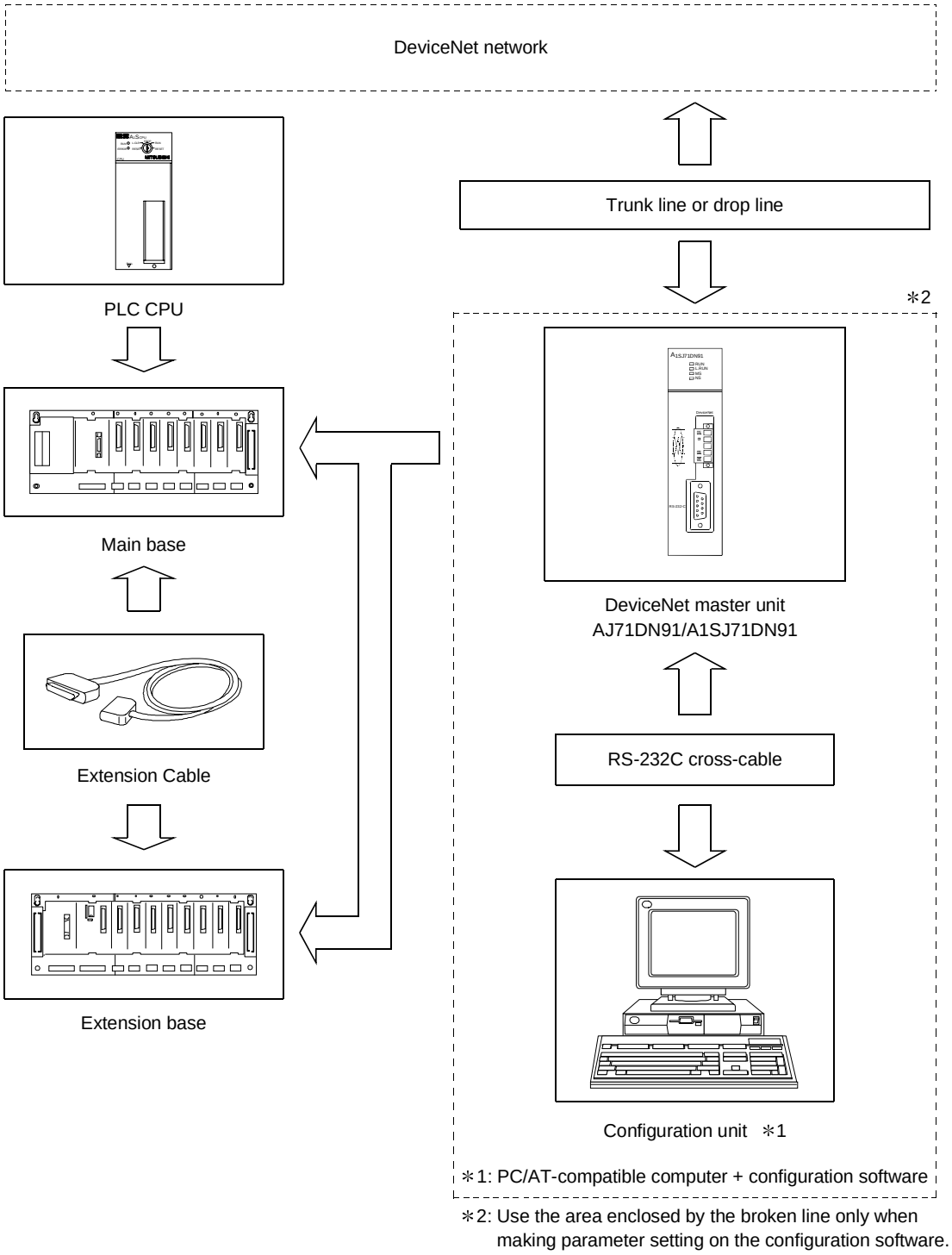
2.1.1 A typical system configuration that connects with a trunk line



2.1.2 A typical system configuration that connects with a drop line



2.1.3 System configuration with a DeviceNet master unit



2.2 Applicable Systems

This section describes important points regarding which PLC CPUs can be used and the system configuration.

2.2.1 Mountable CPUs and number of units

Table 2.1 shows which PLC CPUs can be mounted and the number of units.

Table 2.1 Mountable CPUs and Number of Units

Mounting Position			Number of Mountable Units	
			A1SJ71DN91	AJ71DN91
PLC CPU	A0J2CPU		Cannot be used	No restriction
	A0J2HCPU			
	A1SCPU(S1)		No restriction	
	A1SHCPU			
	A1SJCPU(S3)			
	A1SJHCPU(S8)			
	A1SCPUC24-R2			
	A2SCPU(S1)			
	A2SHCPU(S1)			
	A2USCPU(S1)			
	A2USHCPU-S1			
	A2ASCPU(S1/S30)			
	Q2ASCPU(S1)			
	Q2ASHCPU(S1)			
	A1CPU		Cannot be used	
	A2CPU(S1)			
	A3CPU			
	A1NCPU			
	A2NCPU(S1)			
	A3NCPU			
	A3MCPU			
	A3HCPU			
	A2ACPU(S1)			
	A3ACPU			
	A2UCPU(S1)			
	A3UCPU			
	A4UCPU			
	Q2ACPU(S1)			
	Q3ACPU			
	Q4ACPU			
	Q4ARCPU			
Data link and network	MELSECNET remote I/O station		Cannot be used	Cannot be used
	MELSECNET/B remote I/O station			
	MELSECNET/10 remote I/O station	AJ72LP25 AJ72BR15		
		A1SJ72QLP25 AJ72QLP25 A1SJ72QBR15 AJ72QBR15		

2.2.2 Important points about the system configuration

This section gives some important points about configuration of a DeviceNet network system.

(1) Maximum Number of Units
Units up to the number of CPU I/Os may be installed. The DN91 uses 32 I/O points and one slot.

(2) Applicable Base Units
The DN91 can be mounted in any main base unit or extension base unit slot, with the following exceptions.
(a) Avoid mounting the DN91 in an extension base unit with no power supply (A5□B, A1S5□B extension base unit) as the power supply capacity may be insufficient.
If the DN91 is mounted in this type of unit, select the power supply unit and extension cable with due consideration to the current capacity of the power supply unit and the voltage drop in the extension cable.
See the user's manual of your PLC CPU for details.

(b) The DN91 cannot be mounted in the final slot of the A3CPU(P21/R21) expansion 7th stage.

(3) Cannot Be Mounted in MELSECNET(II), MELSECNET/B or MELSECNET/10 Remote I/O Station
The DN91 cannot be mounted in a MELSECNET(II), MELSECNET/B or MELSECNET/10 remote I/O station.

(4) Cautions When Connecting Wiring
To avoid noise interference, separate DeviceNet communication cables, power cables, and I/O unit signal cables.

(5) No Remote Operation from Another Node
It is not enabled to read, write, or monitor the sequence program of the PLC CPU, which contains the DN91, and the data of slave stations via nodes on the DeviceNet.

2.2.3 Operating environment of the configuration software (parameter setting tool)

This section describes the operating environment when setting DN91 parameters with the configuration software.
The configuration software is a peripheral device which installs the following configuration software in a personal computer to allocate communication data for each slave station to the DeviceNet master station.

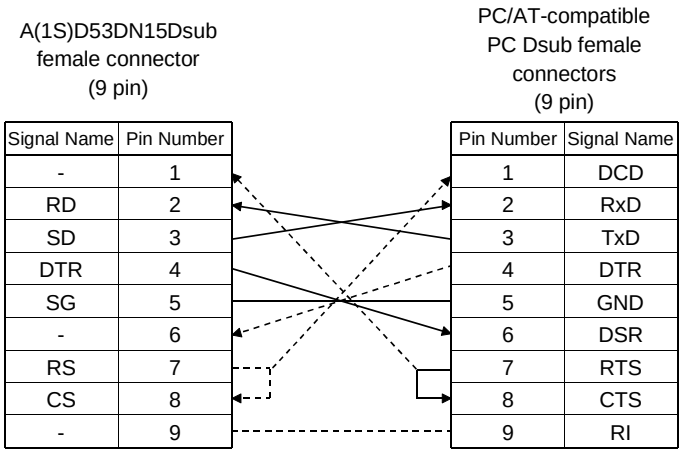
(1) Configuration Software
SyCon Ver. 2.0.6.2 or later (Include DLL file Ver. 2.5.0.1 or later.)
Connect the DN91 and personal computer with the RS-232C cross-cable.

(2) Operating Environment of the Configuration Software
The operating environment is shown below.

Table 2.2 Operating Environment

Item	Environment
Personal computer	PC/AT compatible personal computer
CPU	Intel 486 processor, or above
OS	Microsoft® Windows® 95 Operating System Microsoft® Windows NT® Workstation Operating System Version 3.51 Microsoft® Windows NT® Workstation Operating System Version 4.0
Free disk space	10 Mbyte min.
RAM	16 Mbyte min.
Display resolution	800 x 600 dot, min.
External storage	CD-ROM drive (for installation only)

(3) RS-232C Cross-cable
The wiring connections of the RS-232C cross-cable which links the PC/AT-compatible personal computer and DN91 are shown below.



- Shielded cable is recommended.
- -------- indicates that no connection is needed but it is recommended to make a connection to eliminate specific orientation.

REMARK

Configurator suppliers are listed below.

• USA
Hilscher North America Inc.
HQ Cantera Center
4320 Winfield Road
Warrenville
USA-60565 Illinois
TEL: +1-630-836-8677
FAX: +1-630-836-8010

• Germany
Hilscher Gesellschaft fur Systemautomation mbH
Rheinstrasse 15
D-65795 Hattersheim
Germany
TEL: +49-6190-9907-0
FAX: +49-6190-9907-50

• Japan-Representative Office
Euro-Far East Co., Ltd.
Lilas Nogizaka Bldg. #901
Minami Aoyama 1-15-18
Minato-ku
Tokyo 107-0062-Japan
TEL: +81-3-3470-8769
FAX: +81-3-3478-8648

2.3 Products Connectable to a Slave Station

While it is considered connectable with most commercially available DeviceNet products, we cannot guarantee the connectivity with products of other manufacturers.

3. SPECIFICATIONS

3.1 General Specifications

Table 3.1 shows the general specifications of the DN91.

Table 3.1 General Specifications

Item	Specification					
Operating ambient temperature	0 to 55 °C					
Operating ambient humidity	10 to 90 %RH, no condensation					
Storage ambient temperature	- 20 to 75 °C					
Storage ambient humidity	10 to 90 %RH, no condensation					
Vibration resistance	Conforming to JIS B3502, IEC61131-2 ∗3	Intermittent vibrations	Frequency	Acceleration	Amplitude	Number of Sweeps
			10 to 57 Hz	—	0.075 mm	10 in X, Y, and Z directions (80 minutes)
			57 to 150 Hz	9.8 m/s^2	—	
		Continuous vibrations	Frequency	Acceleration	Amplitude	
			10 to 57 Hz	—	0.035 mm	
			57 to 150 Hz	4.9 m/s^2	—	
Shock resistance	Conforming to JIS B 3502, IEC 61131-2 (147 m/s^2, 3 times in 3 directions)					
Operating environment	No corrosive gas					
Operating altitude	2000 m max.					
Installation position	In control box					
Over-voltage category ∗1	II max.					
Degree of contamination ∗2	2 max.					

∗1: Indicates the position of the distribution board to which the device is assumed to be connected between the public power network and the position of the machine in the factory.
Category II is applicable to devices supplied by power from fixed plant.
For devices rated up to 300 V, surge-voltage resistance is 2500 V.

∗2: Indicator showing the degree of generation of conducting material in the device operating environment.
A degree of contamination of 2 indicates that only non-conducting contamination occurs. However, temporary conductivity may arise in this environment due to accidental condensation.

∗3: JIS (Japanese Industrial Standard)

3.2 Performance Specifications

Table 3.2 shows the general specifications of the DN91.

Table 3.2 Performance Specifications

<table>
<tr><th colspan="4">Item</th><th colspan="6">Specification</th></tr>
<tr><td rowspan="11">Communication specification</td><td colspan="3">By node type</td><td colspan="6">Group 2 dedicated client</td></tr>
<tr><td colspan="3">Settable station numbers</td><td colspan="6">0 to 63</td></tr>
<tr><td colspan="3">Maximum number of slave stations to communicate with</td><td colspan="6">63</td></tr>
<tr><td rowspan="4">Communication data volume</td><td rowspan="2">I/O communi-cation</td><td>Send</td><td colspan="6">2048 points (256 bytes) ∗2</td></tr>
<tr><td>Re-ceive</td><td colspan="6">2048 points (256 bytes) ∗2</td></tr>
<tr><td rowspan="2">Message communi-cation</td><td>Send</td><td colspan="6">240 bytes</td></tr>
<tr><td>Re-ceive</td><td colspan="6">240 bytes</td></tr>
<tr><td colspan="3">Communication speed</td><td colspan="6">Select 125 kbaud, 250 kbaud, or 500 kbaud</td></tr>
<tr><td colspan="3" rowspan="4">Max. cable length ∗1</td><td rowspan="2">Communi-cation Speed</td><td colspan="3">Trunk Line Max. Transfer Distance</td><td colspan="2">Drop Line</td></tr>
<tr><td>Thick Cable</td><td>Thin Cable</td><td>Thick Cable/Thin Cable Combination</td><td>Max.</td><td>Total</td></tr>
<tr><td>125 kbaud</td><td>500 m</td><td rowspan="3">100 m</td><td rowspan="3">See 3.2.1</td><td rowspan="3">6 m</td><td>156 m</td></tr>
<tr><td>250 kbaud</td><td>250 m</td><td>78 m</td></tr>
<tr><td>500 kbaud</td><td>100 m</td><td>39 m</td></tr>
<tr><td colspan="3">Amperage consumption (mA) required on the network</td><td colspan="6">26.5</td></tr>
<tr><td colspan="3">Number of E^2PROM write times</td><td colspan="6">Max. 100 thousand times</td></tr>
<tr><td colspan="4">Number of occupied I/Os</td><td colspan="6">Special 32 points</td></tr>
<tr><td colspan="4">Internal current consumption at 5 VDC (A)</td><td colspan="6">0.24</td></tr>
<tr><td colspan="4">weight (kg)</td><td colspan="6">A1SJ71DN91: 0.23, AJ71DN91: 0.43</td></tr>
</table>

∗1: See the DeviceNet Specifications (Release 2.0) Volume 1 and Volume 2 for details about the maximum cable lengths.

∗2: Up to 255 bytes can be transferred per slave station.

3.2.1 Maximum transfer distance of a trunk line that contains both thick and thin cables

This section shows the maximum transfer distances for thick cable/thin cable combinations.

Communication Speed	Trunk Line Max. Transfer Distance with a Thick Cable/Thin Cable Combination
125 kbaud	(Thick cable length + 5) × thin cable length ≤ 500 m
250 kbaud	(Thick cable length + 2.5) × thin cable length ≤ 250 m
500 kbaud	Thick cable length × thin cable length ≤ 100 m

3.3 PLC CPU I/O Signals

This section describes the I/O signals for the DN91 PLC CPU.

3.3.1 Table of I/O signals

Table 3.3 shows the table of DN91 I/O signals.
The letter "n" in the table represents the leading I/O number of DN91. It is determined by the position installed and the unit installed before DN91.
<Example> If the DN91 head I/O number is "X/Y30"
Xn0 to X(n+1)F → X30 to X4F
Yn0 to Y(n+1)F → Y30 to Y4F

Table 3.3 Table of I/O Signals

DN91 → PLC CPU		PLC CPU → DN91	
Input Number	Signal Name	Output Number	Signal Name
Xn0	Watchdog timer error	Yn0	Unusable
Xn1	Refreshing	Yn1	
Xn2	Message communication complete	Yn2	
Xn3	Error set signal	Yn3	
Xn4	Slave down signal	Yn4	
Xn5	Message communication error signal	Yn5	
Xn6	Parameter being set	Yn6	
Xn7	Parameter setting complete	Yn7	
Xn8	Unusable	Yn8	
Xn9		Yn9	
XnA		YnA	
XnB		YnB	
XnC		YnC	
XnD		YnD	
XnE		YnE	
XnF	Unit ready	YnF	
X(n+1)0	Unusable	Y(n+1)0	Unusable
X(n+1)1		Y(n+1)1	Refresh request
X(n+1)2		Y(n+1)2	Message communication request
X(n+1)3		Y(n+1)3	Error reset request
X(n+1)4		Y(n+1)4	Unusable
X(n+1)5		Y(n+1)5	
X(n+1)6		Y(n+1)6	
X(n+1)7		Y(n+1)7	Parameter set request
X(n+1)8		Y(n+1)8	Unusable
X(n+1)9		Y(n+1)9	
X(n+1)A		Y(n+1)A	
X(n+1)B		Y(n+1)B	
X(n+1)C		Y(n+1)C	
X(n+1)D		Y(n+1)D	
X(n+1)E		Y(n+1)E	
X(n+1)F		Y(n+1)F	

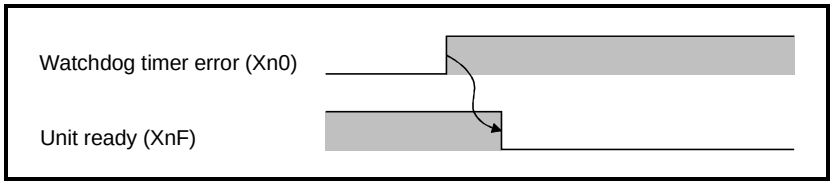
Important

The output signals designated as "unusable" in Table 3.3 are reserved for system use and are not available to the user. Normal operation cannot be guaranteed if the user operates one of these output signals (that is, turns the signal ON or OFF).

3.3.2 I/O signal details

This section explains the I/O signal ON/OFF timing and conditions.

(1) Watchdog timer error: Xn0
Turns ON if an error occurs in DN91.
OFF: Unit normal
ON : Unit abnormal

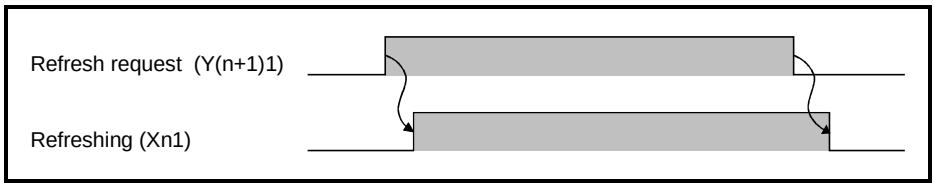


(2) Refreshing: Xn1, Refresh request: Y(n+1)1
These signals determine whether the data in the input data area and output data area of the buffer memory is used to refresh the network.
Refresh is conducted if the status of the master communication status area in buffer memory is "operation in progress."
(a) To start the data refresh, turn ON refresh request (Y(n+1)1) with a sequence program.

(b) When refresh request (Y(n+1)1) is turned ON, the refresh operation starts and refreshing (Xn1) turns ON automatically.

(c) To stop the data refresh, turn OFF refresh request Y(n+1)1 with a sequence program.

(d) The data refreshing is interrupted with "Refreshing" signal (Xn1) turned OFF automatically and "OFF" or 0 data transmitted to all slave stations.
Refreshing the input data area still continues.



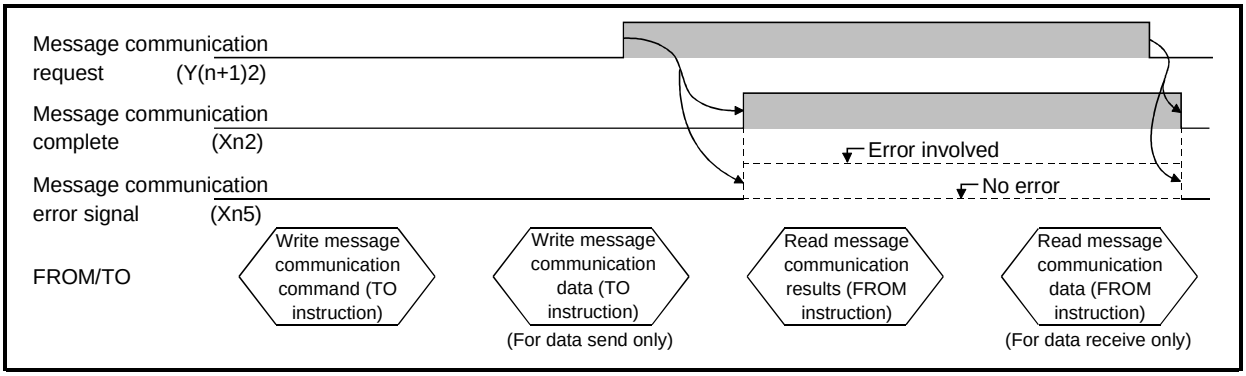
(3) Message communication complete : Xn2
Message communication error signal: Xn5
Message communication request : Y(n+1)2
These signals are used for message communication. Message communication is conducted if the status of the master communication status area in buffer memory is "operation in progress."

(a) Follow the procedure below to conduct message communication.
1) Write the message communication data to the message communication command area in buffer memory.
2) Turn ON message communication request (Y(n+1)2) with a sequence program.
(Set the interval of turning ON the message communication request at 100 ms or over.)

(b) The message communication completes with the results written onto the "Message communication results" area, and the message communication complete (Xn2) turns ON.

(c) Check the results of the message communication through the message communication error signal (Xn5).

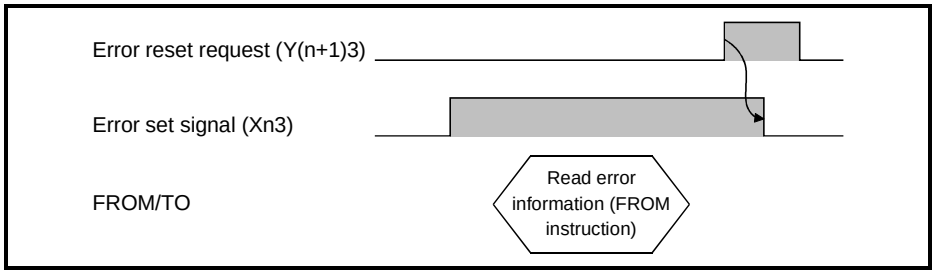
(d) After reading the communication data with FROM command, the sequence program is used to turn OFF the message communication request (Y(n+1)2). The message communication complete (Xn2) and message communication error signal (Xn5) automatically turns OFF.



(4) Error set signal: Xn3, Error reset request: Y(n+1)3
These signals are used to notify an error and reset error codes.

(a) If an error occurs, error information is stored in the error information area in buffer memory and the error set signal (Xn3) turns ON.
The error set signal automatically turns OFF when the cause of the error is removed.

(b) Once the cause of error is removed, turning ON the error-resetting request (Y(n+1)3) with the sequence program clears the error code set on the "error information" area.



(5) Slave down signal: Xn4

This signal indicates whether any slave station has stopped communication.

(a) This signal turns ON if any slave station for which parameters are set stops communication.

OFF: All stations communicating normally

ON : Abnormal communication at a station

Which station has stopped communication can be confirmed from the station communication status area at addresses 01BC$_H$ to 01BF$_H$ of the buffer memory.

(b) This signal automatically turns OFF when the slave station communication restarts.

(6) Parameter-being-set : Xn6

Parameter set complete: Xn7

Parameter set request : Y(n+1)7

These signals are used to set parameters with a sequence program. Set the parameters when the refreshing (Xn1) signal is OFF.

(a) Follow the procedure below to write parameters.

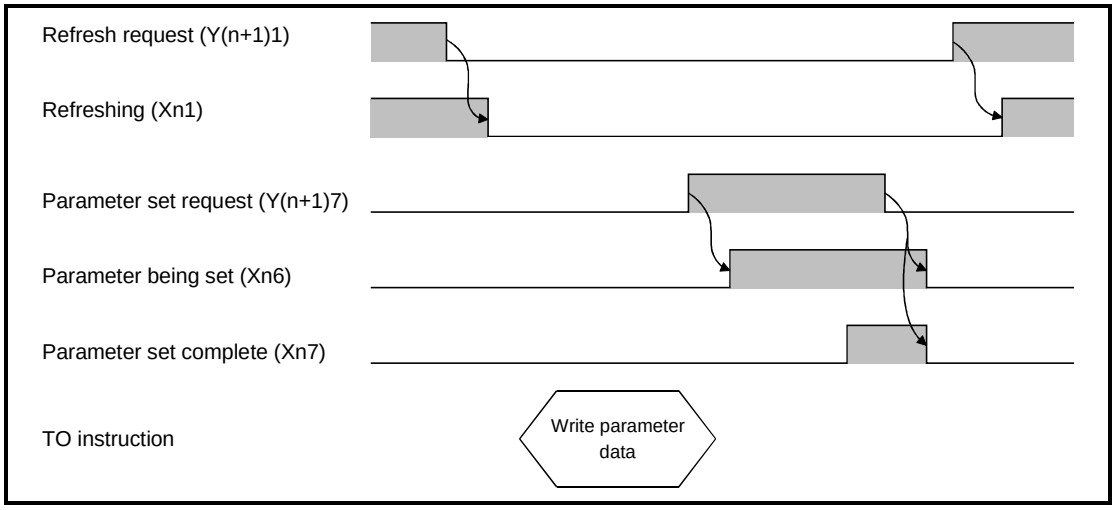
1) Write the parameters to the parameter set area in buffer memory.

2) Turn on parameter set request (Y(n+1)7) with a sequence program.

(b) Once the write request is received and the parameter analysis completes normally, parameter-writing action gets executed with the parameter-being-set (Xn6) turned ON.

(c) Parameter set complete (Xn7) automatically turns ON when the parameter write operation is complete. Communication with other slave stations is disabled while parameters are being set.

Parameter set complete (Xn7) automatically turns OFF when parameter set request (Y(n+1)7) turns OFF.

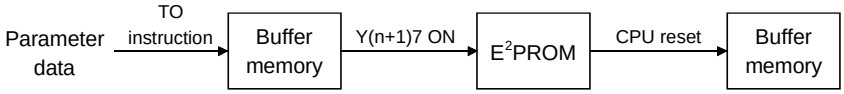


POINTS

(1) If refreshing (Xn1) is ON when parameter set request (Y(n+1)7) turns ON, parameter set complete (Xn7) does not turn ON. First, turn OFF refresh request (Y(n+1)1) and confirm that refreshing (Xn1) is OFF before turning parameter set request (Y(n+1)7) OFF and back ON.

(2) If parameter set request (Y(n+1)7) is ON when refresh request (Y(n+1)1) turns ON, refreshing (Xn1) does not turn ON. First, turn OFF parameter set request (Y(n+1)7), then reset refresh request (Y(n+1)1) and turn it back ON.

(3) Parameter data flows as shown below.



Since E^2PROM has a restriction on the number of write times, execute the parameter set request (Y(n+1)7) only when parameters are created newly or changed.

(7) Unit ready: XnF

This signal indicates whether the unit is able to operate.
It turns ON automatically when unit operation is enabled.

3.4 Buffer Memory

Buffer data is used for data communication between DN91 and the PLC CPU.
It is used for reading and writing of DN91 buffer memory data and for the PLC CPU FROM/TO instructions.
The buffer memory returns to zero (0) when powered OFF or when the PLC CPU reset.
If the parameters are set by the sequence program, however, the "Parameter" area is initialized with the parameters that are already set.

3.4.1 Buffer memory table

The buffer memory table is shown in Table 3.4.

Table 3.4 Buffer Memory Table

Address		Item	Contents	Write Enabled/ Disabled by CPU	See Page
Hexadecimal	Decimal				
0000H to 007FH	0 to 127	Input data	Stores input data from each slave station.	Disabled	3.4.2 (1)
0080H to 00FFH	128 to 255	Output data	Stores output data for each slave station.	Enabled	3.4.2 (2)
0100H to 010FH	256 to 271	Not used	—	—	—
0110H to 011FH	272 to 287	Message communication command	Stores request data for message communication.	Enabled	3.4.2 (3)
0120H to 012FH	288 to 303	Message communication result	Stores result data from message communication.	Disabled	3.4.2 (4)
0130H to 01A7H	304 to 423	Message communication data	Stores communication data for message communication.	Enabled	3.4.2 (5)
01A8H to 01A9H	424 to 425	Model display	Setting is "DN91" in ASCII code	Disabled	—
01AAH to 01AFH	426 to 431	Not used	—	—	
01B0H	432	Master communication status	Stores the DN91 status	Disabled	3.4.2 (6)
01B1H	433	Error information	Upper byte: Error code Lower byte: Stores station number where the error occurred.	Disabled	3.4.2 (7)
01B2H	434	Bus error counter	Stores the number of error detections for communication data.	Disabled	3.4.2 (8)
01B3H	435	Bus-off counter	Stores the number of communication errors.	Disabled	3.4.2 (9)
01B4H to 01B7H	436 to 439	Configuration status of each station	Indicates whether parameters are set for each slave station.	Disabled	3.4.2 (10)
01B8H to 01BBH	440 to 443	Not used	—	—	—
01BCH to 01BFH	444 to 447	Communication status of each station	Indicates whether each station is conducting I/O communication	Disabled	3.4.2 (11)
01C0H to 01C3H	448 to 451	Not used	—	—	—
01C4H to 01C7H	452 to 455	Error status of each station	Indicates whether an error has occurred for each station.	Disabled	3.4.2 (12)
01C8H to 01CBH	456 to 459	Not used	—	—	—
01CCH to 01CFH	460 to 463	Down-station detection disabled setting	Sets whether a down slave station is reflected in the slave down signal (Xn4).	Enabled	3.4.2 (13)
01D0H to 01D3H	464 to 467	Not used	—	—	—
01D4H to 03CFH	468 to 975	Parameter	Area to set parameters with a sequence program.	Enabled	3.4.2 (14)

3.4.2 Details of the buffer memory

This section describes details about the items listed in Table 3.4.

(1) Input Data

(Addresses: 0000_H to $007F_H$/0 to 127)

Data received from each slave station is saved. The order of the data differs according to whether the parameters were set by a sequence program or by the configuration software.

(a) Parameters set by a sequence program

If the parameters were set by a sequence program, the data is saved as a series of words of a slave station. In the case of double-word data, the data is saved as the lower word followed by the upper word. If an odd number of byte input modules is available, one byte of free area must be inserted in order to arrange the data as a series of words.

A bit input module and a byte input module are handled equally.

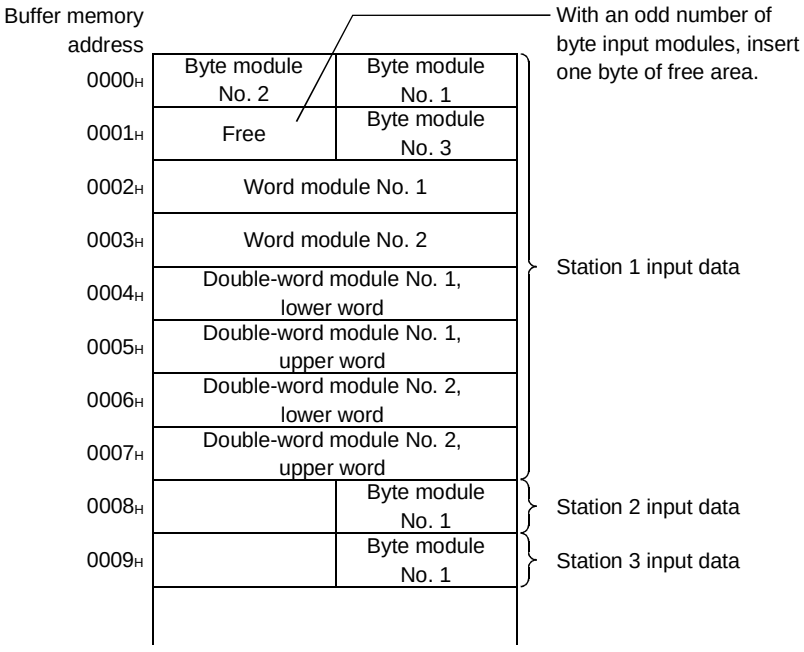
See the example below.

<Example>

Station 1 - Byte input modules = 3
Word input modules = 2
Double-word input modules = 2

Station 2 - Byte input modules = 1

Station 3 - Byte input modules = 1

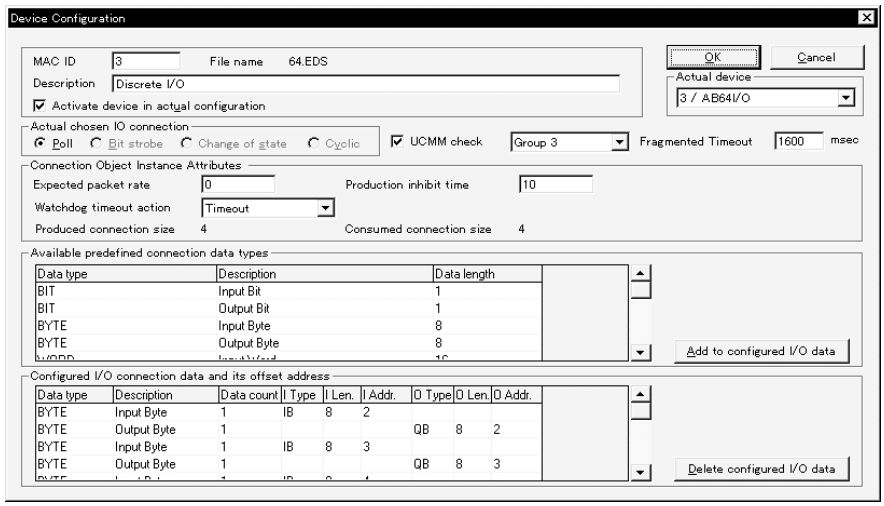


Word input module : numeric data represented by bits 9 to 16
Double-word input module: numeric data represented by bits 17 to- 32
Byte input module : numeric data represented by ON/OFF data or bits 1 to 8

(b) Parameters set by configuration software

The buffer memory address at which the input data for each station is stored is shown in the diagram below.

The address is displayed for the Customized I/O data, I. Addr item on the screen.



The memory address is determined by the value of the Customized I/O data, I. Addr item in the diagram above and the addressing mode set from the configuration software Master Setting screen.

See the example below.

<Example>

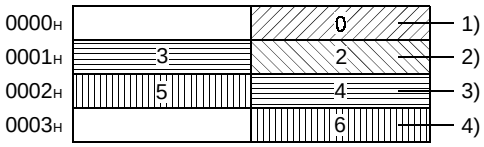
Consider the case where the Customized I/O data, I. Addr item is set as follows:

Data Type	I. Addr	
BYTE	0	…1)
BYTE	2	…2)
WORD	3	…3)
WORD	5	…4)

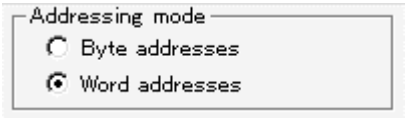
1) If the addressing mode is byte addressing

The setting screen appears as:

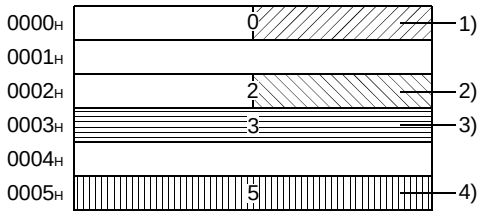
and the relationship between the buffer memory address and I. Addr is shown in the diagram below.



2) If the addressing mode is word addressing
The setting screen appears as:



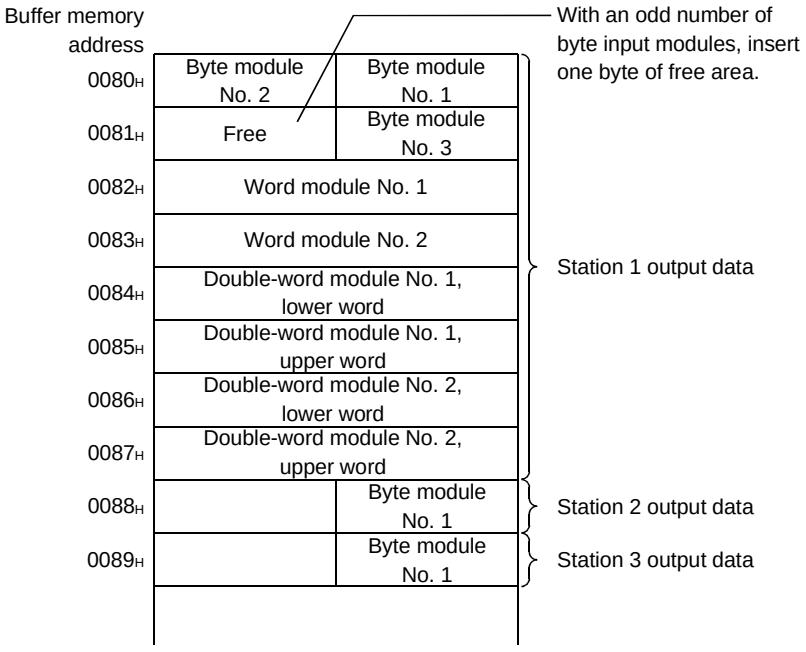
and the relationship between the buffer memory address and I. Addr is a 1:1 correspondence, as shown in the diagram below.



See the Configuration Software Manual for details about the configuration software.

(2) Output Data
(Addresses : 0080H to 00FFH/128 to 255)
Data sent to each slave station is written with the TO instruction. As in the case of the input data, the data order differs according to whether the parameters were set by a sequence program or by the configuration software.

(a) Parameters set by a sequence program
If the parameters were set by a sequence program, the data is saved as a series of words of a slave station. In the case of double-word data, the data is saved as the lower word followed by the upper word. If an odd number of byte input modules is available, one byte of free area must be inserted in order to arrange the data as a series of words.
See the example below.
<Example>
Station 1 - Byte output modules = 3
Word output modules = 2
Double-word output modules = 2
Station 2 - Byte output modules = 1
Station 3 - Byte output modules = 1



(b) Parameters set by configuration software

The buffer memory address at which the output data for each station is stored is displayed for the Customized I/O data, O. Addr item on the configuration software screen.

The memory address is determined by the value of the Customized I/O data, O. Addr item on the configuration software screen and the addressing mode set from the configuration software Master Setting screen.

See the example below.

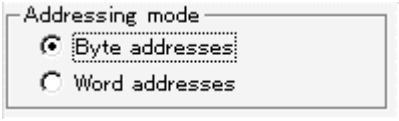
<Example>

Consider the case where the Customized I/O data, O. Addr item is set as follows:

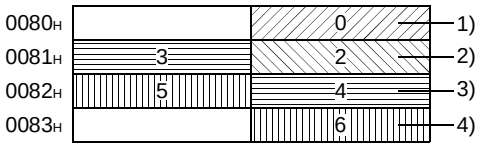
Data Type	O. Addr	
BYTE	0	...1)
BYTE	2	...2)
WORD	3	...3)
WORD	5	...4)

1) If the addressing mode is byte addressing

The setting screen appears as:

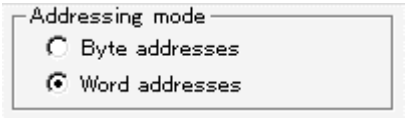


and the relationship between the buffer memory address and O. Addr is shown in the diagram below.

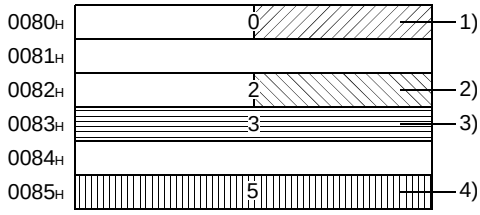


2) If the addressing mode is word addressing

The setting screen appears as:



and the relationship between the buffer memory address and O. Addr is a 1:1 correspondence, as shown in the diagram below.



(3) Message Communication Commands (Addresses - 0110H to 011FH/272 to 287)

TO command is used to write the message communication command.

(a) Reading Attribute Data from a Slave Station

1) Set the command data in the message communication command area using the TO instruction.
2) Turn ON message communication request (Y(n+1)2) with a sequence program.
3) Message communication complete (Xn2) automatically turns ON when the message communication completes.
4) Check the message communication error signal (Xn5) to see if the message communication has been normally completed.
5) The read attribute data is saved in the message communication data area.

Table 3.5 shows the data that should be set by a sequence program.

Table 3.5 Set Data for Get Attribute

Buffer Memory Address (Hexadecimal)	Item	Contents
0110H	Command number	0101H = Get Attribute
0111H	Slave station number (slave MAC ID), class ID	Lower byte: Slave station number to read attribute data (MAC ID) Upper byte: Object class ID to read attribute data
0112H	Instance ID	Object instance ID to read attribute data
0113H	Attribute ID	Lower byte: Object attribute ID to read attribute data Upper byte: Always set to 0

(b) Writing Attribute Data to a Slave Station

1) Set the command data in the message communication command area using the TO instruction.
2) Set the attribute data to be written in the message communication data area using the TO instruction.
3) Turn ON message communication request (Y(n+1)2) with a sequence program.
4) Message communication complete (Xn2) automatically turns ON when the message communication completes.
5) Check the message communication error signal (Xn5) to see if the message communication has been normally completed.

Table 3.6 shows the data that should be set by a sequence program.

Table 3.6 Set Data for Set Attribute

Buffer Memory Address (Hexadecimal)	Item	Contents
0110H	Command number	0102H = Set Attribute
0111H	Slave station number (slave MAC ID), class ID	Lower byte: Slave station number (MAC ID) Upper byte: Object class ID
0112H	Instance ID	Object instance ID
0113H	Attribute ID, data length	Lower byte: Object attribute ID Upper byte: Byte length of attribute data to be written 1 to 240 (1H to F0H)

(c) Reading error information from a slave station

1) Set the command data in the message communication command area using the TO instruction.
2) Turn ON message communication request (Y(n+1)2) with a sequence program.
3) Once reading action completes, the message communication complete (Xn2) automatically turns ON.
4) The read attribute data is saved in the message communication data area.

Table 3.7 shows the set data to read communication error information

Table 3.7 Set Data To Read Communication Error Information

Buffer Memory Address (Hexadecimal)	Item	Contents
0110H	Command number	0001H = Read Communication Error Information
0111H	Slave station number (slave MAC ID)	Lower byte: Slave station number to read error information (MAC ID) Upper byte: Always set to 0

(d) When resetting:

Table 3.8 Reset Setting Data

Buffer Memory Address (Hexadecimal)	Item	Contents
0110H	Command number	0120H = Reset
0111H	Slave station number (slave MAC ID), class ID	Lower byte: slave station number (MAC ID) Upper byte: object class ID
0112H	Instance ID	Object instance ID

(4) Message Communication Results (Addresses - 0120H to 012FH/288 to 303)

When the message communication commands are used, the process result is set in the DN91 message communication result area and message communication complete (Xn2) turns ON.

The process results can be read with a FROM instruction in a sequence program.

The process results are stored as shown in the table below.

See 8.3.2 Message Communication Execution Error Codes for details about the buffer memory address 0121H execution error code.

Table 3.9 Get Attribute Result Data

Buffer Memory Address (Hexadecimal)	Item	Contents
0120H	Command number	0101H = Get Attribute
0121H	Execution error code	Normal completion: 0000H Error : Execution error code
0122H	Slave station number (slave MAC ID), class ID	Lower byte: Slave station number (MAC ID) Upper byte: Object class ID
0123H	Instance ID	Object instance ID
0124H	Attribute ID, data length	Lower byte: Object attribute ID Upper byte: Number of bytes 1 to 240 (1H to F0H) of read attribute data

Table 3.10 Set Attribute Result Data

Buffer Memory Address (Hexadecimal)	Item	Contents
0120H	Command number	0102H = Set Attribute
0121H	Execution error code	Normal completion: 0000H Error : Execution error code
0112H	Slave station number (slave MAC ID), class ID	Lower byte: Slave station number (MAC ID) Upper byte: Object class ID
0123H	Instance ID	Instance ID
0124H	Attribute ID	Lower byte: Object attribute ID to write attribute data Upper byte: Number of bytes of attribute data (1 to 240)

Table 3.11 Result Data for Reading Communication Error Information

Buffer Memory Address (Hexadecimal)	Item	Contents
0120H	Command number	0001H = Read Communication Error Information
0121H	Execution error code	Normal completion: 0000H Error : Execution error code

Table 3.12 Reset Setting Data

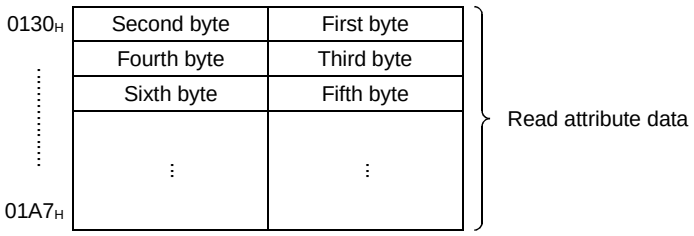
Buffer Memory Address (Hexadecimal)	Item	Contents
0120H	Command number	0120H = Reset
0121H	Execution error code	Normal completion: 0000H Error : Execution error code
0122H	Slave station number (slave MAC ID), class ID	Lower byte: slave station number (MAC ID) Upper byte: object class ID
0123H	Instance ID	Object instance ID

(5) Message Communication Data (Addresses - 0130H to 01A7H/304 to 423)

The message communication data area is used for the following applications.

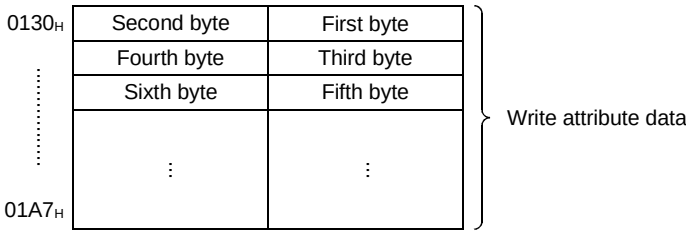
(a) Get Attribute Data

The attribute data read through the message communication is stored as a byte string.



(b) Set Attribute Data

Attribute data to be written via message communication is written as a byte string.



(c) Read Communication Error Information

Stores read communication error information.

The data set at each address is shown in Table 3.13.

Table 3.13 Set Data for Read Communication Error Information

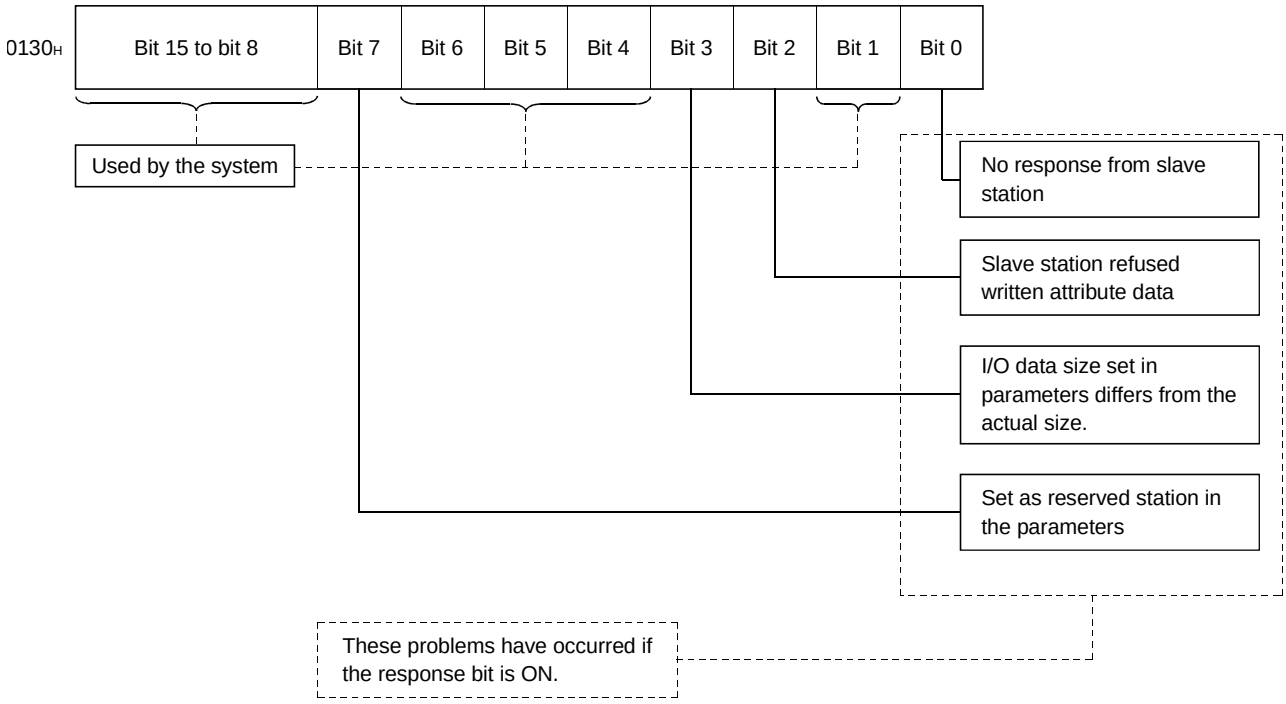
Buffer Memory Address (Hexadecimal)	Item	Contents
0130H	Slave status	Indicates whether the slave station has parameters set and whether it responded. (See 1).)
0131H	Unusable	———
0132H	Communication error codes	Stores the same error code as the upper byte of buffer memory address 01B1H. See 8.3.1 Communication Error Codes for details about the error codes.
0133H	General error codes	Stores the DeviceNet general error code that has been sent from a slave station. Valid only when the communication error code is 35 (0023H). (Refer to 2).) ＊1
0134H	Additional error codes	Stores the additional error codes sent by the slave stations. ＊2
0135H	Number of heartbeat timeouts	Stores the number of times the DN91 detected a slave station down.

＊1: See the slave station manual for details about the actual problems and remedies.

＊2: See the slave station manual for a description of each error code.

1) Slave status

The problem at a slave station is notified by turning bits ON and OFF, as shown in the diagram below.



2) Table 3.14 shows the DeviceNet general error codes

Table 3.14 Table of DeviceNet General Error Codes

Error Code		Error Name	Description
Hexadecimal	Decimal		
0000_H to 0001_H	0 to 1	Reserved	Reserved by DeviceNet.
0002_H	2	Resource unavailable	The requested service could not be run as the required resource was not free.
0003_H to 0007_H	3 to 7	Reserved	Reserved by DeviceNet.
0008_H	8	Service not supported	The requested service is not supported. Or, the requested service is undefined in the designated object class or instance.
0009_H	9	Invalid attribute value	Abnormal attribute data in the requested service.
$000A_H$	10	Reserved	Reserved by DeviceNet.
$000B_H$	11	Already in requested mode/state	The designated object is already transferred to the requested mode or status.
$000C_H$	12	Object state conflict	The designated object was not in a status to execute the requested service.
$000D_H$	13	Reserved	Reserved by DeviceNet.
$000E_H$	14	Attribute not settable	An unchangeable attribute was designated for the requested setting service.
$000F_H$	15	Privilege violation	The service request destination has no access rights.
0010_H	16	Device state conflict	The designated device was not in a status to execute the requested service.
0011_H	17	Reply data too large	The response data length exceeded the processable data length.
0012_H	18	Reserved	Reserved by DeviceNet.
0013_H	19	Not enough data	The requested service did not supply sufficient data for processing.
0014_H	20	Attribute not supported	The requested service designated an undefined attribute.
0015_H	21	Too much data	The requested service included invalid data.
0016_H	22	Object does not exist	The requested service designated an unmounted object.
0017_H	23	Reserved	Reserved by DeviceNet.
0018_H	24	No stored attribute data	The object attribute data was not saved before the service was requested.
0019_H	25	Store operation failure	The object attribute data was not saved due a problem during the save processing.
$001A_H$ to $001E_H$	26 to 30	Reserved	Reserved by DeviceNet.
$001F_H$	31	Vendor specific error	An error specific to a vendor occurred. The "Additional error code" area (0134_H) of the error response shows the specific error. The error code is used only when any of the error codes shown in this table or within the object class definition does not correspond to the relevant error.
0020_H	32	Invalid parameter	A parameter problem occurred with the requested service. This code is used if the parameter does not meet the requirements in this specification of DeviceNet or the important conditions defined in the application object specifications.
0021_H to 0027_H	33 to 39	Future extensions	Reserved by DeviceNet.
0028_H	40	Invalid Member ID	The member ID of the requested service designated an unmounted class, instance, or attribute.
0029_H	41	Member not settable	An unchangeable member was designated for the requested setting service.
$002A_H$ to $00CF_H$	42 to 207	Reserved	Reserved by DeviceNet.
$00D0_H$ to $00FF_H$	208 to 255	Reserved for Object Class and service errors	Error codes in this range are used to represent errors unique to object classes. The codes of the range are used only when any of the error codes shown in this table do not correctly explain the error that has occurred. "DeviceNet general error code" area (0133_H) may be explained in further detail using the "Additional error code" area (0134_H).

(6) Master Communication Status (Address 01B0H/432)

The master communication status is shown by the upper and lower bytes, as shown below.

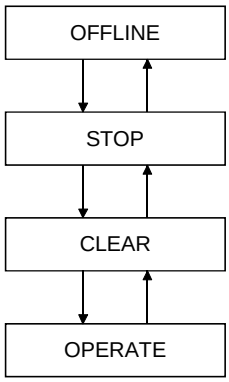
(a) Upper Byte

This byte shows the DN91 I/O communication status. It contains a value indicating the communication status, as shown in Table 3.15.

Table 3.15 I/O Communication Statuses

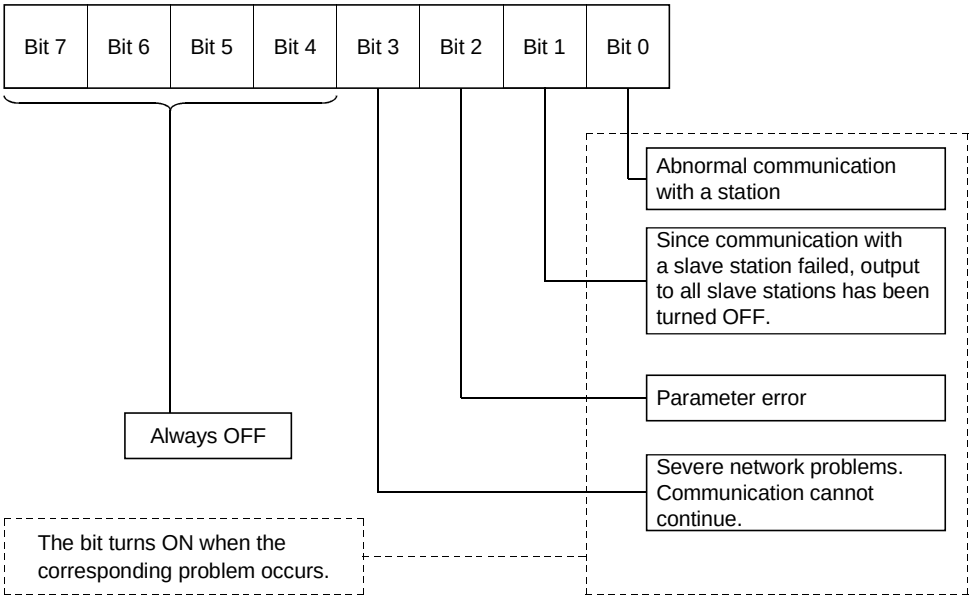
Value	Name	Operation
0000H	OFFLINE	Initializing
0040H	STOP	I/O communication stopped
0080H	CLEAR	Resetting output data for all slave stations after 0 data was sent.
00C0H	OPERATE	Conducting I/O communication

When powering ON, after normal completion of self-diagnosis and parameter check, the state automatically advances from "OFFLINE" to "OPERATE".
When Refreshing (Xn1) is ON, "0" data is sent to reset the output data of slave stations.
While setting parameters, the state advances from "OPERATE", "CLEAR", "STOP", and to "OFFLINE".



(b) Lower Byte

Indicates the communication status of the network. The bits turn ON/OFF according to the communication status, as shown in the diagram below.



(7) Error Information (Address 01B1H/433)

Stores the detected communication error code.

(a) The error information is stored in the error information area when an error occurs. The error set signal (Xn3) turns ON.

(b) The data in the "Error information" area is cleared by turning ON the error reset request (Y(n+1)3) through the sequence program.

(c) The error information is stored as the error code in the upper byte and the station number in the lower byte, as described below.

1) Upper Byte

This byte stores the error codes.

See 8.3.1 Communication Error Codes for details.

2) Lower Byte

This byte stores the station number (MAC ID) of the station where the error occurred.

FEH, FFH (254, 255): Host station (DN91)

0H to 3FH (0 to 63) : Station number (MAC ID) of the slave station where the error occurred

REMARK

If an error occurs in multiple stations, the error for the station with the lowest station number (MAC ID) is stored.

(8) Bus Error Counter (Address 01B2H/434)

Stores the number of times the invalid frame count of CAN chip (DeviceNet communication chip) exceeded 96. Any increase in the value indicates the instability of communication.

(9) Bus-off Counter (Address 01B3H/435)

Stores the number of times DN91moved into the state of Bus-off. Any increase in the value indicates the instability of communication.

(10) Station Configuration Status (Address 01B4H to 01B7H/436 to 439)

Stores the parameter setting status for each slave station.

• If a bit is ON, the parameters are set.

• If a bit is OFF, the parameters are not set.

The buffer memory addresses and the station number corresponding to each bit are shown in Table 3.16.

Table 3.16 Station Number Corresponding to Each Bit in the Station Configuration Status

Buffer Memory Address	Station Number Corresponding to Each Bit				
(Hexadecimal)	Bit 15	Bit 14	…	Bit 1	Bit 0
01B4H	Station 15	Station 14	…	Station 1	Station 0
01B5H	Station 31	Station 30	…	Station 17	Station 16
01B6H	Station 47	Station 46	…	Station 33	Station 32
01B7H	Station 63	Station 62	…	Station 49	Station 48

(11) Station Communication Status (Address 01BC$_H$ to 01BF$_H$/444 to 447)

Stores whether or not I/O communication is normal for each slave station.

• If a bit is ON, I/O communication

• If a bit is OFF, I/O communication interrupted

The buffer memory addresses and the station number corresponding to each bit are shown in Table 3.17.

Table 3.17 Station Number Corresponding to Each Bit in the Station Communication Status

Buffer Memory Address	Station Number Corresponding to Each Bit				
(Hexadecimal)	Bit 15	Bit 14	…	Bit 1	Bit 0
01BC$_H$	Station 15	Station 14	…	Station 1	Station 0
01BD$_H$	Station 31	Station 30	…	Station 17	Station 16
01BE$_H$	Station 47	Station 46	…	Station 33	Station 32
01BF$_H$	Station 63	Station 62	…	Station 49	Station 48

(12) Station Problem Status (Address 01C4$_H$ to 01C7$_H$/452 to 455)

Stores whether or not a communication error has occurred for each slave station.

• If a bit is ON, problem information exists

• If a bit is OFF, no problem information exists

Follow the procedure below to turn OFF a bit.

(a) Read the communication error information for the station, using the buffer memory message communication area. (For information on reading communication error information, see 3.4.2 (3) Message Communication Commands, (4) Message Communication Results, and (5) Message Communication Data.)

(b) When Read Communication Error Information is executed, the corresponding bit automatically turns OFF.

The buffer memory addresses and the station number corresponding to each bit are shown in Table 3.18.

Table 3.18 Station Number Corresponding to Each Bit in the Station Problem Status

Buffer Memory Address	Station Number Corresponding to Each Bit				
(Hexadecimal)	Bit 15	Bit 14	…	Bit 1	Bit 0
01C4$_H$	Station 15	Station 14	…	Station 1	Station 0
01C5$_H$	Station 31	Station 30	…	Station 17	Station 16
01C6$_H$	Station 47	Station 46	…	Station 33	Station 32
01C7$_H$	Station 63	Station 62	…	Station 49	Station 48

(13) Down-station Detection Disabled Setting (Address 01CC$_H$ to 01CF$_H$/460 to 463)

This setting determines whether the down status of a slave station shown in the Station Communication Status (Address 01BC$_H$ to 01BF$_H$/444 to 447) is reflected in the slave down signals (Xn4).

- If a bit is ON, the corresponding slave down signal (Xn4) does not turn ON when a slave station is down.
- If a bit is OFF, the corresponding slave down signal (Xn4) does turn ON when a slave station is down.

The buffer memory addresses and the station number corresponding to each bit are shown in Table 3.19.

Table 3.19 Station Number Corresponding to Each Bit for the Down-station Detection Disabled Settings

Buffer Memory Address	Station Number Corresponding to Each Bit				
(Hexadecimal)	Bit 15	Bit 14	…	Bit 1	Bit 0
01CC$_H$	Station 15	Station 14	…	Station 1	Station 0
01CD$_H$	Station 31	Station 30	…	Station 17	Station 16
01CE$_H$	Station 47	Station 46	…	Station 33	Station 32
01CF$_H$	Station 63	Station 62	…	Station 49	Station 48

POINT

Turn ON the relevant bit for prohibition of faulty station detection with stations designated as reserved in parameter settings. If the bit is left OFF, any reserved station will be recognized faulty.

(14) Parameters (Address 01D4H to 03CFH/468 to 975)

Used to set parameters via the sequence program.
The parameters set by a sequence program are written to E^2PROM.

Once parameters have been set, they do not require setting again until changes are made to the parameters. After DN91 is turned ON, if the E^2PROM contains valid parameters, the parameters from E^2PROM are stored in the parameter area

Follow the procedure below to write new parameters.

(a) Set parameters in the parameter area, as shown in Table 3.20.

(b) Turn ON the parameter set request (Y(n+1)7) with a sequence program.

(c) The set parameters are written.

Table 3.20 Parameter Set Data

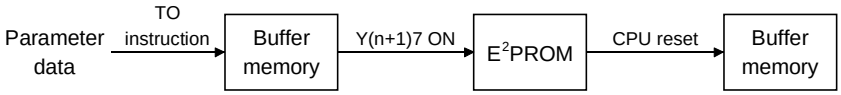
Buffer Memory Address (16 hex)	Item	Contents
01D4H	Host station (MAC ID)	Stores the station number (MAC ID) of DN91 in a range from 0000H to 0003H. Setting parameters with this value set at FFFFH invalidates the parameters that have been set by the sequence program.
01D5H	Baud rate	Select the baud rate: 1 = 500 kbaud, 2 = 250 kbaud, 3 = 125 kbaud
01D6H, 01D7H	Not used	—
01D8H	Station number and message group of the first slave station	Lower byte: Station number (MAC ID) of first slave station 0 to 63 Upper byte: 01H → Station that supports UCMM and uses the message group 3. 02H → Station that supports UCMM and uses the message group 2. 03H → Station that supports UCMM and uses the message group 1. 04H → Station that does not support UCMM. (Dedicated server of group 2) 80H → Reserved station
01D9H	Connection type for the first slave station	Select the connection type for I/O communication: 0001H = polling, 0002H = bit strobe, 0004H = change of state, 0008H = cyclic
01DAH	Number of byte modules for the first slave station	Lower byte: Number of input byte modules Upper byte: Number of output byte modules (8 points of bit modules are calculated as one byte module.) Set in hexadecimal. Example: Set 0A0AH when there are 10 bytes of input byte modules and 10 bytes of output byte modules.
01DBH	Number of word modules for the first slave station	Lower byte: Number of input word modules Upper byte: Number of output word modules Set in hexadecimal.
01DCH	Number of double-word modules for the first slave station	Lower byte: Number of input double-word modules Upper byte: Number of output double-word modules Set in hexadecimal.
01DDH	Expected packet rate for the first slave station (EXPECTED PACKET RATE)	Sets the expected packet rate at the slave station. Setting = 0000H (default) → 500 ms Setting ≠ 0000H → The value (setting - 1) is the communication watchdog timer setting (ms). The setting will vary depending on the connection type. Refer to Table 3.21 for further details of the setting.

Buffer Memory Address (16 hex)	Item	Contents
01DE$_H$	Watchdog timeout action for the first slave station (WATCHDOG TIMEOUT ACTION)	Slave station watchdog timeout action Set value = 0000$_H$ (default value) Equal to TIMEOUT below. Set value = 0001$_H$: TIMEOUT Connection enters timeout status. Can only be reset by the operator stopping and restarting communication. Set value = 0002$_H$: AUTO DELETE Connection is automatically deleted. Communication stops and automatically restarts. Outputs are cleared to 0. Set value = 0003$_H$: AUTO RESET Communication is continued with the connection maintained. Outputs are not cleared to 0.
01DF$_H$	First Slave Station Production Inhibit Time	Sets the production inhibit time. Setting = 0000$_H$ (default) →10 ms Setting ≠ 0000$_H$ → The value (setting - 1) is the minimum transmission interval (ms). The setting will vary depending on the connection type. Refer to Table 3.21 for further details of the setting.
01E0$_H$ to 01E7$_H$	Setting for the second slave station	Same as with the first slave station
01E8$_H$ to 01EF$_H$	Setting for the third slave station	Same as with the first slave station
01F0$_H$ to 01F7$_H$	Setting for the 4th slave station	Same as with the first slave station
01F8$_H$ to 01FF$_H$	Setting for the 5th slave station	Same as with the first slave station
0200$_H$ to 0207$_H$	Setting for the 6th slave station	Same as with the first slave station
0208$_H$ to 020F$_H$	Setting for the 7th slave station	Same as with the first slave station
0210$_H$ to 0217$_H$	Setting for the 8th slave station	Same as with the first slave station
0218$_H$ to 021F$_H$	Setting for the 9th slave station	Same as with the first slave station
0220$_H$ to 0227$_H$	Setting for the 10th slave station	Same as with the first slave station
0228$_H$ to 022F$_H$	Setting for the 11th slave station	Same as with the first slave station
0230$_H$ to 0237$_H$	Setting for the 12th slave station	Same as with the first slave station
0238$_H$ to 023F$_H$	Setting for the 13th slave station	Same as with the first slave station
0240$_H$ to 0247$_H$	Setting for the 14th slave station	Same as with the first slave station
0248$_H$ to 024F$_H$	Setting for the 15th slave station	Same as with the first slave station
0250$_H$ to 0257$_H$	Setting for the 16th slave station	Same as with the first slave station
0258$_H$ to 025F$_H$	Setting for the 17th slave station	Same as with the first slave station
0260$_H$ to 0267$_H$	Setting for the 18th slave station	Same as with the first slave station
0268$_H$ to 026F$_H$	Setting for the 19th slave station	Same as with the first slave station
0270$_H$ to 0277$_H$	Setting for the 20th slave station	Same as with the first slave station
0278$_H$ to 027F$_H$	Setting for the 21st slave station	Same as with the first slave station
0280$_H$ to 0287$_H$	Setting for the 22nd slave station	Same as with the first slave station
0288$_H$ to 028F$_H$	Setting for the 23rd slave station	Same as with the first slave station
0290$_H$ to 0297$_H$	Setting for the 24th slave station	Same as with the first slave station
0298$_H$ to 029F$_H$	Setting for the 25th slave station	Same as with the first slave station
02A0$_H$ to 02A7$_H$	Setting for the 26th slave station	Same as with the first slave station
02A8$_H$ to 02AF$_H$	Setting for the 27th slave station	Same as with the first slave station
02B0$_H$ to 02B7$_H$	Setting for the 28th slave station	Same as with the first slave station
02B8$_H$ to 02BF$_H$	Setting for the 29th slave station	Same as with the first slave station
02C0$_H$ to 02C7$_H$	Setting for the 30th slave station	Same as with the first slave station
02C8$_H$ to 02CF$_H$	Setting for the 31st slave station	Same as with the first slave station
02D0$_H$ to 02D7$_H$	Setting for the 32nd slave station	Same as with the first slave station

Buffer Memory Address (16 hex)	Item	Contents
02D8H to 02DFH	Setting for the 33rd slave station	Same as with the first slave station
02E0H to 02E7H	Setting for the 34th slave station	Same as with the first slave station
02E8H to 02EFH	Setting for the 35th slave station	Same as with the first slave station
02F0H to 02F7H	Setting for the 36th slave station	Same as with the first slave station
02F8H to 02FFH	Setting for the 37th slave station	Same as with the first slave station
0300H to 0307H	Setting for the 38th slave station	Same as with the first slave station
0308H to 030FH	Setting for the 39th slave station	Same as with the first slave station
0310H to 0317H	Setting for the 40th slave station	Same as with the first slave station
0318H to 031FH	Setting for the 41st slave station	Same as with the first slave station
0320H to 0327H	Setting for the 42nd slave station	Same as with the first slave station
0328H to 032FH	Setting for the 43rd slave station	Same as with the first slave station
0330H to 0337H	Setting for the 44th slave station	Same as with the first slave station
0338H to 033FH	Setting for the 45th slave station	Same as with the first slave station
0340H to 0347H	Setting for the 46th slave station	Same as with the first slave station
0348H to 034FH	Setting for the 47th slave station	Same as with the first slave station
0350H to 0357H	Setting for the 48th slave station	Same as with the first slave station
0358H to 035FH	Setting for the 49th slave station	Same as with the first slave station
0360H to 0367H	Setting for the 50th slave station	Same as with the first slave station
0368H to 036FH	Setting for the 51st slave station	Same as with the first slave station
0370H to 0377H	Setting for the 52nd slave station	Same as with the first slave station
0378H to 037FH	Setting for the 53rd slave station	Same as with the first slave station
0380H to 0387H	Setting for the 54th slave station	Same as with the first slave station
0388H to 038FH	Setting for the 55th slave station	Same as with the first slave station
0390H to 0397H	Setting for the 56th slave station	Same as with the first slave station
0398H to 039FH	Setting for the 57th slave station	Same as with the first slave station
03A0H to 03A7H	Setting for the 58th slave station	Same as with the first slave station
03A8H to 03AFH	Setting for the 59th slave station	Same as with the first slave station
03B0H to 03B7H	Setting for the 60th slave station	Same as with the first slave station
03B8H to 03BFH	Setting for the 61st slave station	Same as with the first slave station
03C0H to 03C7H	Setting for the 62nd slave station	Same as with the first slave station
03C8H to 03CFH	Setting for the 63rd slave station	Same as with the first slave station

POINTS

(1) Parameter data flows as shown below.



Since E^2PROM has a restriction on the number of write times, execute the parameter set request (Y(n+1)7) only when parameters are created newly or changed.

(2) When creating parameters, write "0" to the unnecessary parameter area. The previous data remaining there may cause an error.

Table 3.21 Details of Expected Packet Rate and Production Inhibit Time

	Expected Packet Rate	Production Inhibit Time
Polling	(1) Set the communication watchdog timer value for a slave station. Any interruption of communication between the master and slave stations for the time setting, the slave station executes the action designated by the Watchdog Timeout Action.	(1) Set the minimum transmission interval, or the minimum time a slave can get the transmission data ready. The master station sends the polling request at this interval.
	(2) When the expected packet rate setting ≠ 1, or the expected packet rate ≠ 0 ms, it must be the Expected packet rate ≥ the Production inhibit time.	
	(3) When the setting value = 1, or when the Expected packet rate = 0 ms, the Watchdog timer monitoring is disabled.	
Bit strobe	(1) Set the communication watchdog timer value for a slave station. Any interruption of communication between the master and slave stations for the time setting, the slave station executes the action designated by the Watchdog Timeout Action.	(1) Set the minimum transmission interval, or the minimum time a slave can get the transmission data ready. The master station sends the polling request at this interval.
	(2) When the expected packet rate setting ≠ 1, or the expected packet rate ≠ 0 ms, it must be the Expected packet rate ≥ the Production inhibit time.	
	(3) When the setting value = 1, or when the Expected packet rate = 0 ms, the Watchdog timer monitoring is disabled.	(3) This value must be the same for all bit strobe connections.
Change of state	(1) Always set the value = 1 or, in other word, set the expected packet rate = 0 ms.	(1) Always set the value = 1, or set the production inhibit time = 0 ms.
Cyclic	(1) Designate the data transmission interval from a slave station to the master station.	(1) Designate the data transmission interval from the master station to slave stations.
	(2) When the expected packet rate setting ≠ 1, or the expected packet rate ≠ 0 ms, it must be the Expected packet rate ≥ the Production inhibit time.	
	(3) The setting value = 1 or the Expected packet rate = 0 ms is prohibited.	(3) The setting value = 1 or the Production inhibit time = 0 ms is prohibited.

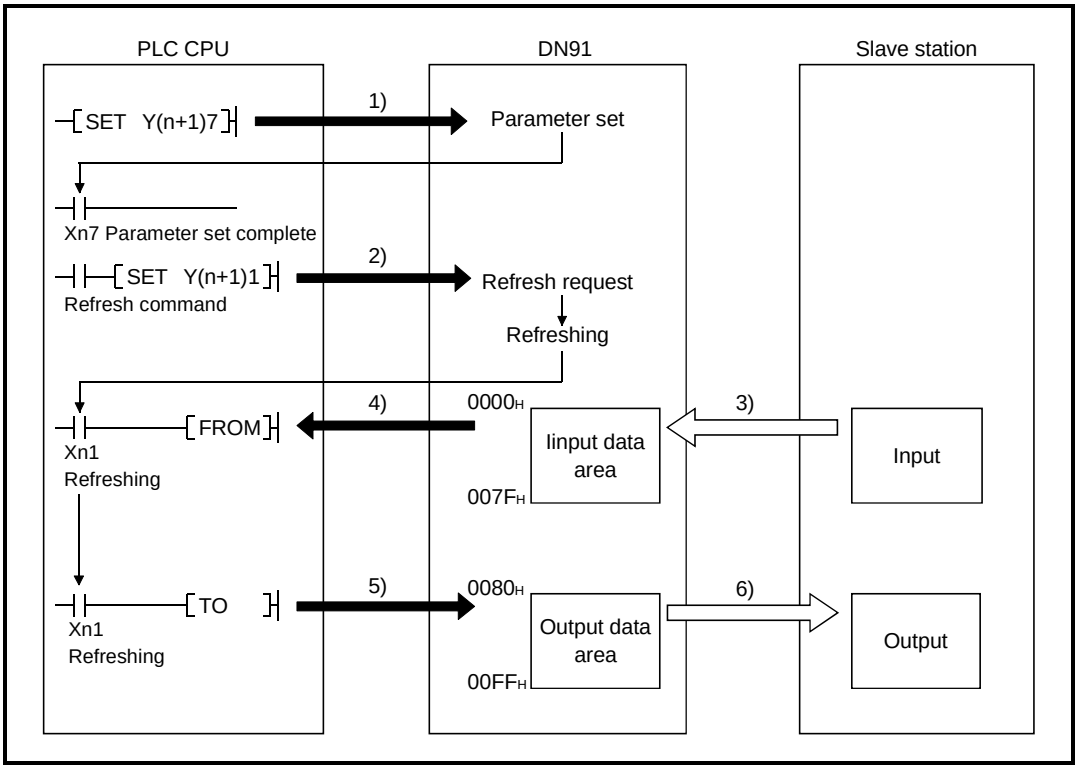
MEMO

4. FUNCTIONS

This section describes the functions.
The DN91 offers the following two types of functions. Proper parameter setting is required in advance.
• I/O communication functions (see Section 4.1)
• message communication functions (see Section 4.2)

4.1 I/O Communication Functions

The I/O communication functions conduct I/O data communication with the slave stations.
The I/O communication functions allow the communication type to be set to match the slave station specification. Four connection types are available: polling, bit strobe, change of state, and cyclic. The connection type can be set using parameters.



[Parameter Set]
1) Write parameters onto the "Parameter" area of the buffer memory, and turn ON the parameter setting request (Y(n+1)1) via the sequence program to set the parameters.
When the parameters are successfully written, the Parameter Setting Complete (Xn7) automatically turns ON.
Once the parameters are set, no subsequent parameter setting is required as long as no change in the parameters is necessary.
When setting the parameters via the configuration software, do not use the sequence program to set the parameters.

[Refresh]

2) Communication with the slave stations starts when the refresh request signal (Y(n+1)1) turns ON.

[Input Data]

3) The input status of each slave station is automatically stored in the input data area of the DN91 buffer memory.

4) The input statuses stored in the input data area of the buffer memory are read to the PLC CPU using sequence program FROM instruction.

[Output Data]

5) The ON/OFF information output to the slave stations is written to the output data area of the buffer memory using the sequence program TO instruction.

6) The ON/OFF information stored in the output data area of the buffer memory is automatically output to the slave stations.

4.1.1 Overview of each connection type

This section provides the overview of the connection types for I/O communications.

(1) Polling

As shown below, polling communication is a communication system where the following communications 1) to 6) with slave stations are repeated, and a connection to make this communication is a polling connection.

1) The master station sends output data.

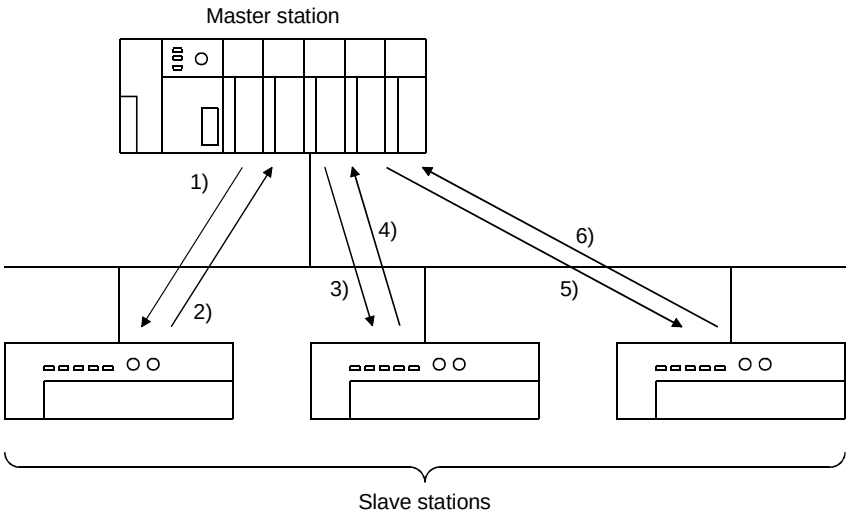
2) 1) triggers the slave station to send input data.

3) The master station sends output data.

4) 3) triggers the slave station to send input data.

5) The master station sends output data.

6) 5) triggers the slave station to send input data.



(2) Bit strobe

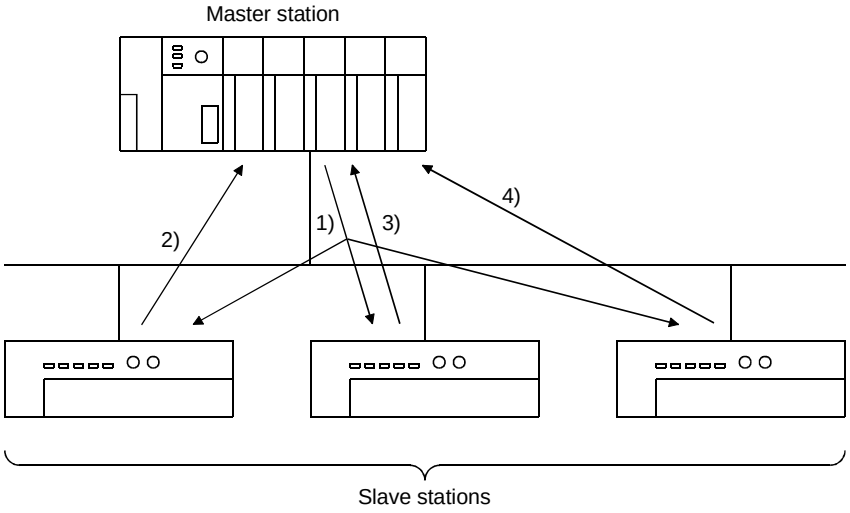
As shown below, bit strobe communication is a communication system where the following communications 1) to 4) with slave stations are repeated, and a connection to make this communication is a bit strobe connection.

1) The master station sends a maximum of 1 bit output information to each slave station simultaneously.

2) Transmission in 1) triggers the slave station to send input data.

3) Transmission in 1) triggers the slave station to send input data.

4) Transmission in 1) triggers the slave station to send input data.



(3) Change of state

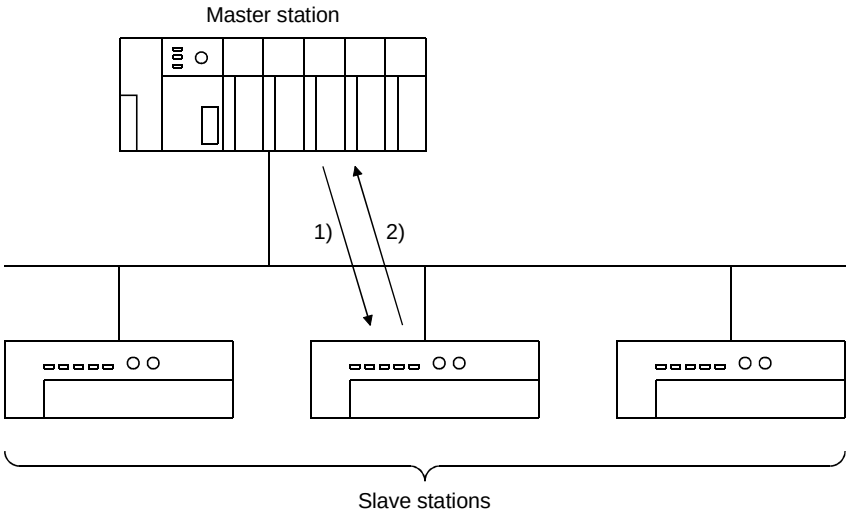
As shown below, change-of-state communication is a communication system where the following communications 1) and 2) with slave stations are made with changes in I/O data, and a connection to make this communication is a change-of-state connection.

Data is not sent if there is no change in I/O data.

1) If the output data of the master station changes, the master station sends that data to the slave station.

2) If the input data of the slave station changes, the slave station sends that data to the master station.

Change-of-state communication does not have the concept of network scans. To specify change-of-state communication, the production disable time and expected packet rate must be set to 0ms.



(4) Cyclic

As shown below, cyclic communication is a communication system where the following communications 1) and 2) with slave stations are repeated periodically, and a connection to make this communication is a cyclic connection.

1) The master station sends its data to the slave station.

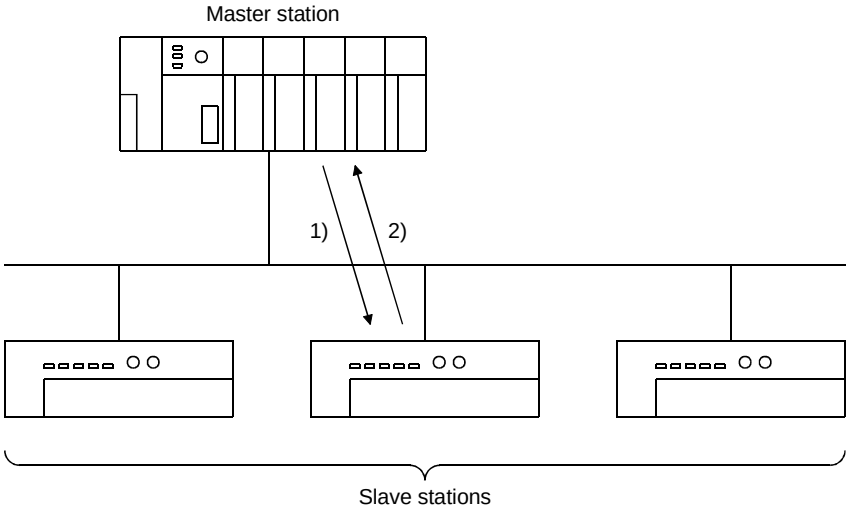
2) The slave station sends its data to the master station.

The cycle of cyclic communication can be specified for each slave station.
Specify the cycle of cyclic communication in the following parameter items.

Cycle of transmission from master station: Production disable time

Cycle of transmission from slave station : Expected packet rate

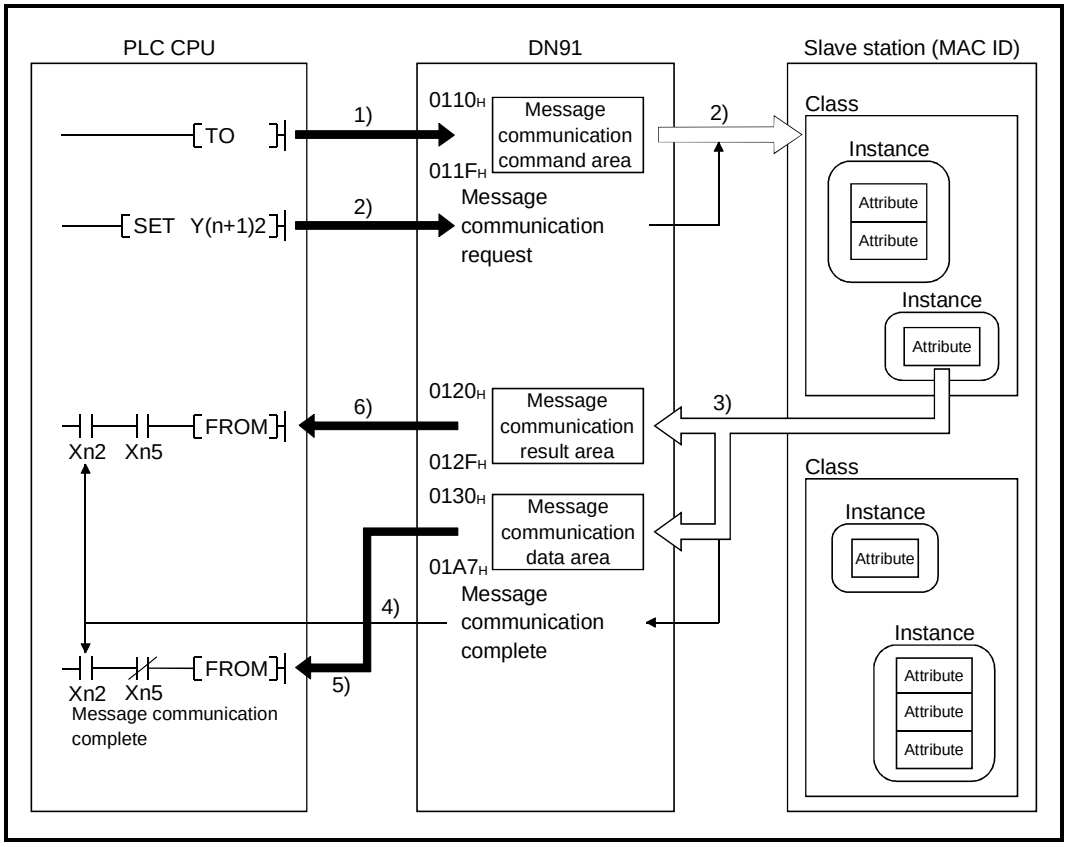
Cyclic communication does not have the concept of network scans.



4.2 Message Communication Functions

The message communication functions read/write attribute data from/to the specified slave station, read communication error information from that slave station, and reset its class/instance.

4.2.1 Get attribute



1) Set "Get Attribute" in the buffer memory message communication command area using the sequence program TO instruction.

2) Turn ON message communication request (Y(n+1)2) with a sequence program to send the data set in the buffer memory message communication command area to the slave stations and start message communication.

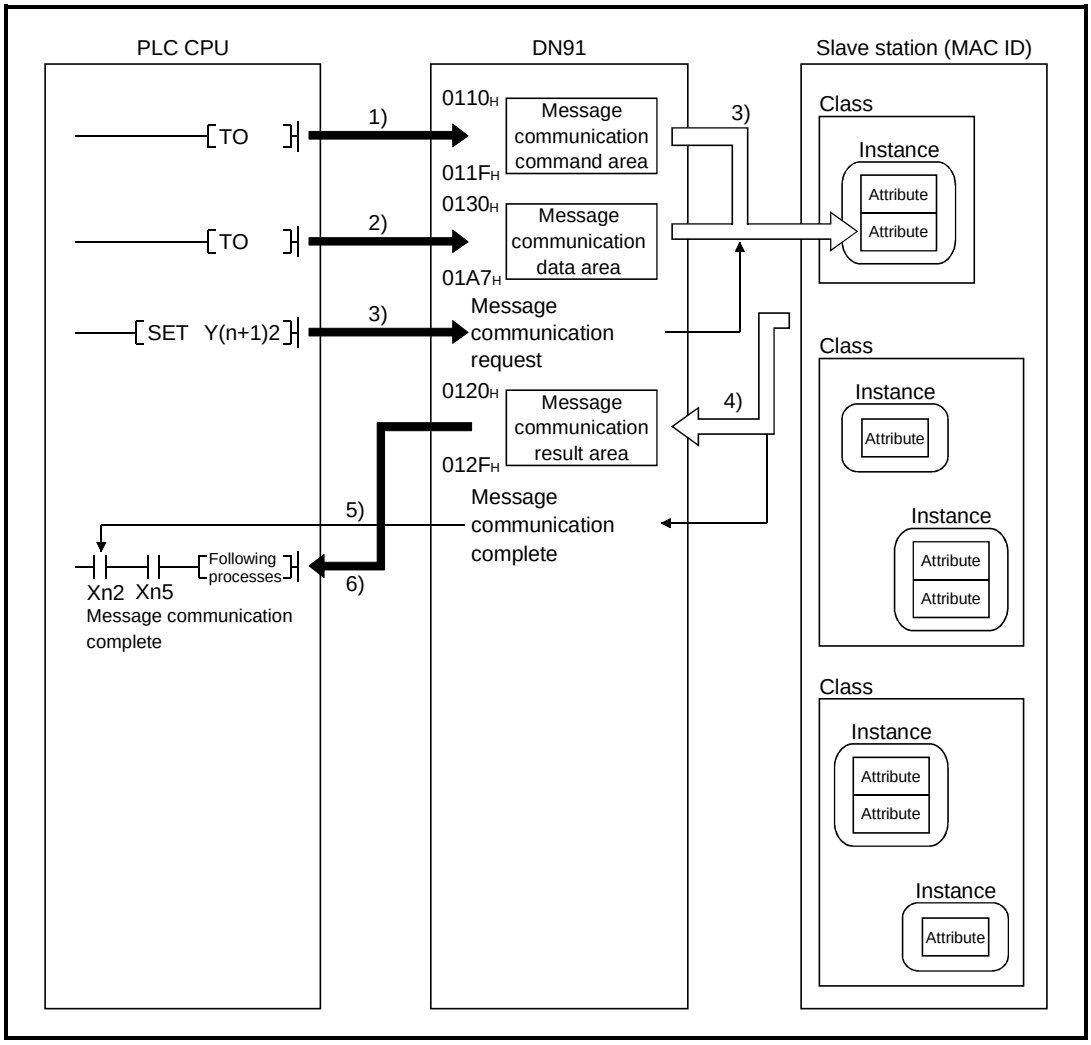
3) DN91 receives data from the slave stations and processes it as follows:
   - The slave station special data set in the message communication command area is stored in the message communication data area of the buffer memory.
   - The result of processing the message communication is stored in the message communication results area of buffer memory.

4) When the process result is stored in the message communication results area of buffer memory, message communication ends and the message communication complete (Xn2) signal automatically turns ON.

5) When the slave station data ends normally in the buffer memory message communication area, it is read to the PC CPU using the sequence program FROM instruction.

6) When the Message communication error signal (Xn5) turns ON, the contents of the "Message communication result" area are read by the FROM instruction to identify the error cause.

4.2.2 Set attribute



1) Set "Set Attribute" in the buffer memory message communication command area using the sequence program TO instruction.

2) Set the data to be written in the buffer memory message communication data area using the sequence program TO instruction.

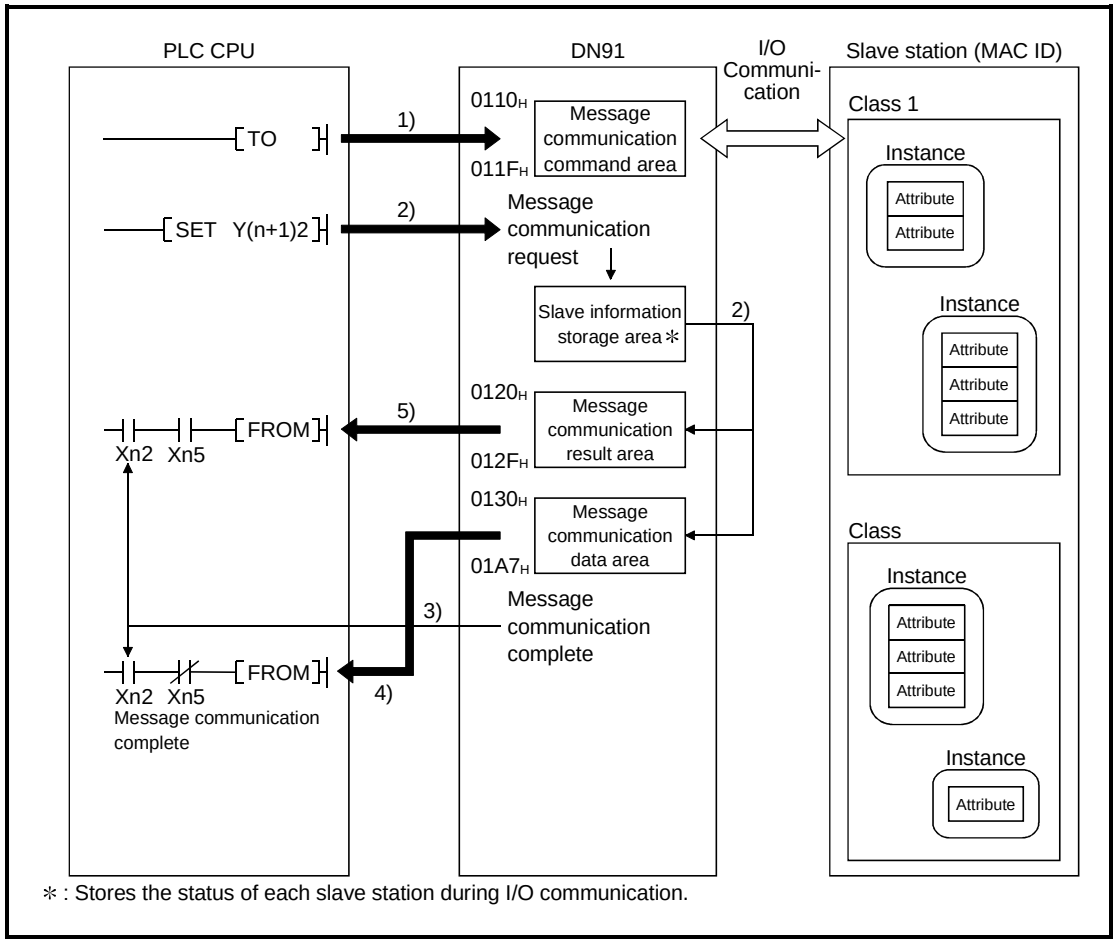
3) Turn ON message communication request (Y(n+1)2) to write the data stored in the buffer memory message communication data area to the special area of the slave station set by the message communication command area.

4) When the write operation is complete, the message communication result is stored in the message communication results area of buffer memory.

5) When the process result is stored in the message communication results area of buffer memory, message communication ends and the message communication complete (Xn2) signal automatically turns ON.

6) When the Message communication error signal (Xn5) turns ON, the contents of the "Message communication result" area are read by the FROM instruction to identify the error cause.

4.2.3 Read communication error information



1) "Read Communication Error Information" is set in the buffer memory "Message communication command" area by the TO instruction in the sequence program.

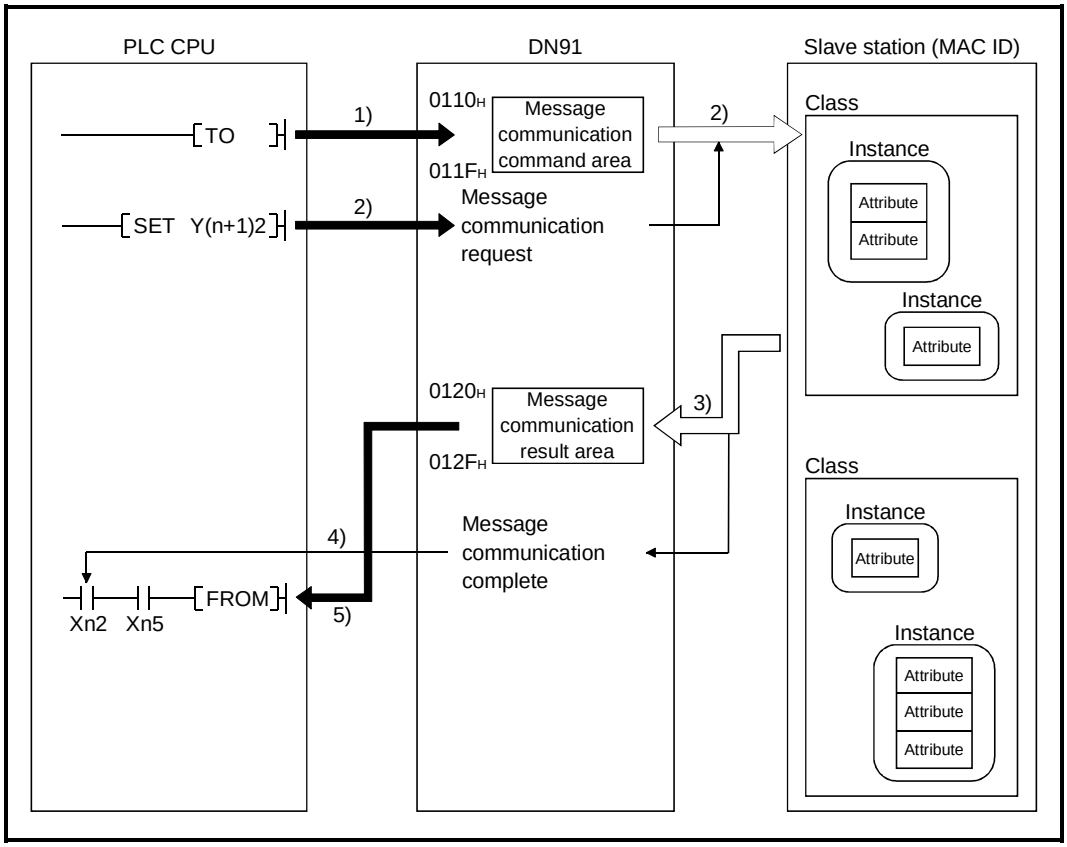
2) When Message communication request (Y(n+1)2) is turned ON in the sequence program, the error information of the relevant slave station accumulated in the DN91 is read and processed as described below.
   - The error information of the slave station set in the "Message communication command" area is stored into the buffer memory "Message communication data" area.
   - The message communication processing result is stored into the buffer memory "Message communication result" area.

3) When the processing result is stored into the buffer memory "Message communication result" area, Message communication complete (Xn2) turns ON automatically.

4) The slave station communication error information stored in the buffer memory "Message communication data" area is read to the PLC CPU by the FROM instruction in the sequence program.

5) When the Message communication error signal (Xn5) turns ON, the contents of the "Message communication result" area are read by the FROM instruction to identify the error cause.

4.2.4 Reset



1) "Reset" is set in the buffer memory "Message communication command" area by the TO instruction in the sequence program.

2) When Message communication request (Y(n+1)2) is turned ON in the sequence program, the slave station is requested to reset the class/instance specified in the buffer memory "Message communication command" area.

3) When the slave station finishes reset processing, the message communication result is stored into the buffer memory "Message communication result" area.

4) When the processing result is stored into the buffer memory "Message communication result" area, message communication is completed and Message communication complete (Xn2) turns ON automatically.

5) When the Message communication error signal (Xn5) turns ON, the contents of the "Message communication result" area are read by the FROM instruction to identify the error cause.

4.2.5 Compatibility with common service codes of DeviceNet specification (Release 2.0)

The following table indicates the compatibility between the commands that can be sent by the DN91 through message communication and the common service codes of the DeviceNet specification (Release 2.0).
Any other common service codes of the DeviceNet specification (Release 2.0) and the slave-specific service codes cannot be sent.

Message communication command of DN91		Common service code of DeviceNet specification (Release 2.0)
Description	Command No.	
Get Attribute Single (Read attribute)	0101_H	$0E_H$
Set Attribute Single (Write attribute)	0102_H	10_H
Read Communication Error Information	0001_H	— ∗
Reset (Reset)	0201_H	05_H

∗: Being a DN91-specific command, Read Communication Error Information is incompatible with the common service codes of the DeviceNet specification (Release 2.0).

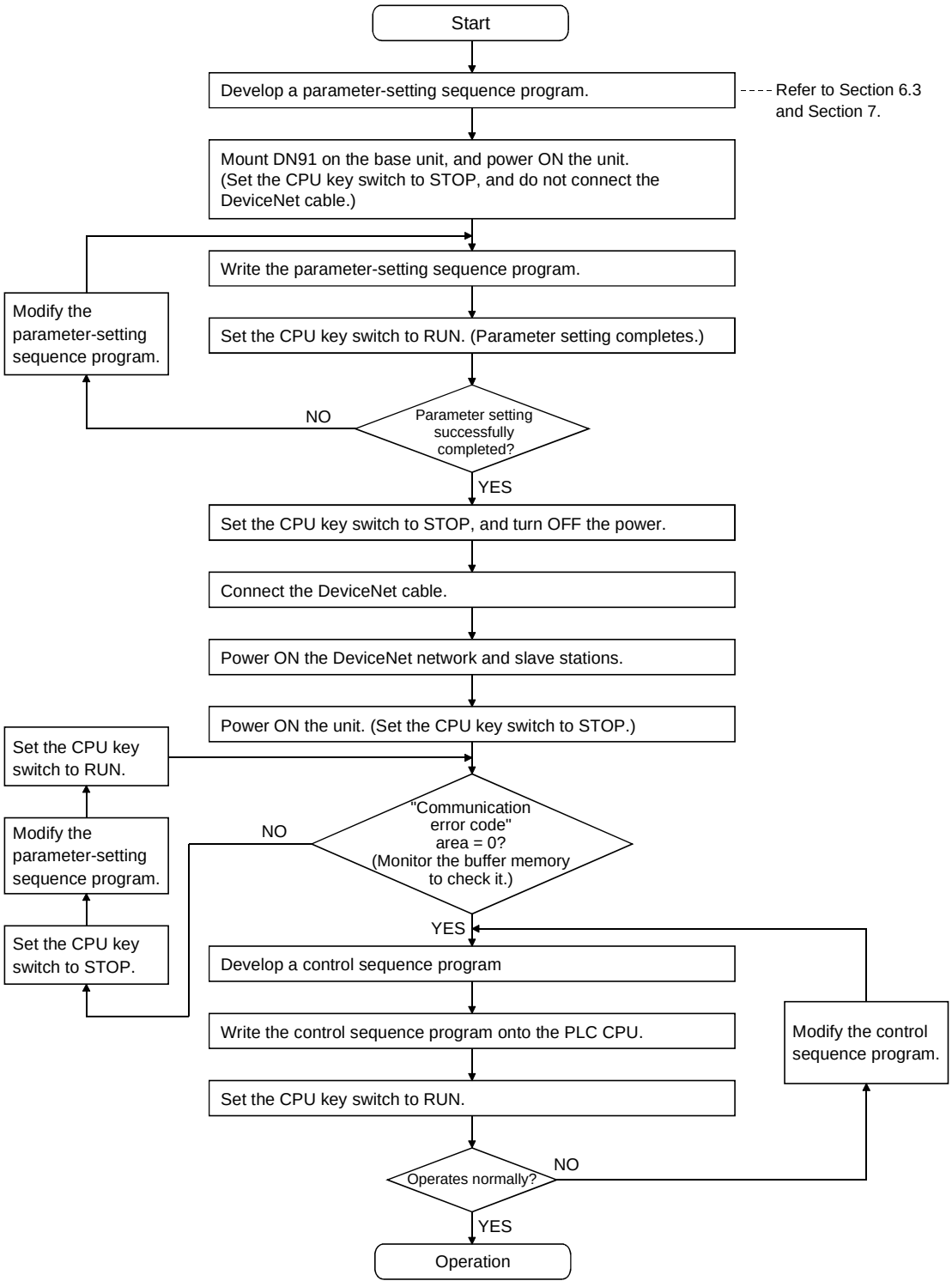
MEMO

5. SETTINGS AND PROCEDURES BEFORE OPERATION

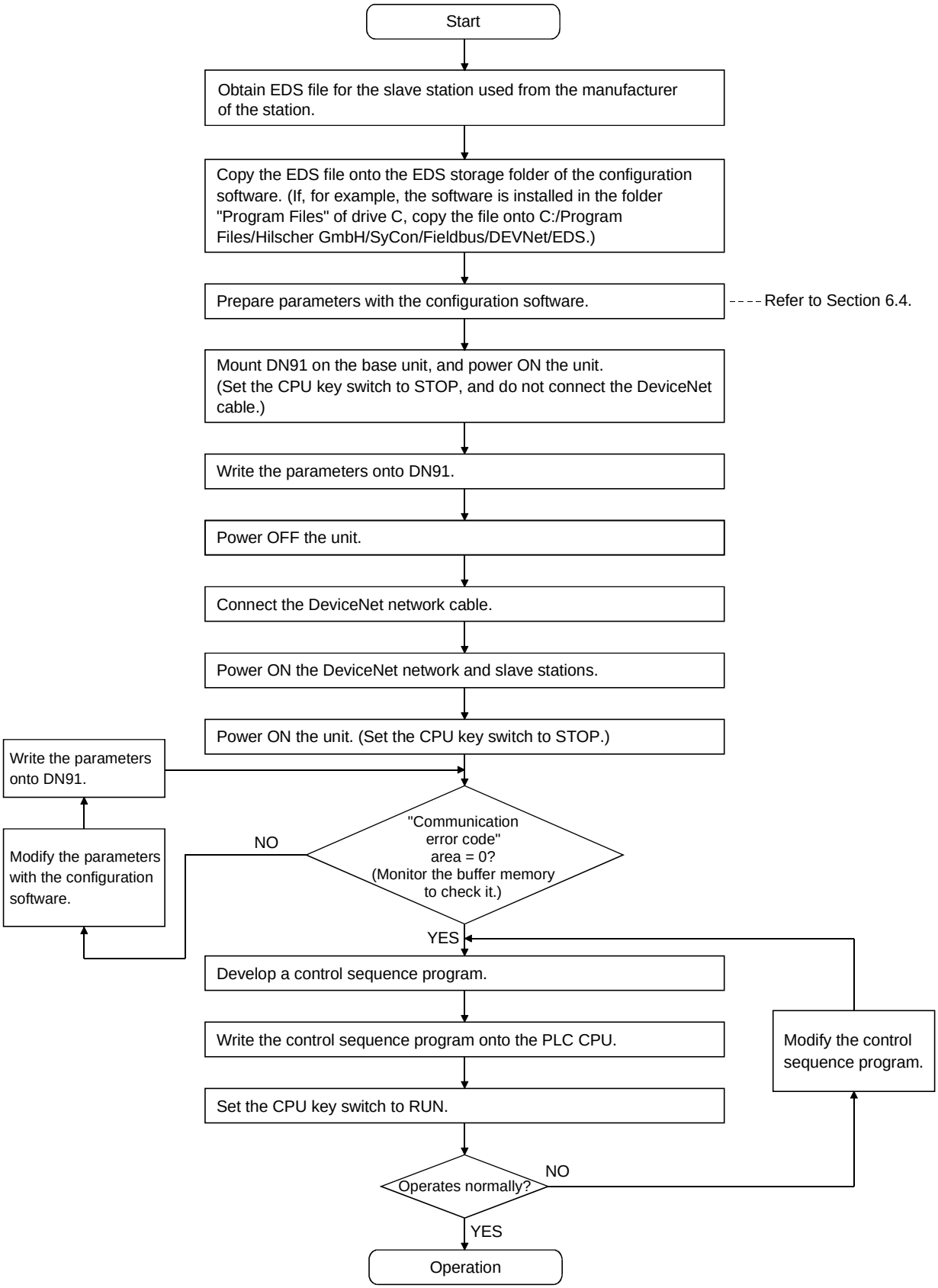
This section describes the procedure before start-up of a system using DN91.

5.1 Settings and Procedures

5.1.1 DN91 start-up procedure when setting parameters with a sequence program



5.1.2 DN91 start-up when setting parameters with the configuration software



5.2 Mounting and Installation

This section describes handling instructions of the DN91 unit between unpacking and installation and the unit installation environment.
For details about the DN91 unit mounting and installation, see the users manual for the PLC CPU being used.

5.2.1 Handling instructions

This section describes handling instructions related to the DN91.

(1) The unit casing and terminal block are made of plastic. Do not drop the unit or apply strong shocks to it.

(2) Do not remove the printed circuit board from the unit casing.
This can cause faults.

(3) During wiring operations, take care that no wiring offcuts or other foreign matter gets inside the unit.
Clean out any foreign matter that does get inside the unit.

(4) Tighten the unit mounting screws and terminal screws in the torque ranges specified below.

Type of Screw	Tightening Torque Range
A1SJ71DN91 Module mounting screw	78 to 118 N · cm
DeviceNet Connector screw	35.3 to 48.0 N · cm
DeviceNet Connector wire screw	60.8 to 82.3 N · cm

5.2.2 Installation environment

Do not mount an A Series PLC under in the following environments:

(1) Locations where the ambient temperature is outside the range 0 to 55 °C.

(2) Locations where the ambient humidity is outside the range 10 to 90 %.

(3) Locations where condensation occurs due to sudden temperature fluctuations.

(4) Locations where corrosive or flammable gases exist.

(5) Locations with a high level of conductive dust or iron filings, oil mist, salt, or organic solvent.

(6) Locations exposed to direct sunlight.

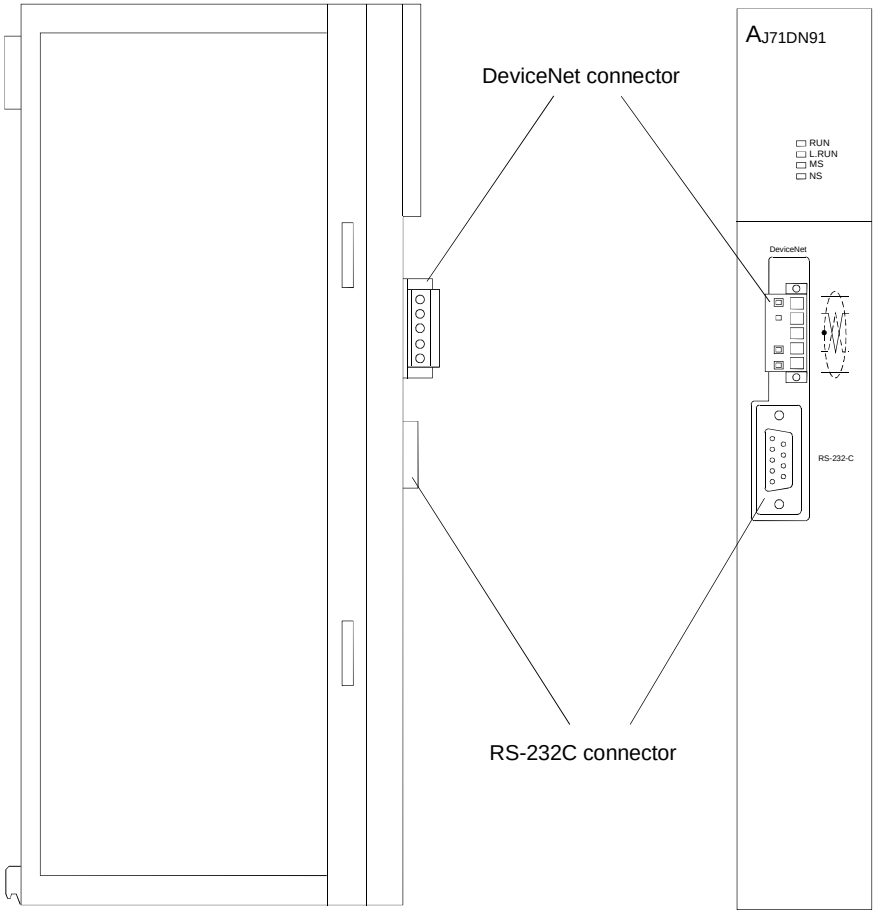
(7) Locations subject to strong electric or magnetic fields.

(8) Locations where vibrations or shocks are directly transmitted to the unit.

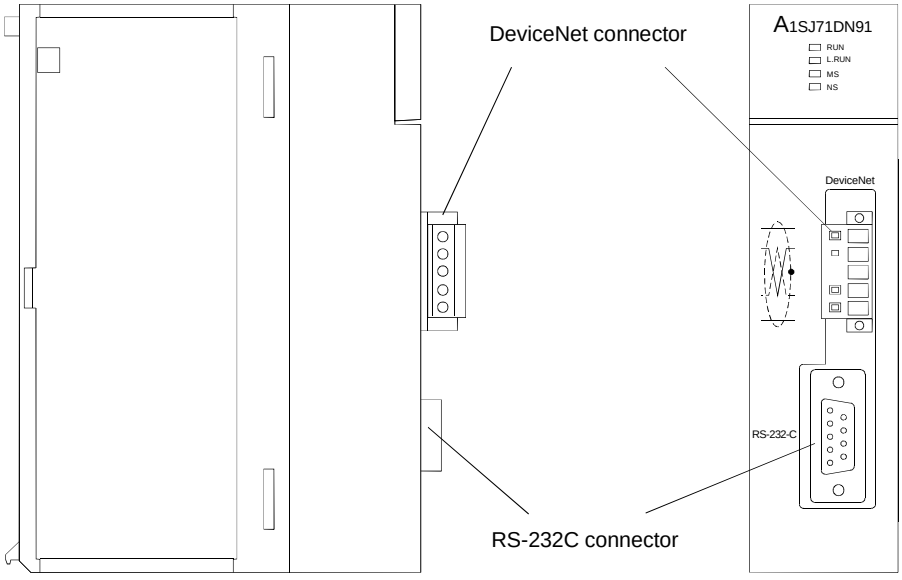
5.3 Nomenclature

This section describes the AJ71DN91 and A1SJ71DN91 parts.

AJ71DN91

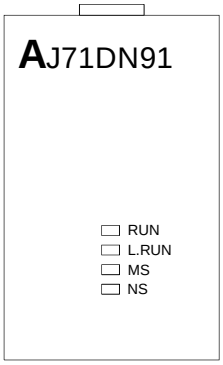


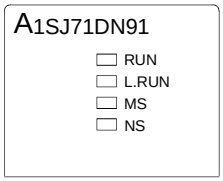
A1SJ71DN91



5.4 LED Displays and Indicator Descriptions

This section describes the names of the LEDs at the top of the AJ71DN91 and A1SJ71DN91 front panel and provides indicator descriptions.



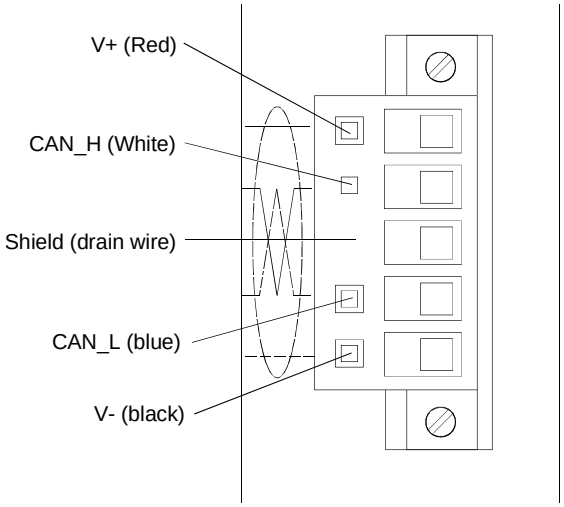


LED Name	Color	Description	LED Display Status	
RUN	Red	Normal operation display	Lit	Normal operation
			Not lit	Unit error detected
				No power supply
				Parameters being loaded
			Flashing	Unit error detected
				Parameters being loaded
L.RUN	Red	Communication status display	Lit	Communicating
			Not lit	Communication stopped
			Flashing (periodic)	Preparing for communication
			Flashing (random)	Communication parameter error
MS	Green	Module status display	Lit	DeviceNet interface unit operating normally
			Flashing	Parameter error
	Red	Module status display	Not used	
NS	Green	Network status display	Lit	Communication enabled with on-line slave stations
			Flashing	Communication not enabled with on-line slave stations
	Red	Network status display	Lit	Duplicate MAC ID error
				Bus-off error occurred
			Flashing	There is a connection that has timed out.

5.5 Connecting Communication Cable to DN91

(1) Connecting communication cables

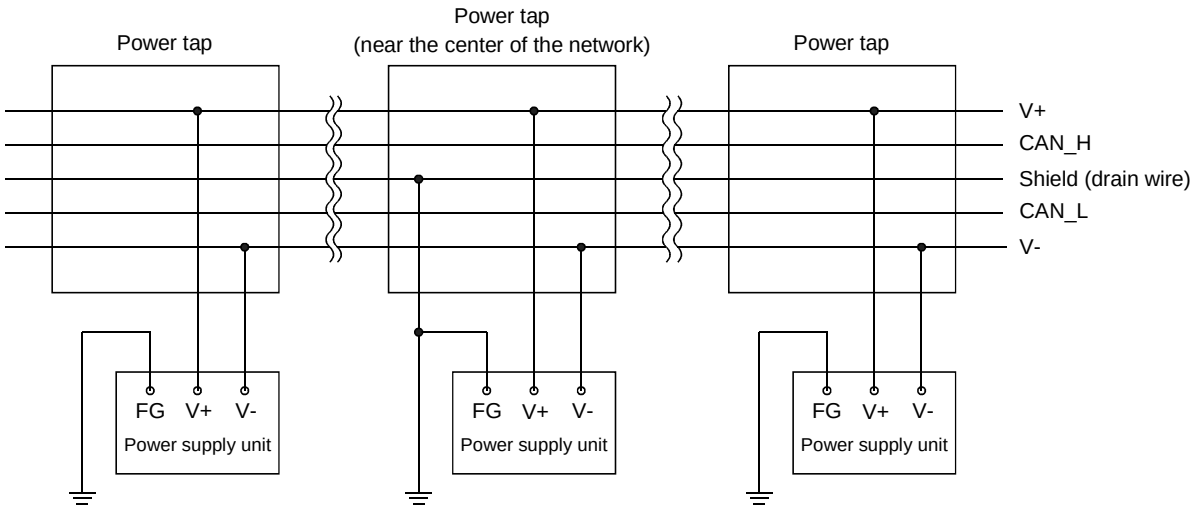
This section describes how to connect the communication cable to the DN91.



The DN91 DeviceNet connector is shown in the diagram above. The upper of the connector is color-coded with the corresponding cable lead colors.
Connect the communication cable, ensuring that each cable lead color matches the marking on the connector.

(2) Grounding the network

DeviceNet network is to be grounded at a single point.
And select a point for grounding in the vicinity of the center of the network.
Connect a cable shield (drain wire) to the ground of the power supply unit for Class-D (Class-3) grounding.
If the network contains multiple power supply units, ground a unit that is positioned near the center of the network and do not ground at any other positions. When using multiple power supply units, use power taps.



5.6 Instructions for Connecting the Network Power Supply

This sections describes the instructions for connecting the network power supply.

5.6.1 Network power supply unit installation position

Follow the procedure below to determine the position to install the network power supply unit.

1) Calculate the current consumption of the stations required on the network.
2) Measure the total length of the network.
3) Refer to Tables 5.1 and 5.2 to determine the maximum current capacity corresponding to the network length and type of cable used.
4) If the current value calculated at step 1) is less than the current value calculated at step 3), any of the network power supply unit installation positions described in Section 5.6.2 can be used.
5) If the current value calculated at step 1) exceeds the current value calculated at step 3), refer to Section 5.6.2 to determine whether the network power supply unit can be installed near the center of the network to supply power to all stations.
6) If the results from step 5) indicate that power cannot be supplied to all stations, increase the number of network power supply units.

Table 5.1 Maximum Current Capacity That May Be Supplied to the Master/Slave Stations According to the Network Length of Thick Cable

Network length (m)	0	25	50	100	150	200	250	300	350	400	450	500
Maximum 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

Table 5.2 Maximum Current Capacity That May Be Supplied to the Master/Slave Stations According to the Network Length of Thin Cable

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

POINT

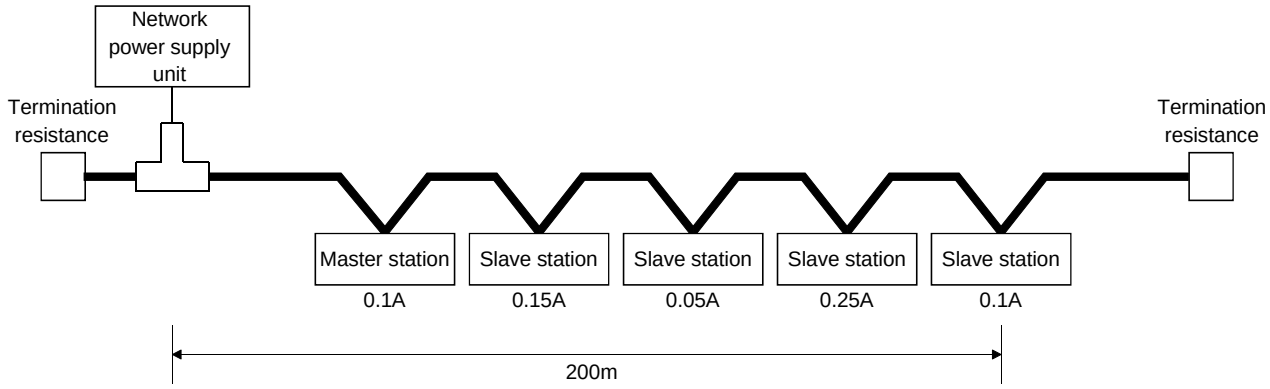
Use a network power supply unit with a current capacity exceeding the required total current consumption.
If the current capacity is insufficient, multiple power supplies may be used. When using multiple power supplies, however, use power supply taps.

5.6.2 Calculating network power supply unit installation position and current capacity

This section describes the calculating network power supply unit installation position and current capacity.

(1) Network power supply unit connected to an end of the network

The current capacity is calculated as shown below when the network power supply unit is connected to the end of a thick-cable network with a total length of 200 m.

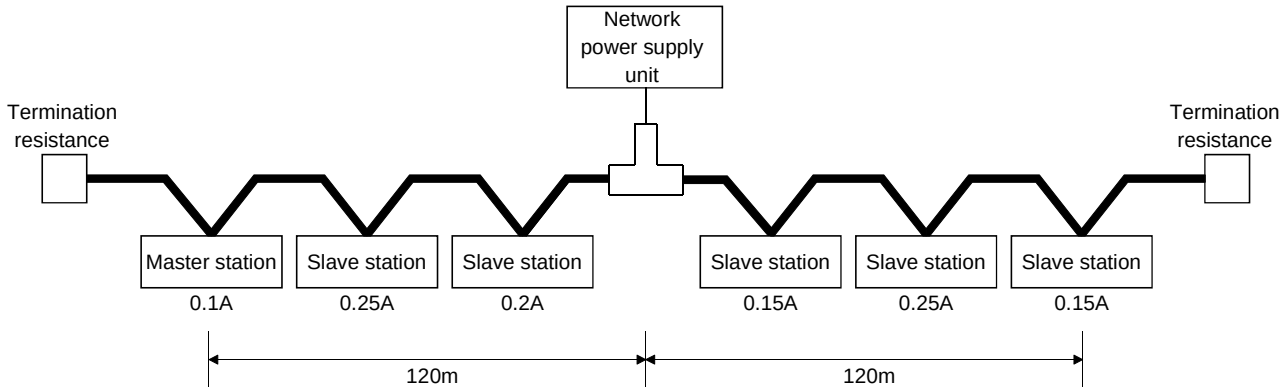


Total power supply distance = 200 m
Total current capacity = 0.1 A + 0.15 A + 0.05 A + 0.25 A + 0.1 A = 0.65 A
Max. current capacity of 200 m of thick cable (from Table 5.1) = 1.53 A

Therefore, this configuration allows power supply to all stations.

(2) Network power supply unit connected to the center of the network

The current capacity is calculated as shown below when the network power supply unit is connected at the center of a thick-cable network.
In this case, the network power supply unit can supply twice the current compared to when it is connected to the end of the network.

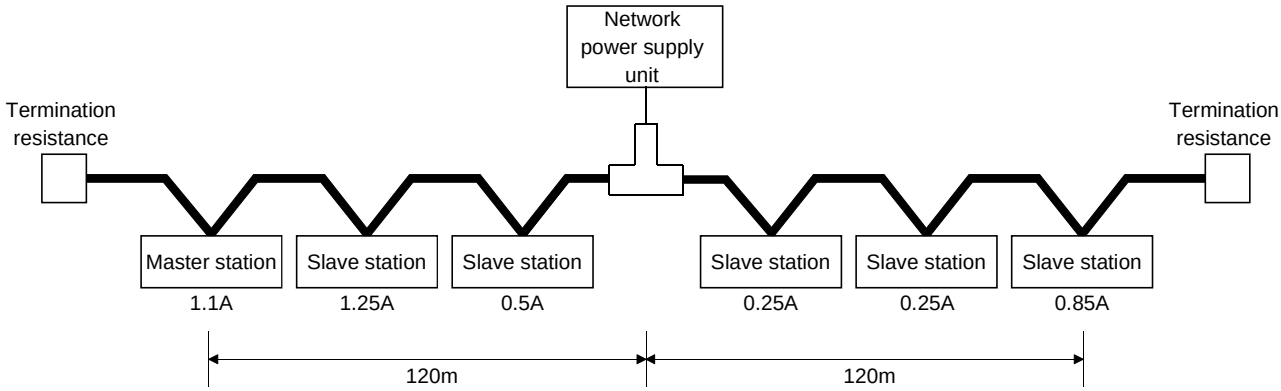


Power supply distance left of the network power supply unit = power supply distance right of the network power supply unit = 120 m
Total current capacity to the left = 0.1 A + 0.25 A + 0.2 A = 0.55 A
Total current capacity to the right = 0.15 A + 0.25 A + 0.15 A = 0.55 A
Max. current capacity of 120 m of thick cable (from Table 5.1) = approx. 2.56 A
(Linearly interpolated between 100 m and 150 m.)

Therefore, this configuration allows power supply to all stations.

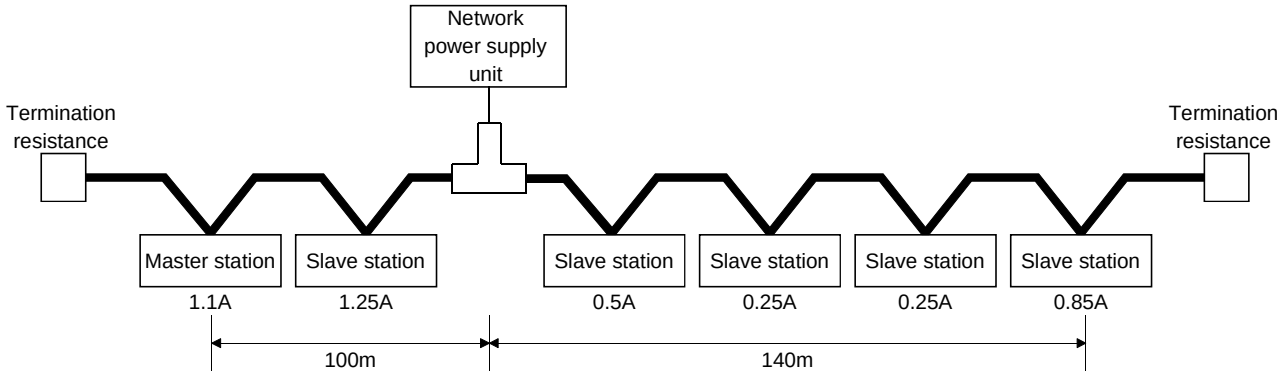
(3) Remedy for Insufficient Network Power Supply Current Capacity

If the network power supply unit is connected to a thick-cable network, as shown below.



Power supply distance left of the network power supply unit = power supply distance right of the network power supply unit = 120 m
Total current capacity to the left = 1.1 A + 1.25 A + 0.5 A = 2.85 A
Total current capacity to the right = 0.25 A + 0.25 A + 0.85 A = 1.35 A
Max. current capacity of 120 m of thick cable (from Table 5.1) = approx. 2.56 A
(Linearly interpolated between 100 m and 150 m.)

In this configuration, the current capacity to the left of the network power supply unit is insufficient.
If this type of situation occurs, move the network power supply unit in the direction of insufficient current capacity (to the left in the diagram above).

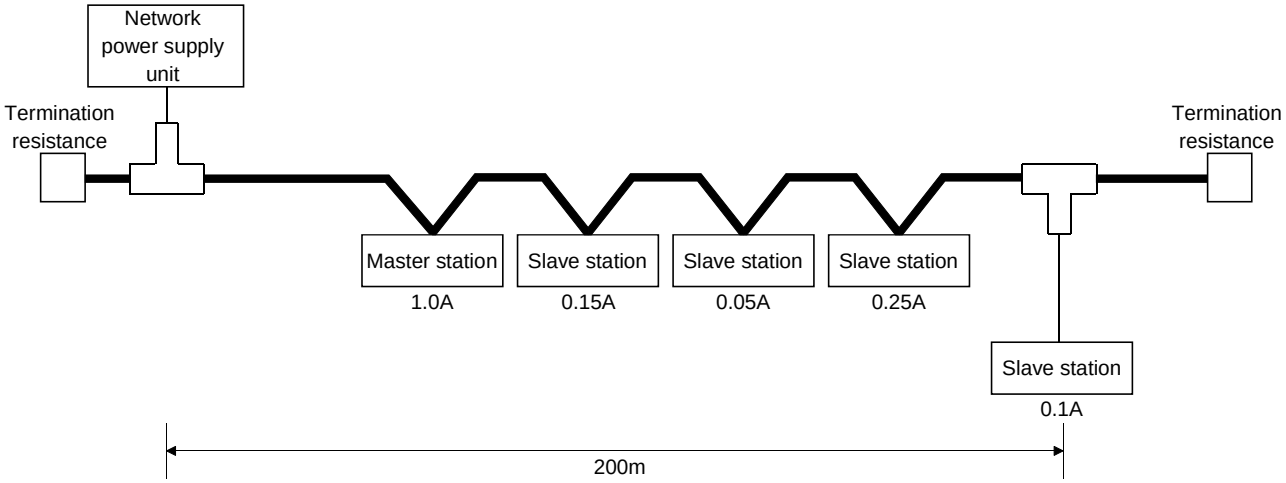


Total power supply distance left of the network power supply unit = 100 m
Total power supply distance right of the network power supply unit = 140 m
Total current capacity to the left = 1.1 A + 1.25 A = 2.35 A
Total current capacity to the right = 0.5 A + 0.25 A + 0.25 A + 0.85 A = 1.85 A
Max. current capacity of 100 m of thick cable (from Table 5.1) = approx. 2.93 A
Max. current capacity of 140 m of thick cable (from Table 5.1) = approx. 2.19 A
(Linearly interpolated between 100 m and 150 m.)

As a result of shifting the network power supply unit in the direction of insufficient current capacity, it is able to supply power to all stations.

(4) Mixed Trunk Line and Drop Line

The current capacity is calculated as shown below when the network power supply unit is connected to a network with 200 m of thick-cable trunk line and 6 m of thin-cable drop line.



Thick-cable power supply distance = 200 m
Drop line power supply distance = 6 m
Total current capacity = 0.5 A + 0.15 A + 0.05 A + 0.25 A + 0.1 A = 1.05 A
Max. current capacity of 200 m of thick cable (from Table 5.1) = 1.53 A
Max. current capacity of 6 m of drop line (from Table 5.3) = 0.75 A
Total current of devices connected to drop line = 0.1 A

Therefore, this configuration allows power supply to all stations.

Table 5.3 Maximum Current Capacity Corresponding to the Drop Line Length

Drop line length (m)	0.30	0.90	1.50	2.25	3.00	4.50	6.00
Max. current (A)	3.00	3.00	3.00	2.00	1.50	1.00	0.75

6. PARAMETER SETTINGS

This section describes the parameter settings required for DN91 operation.
The following two methods are available to set the parameters:
Parameters that have been set are stored in separate areas on E^2PROM within DN91.
Once the parameters are set, no subsequent parameter setting is required as long as no change in the parameters is necessary.

- Setting with a sequence program (see Section 6.3)
- Setting with the configuration software (see Section 6.4)

6.1 Settings Parameter

The parameters may be set by the following two methods:

- Use TO command of the sequence program to set the parameters.
- Use the configuration software to set the parameters.

The following discusses the parameter-setting methods.

(1) Parameter setting by the sequence program

The sequence program-based parameter setting includes the following contents:

1) Host station number (MAC ID of the host station)
2) Baud rate
3) Station number of the n-th unit
4) Connection type of the n-th slave station
5) Number of byte modules for the n-th slave station
6) Number of word modules for the n-th slave station
7) Number of double-word modules for the n-th slave station
8) Expected packet rate for the n-th slave station
9) Watchdog timeout action for the n-th slave station
10) Production inhibit time for the n-th slave station

The setting of above-shown items 3) to 10) may be done for 63 units.

To construct a network of DeviceNet that contains DN91 as the master, setting station numbers (MAC IDs) is required for DN91 and slave stations.
Station numbers available for them are 0 to 63, and any numbers may be used for DN91 and slave stations as long as they do not mutually overlap.
Refer to the operation manual of the slave station for the procedure of setting station numbers (MAC IDs) of the slave stations.

For the procedure and details of setting parameters through the sequence program, refer to Section 7.3 "Setting Parameters with a Sequence Program" and 3.4.2 (14) "Buffer Memory".

(2) Parameter setting by the configuration software

The Configuration software-based parameter setting includes the following contents:

1) Setting configuration
2) Master parameter setting
3) Bus parameter setting
4) Device (slave) parameter setting

For the procedure and details of setting parameters with the configuration software, refer to Section 6.4 "Setting Parameters with the Configuration Software".

6.2 Important Points about the Parameter Settings

Setting the address mode to the byte address using the configuration software may result in the division of a word data into upper and lower bytes and may be stored in separate addresses of the buffer memory.
For that reason, data processing by the sequence program may be required.

REMARK

See the slave station manual for details about the slave station data transfer specifications.

6.3 Setting with a Sequence Program

See the following sections for the methods of setting parameters with a sequence program: 3.3.2 (6) I/O Signal Details, 3.4.2 (14) Parameters, 7.3 Setting Parameters with a Sequence Program.

POINTS

Avoid any setting that validates both parameter setting procedures of using the sequence program and of using configuration software.
1) Setting parameters with the sequence program erases the parameter settings that have been set with the configuration software.
2) When using the configuration software to set the parameters, follow the setting procedure as shown below:
• Set the parameters, referring to 6.4 Setting Parameters with the Configuration Software.
• To invalidate the settings that have been set with the sequence program, use the sequence program to write $FFFF_H$ onto the host station number ($01D4_H$) of the buffer memory and turn ON the parameter-setting request (Y(n+1)7).

6.4 Setting Parameters with the Configuration Software (Parameter Setting Tool)

This system gives an outline of the setting method using the configuration software. While the following explanations are based on screens of SyCon Ver. 2.0.6.2, the screen hierarchy and items of the setting are subject to change due to potential changes in the specifications of the configuration software. Refer to the operation manual of the configuration software for the latest information.

The following four steps are required to set the DN91 parameters:

1) Set configuration

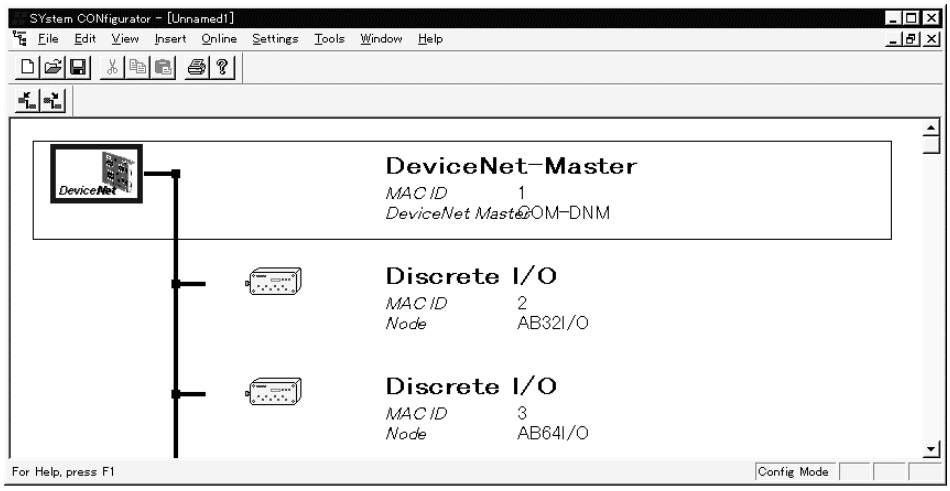
2) Set master parameters

3) Set bus parameters

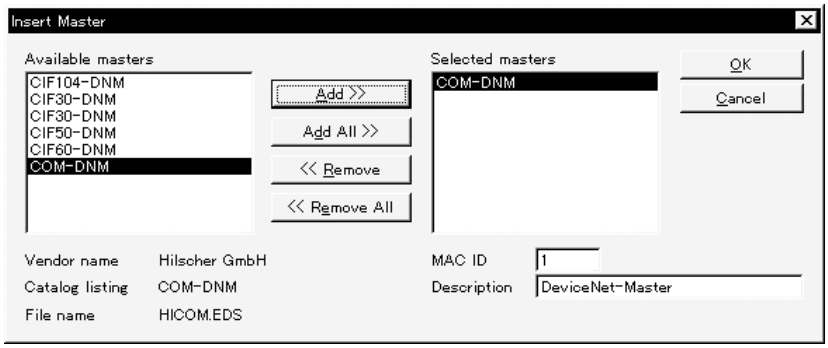
4) Set device (slave) parameters

6.4.1 Setting configuration

Set the DeviceNet network configuration on the screen below.

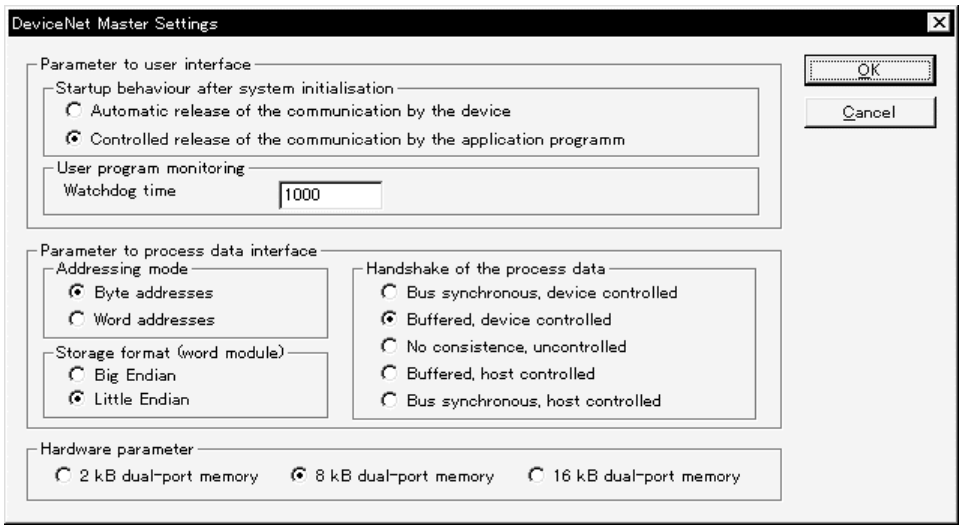


To set the master on the above screen, choose COM-DNM as shown below.



6.4.2 Setting master parameters

Set the master parameters on the screen below.



Set the items as follows:

1) Startup behavior after system initialization
   Select "Controlled release of the communication by the application program."

2) User program monitoring
   This is the time to monitor whether the DN91 is operating normally (units: 1 msec).
   Set a value of 30 msec, or higher.

3) Addressing mode
   Select byte addressing or word addressing as the addressing mode.

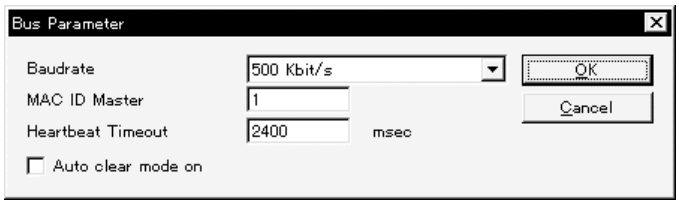
4) Storage format
   Designate the data format of the word data.
   Select "Little Endian."

5) Handshake of the process data
   Select buffered or device controlled.

6) Hardware parameter
   Select "8 kB dual-port memory."

6.4.3 Setting bus parameters

Set the bus parameters on the screen below.



Set the items as follows:

1) Baudrate
   Select one of the following baud rate settings:
   • 125 Kbit/s (125 kbaud)
   • 250 Kbit/s (250 kbaud)
   • 500 Kbit/s (500 kbaud)

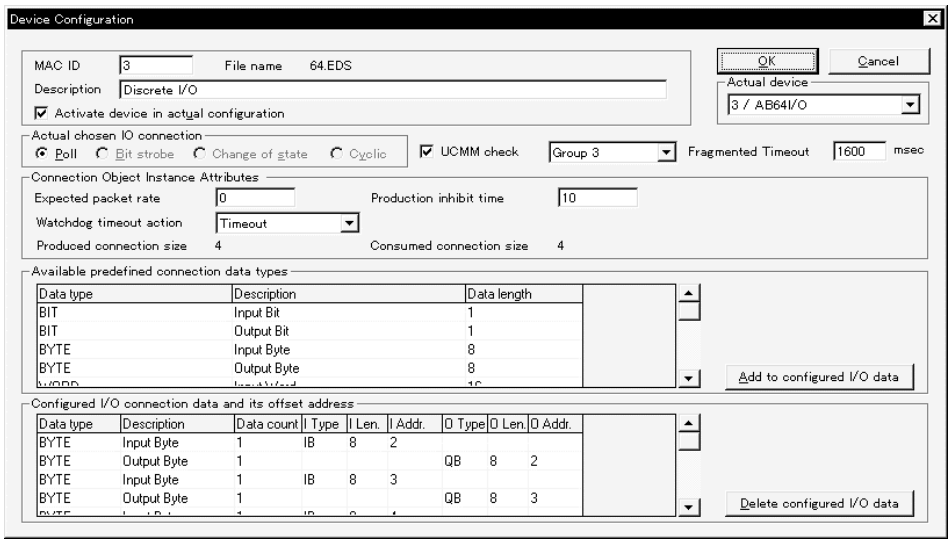
2) MAC ID Master
   Set the DN91 station number as a value from 0 to 63.

3) Heartbeat Timeout
   Set the interval for checking any existence of slave stations.

4) Auto clear mode on
   Set to turn OFF, or not, output to all stations in case an error occurs with any single station.

6.4.4 Set the device (slave station) parameters

Set the slave station parameters on the screen below.



Set the items as follows:

1) MAC ID
   Set the slave station number as a value from 0 to 63.

2) Description
   Enter a name for the slave station.

3) Activate device in actual configuration
   Set whether the station is an actively communicating station or a reserved station.
   • Checked : Actively communicating station
   • Not checked: Reserved station

4) Actual chosen IO connection
   Select the I/O data communication type: Polling, bit strobe, change of state, or cyclic.

5) UCMM check
   Set if a slave station has the UCMM functionality or not. If it does, also set the message group that is used for message communication.

6) Fragmented Timeout
   Set the time for waiting for the acknowledgement of receipt from a slave station for the case of divided message transmission and receipt.

7) Expected packet rate
   Set the expected packet rate.
   See 3.4.2(14) Parameters for details about the settings.

8) Production inhibit time
   Set the production inhibit time.
   See 3.4.2(14) Parameters for details about the settings.

9) Watchdog timeout action
Set the action on a watchdog timeout.
See 3.4.2(14) Parameters for details about the settings.

10) Configured I/O connection data and its offset address
Set the I/O module configuration. Also, set I. Addr and O. Addr to the DN91 buffer memory address allocated to the I/O module I/O data.

MEMO

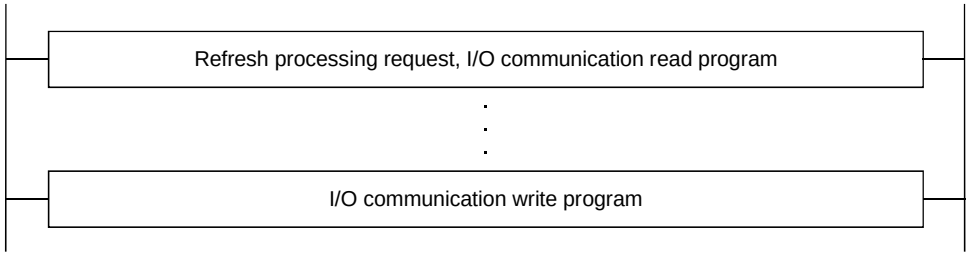
7. PROGRAMMING

This section describes how to create programs.
When diverting the program example introduced in this chapter to the actual system, fully check that there are no problems in the controllability of the system.

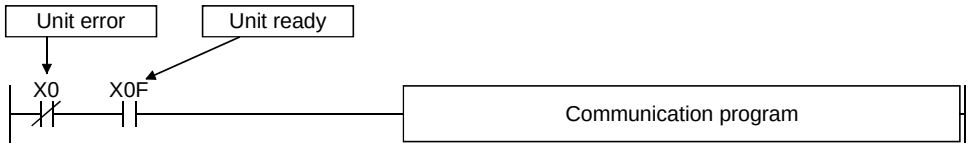
7.1 Important Points about Programming

Follow the points below when creating a program.

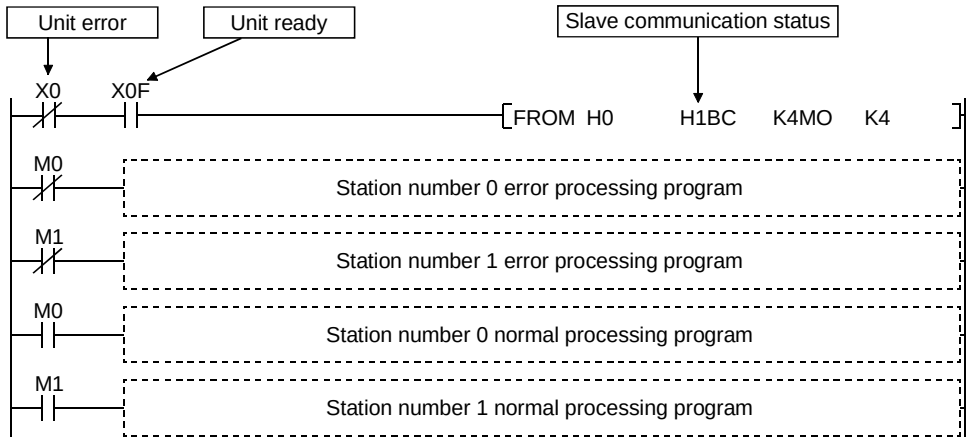
(1) Creating a Slave Station I/O Communication Program
- Place the I/O communication reading program at the beginning of the sequence program.
- Place the I/O communication writing program at the end of the sequence program.



(2) Read received data and write send data when no unit error has occurred and the unit is in ready status.



(3) Create a program to detect the communication status of each station and apply an interlock. Also, create processing programs to handle faults.

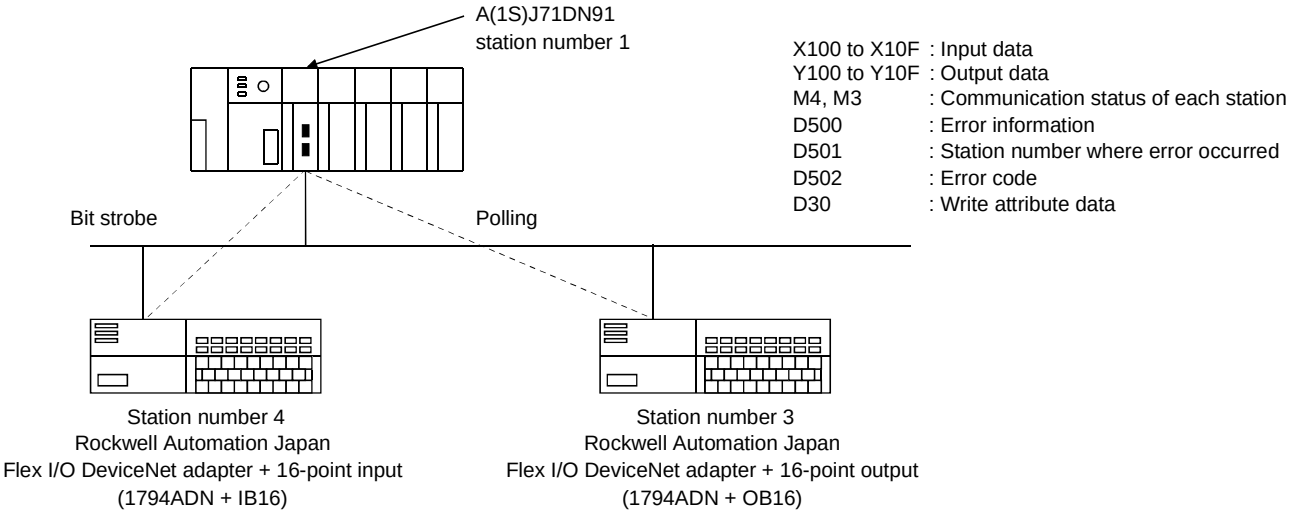


(4) In case parameter setting has been done previously with the sequence program, the settings are stored in the buffer memory when powered ON.
To set the parameters from the scratch, clear the "Parameter" area of the buffer memory to zero (0).

7.2 System Configuration

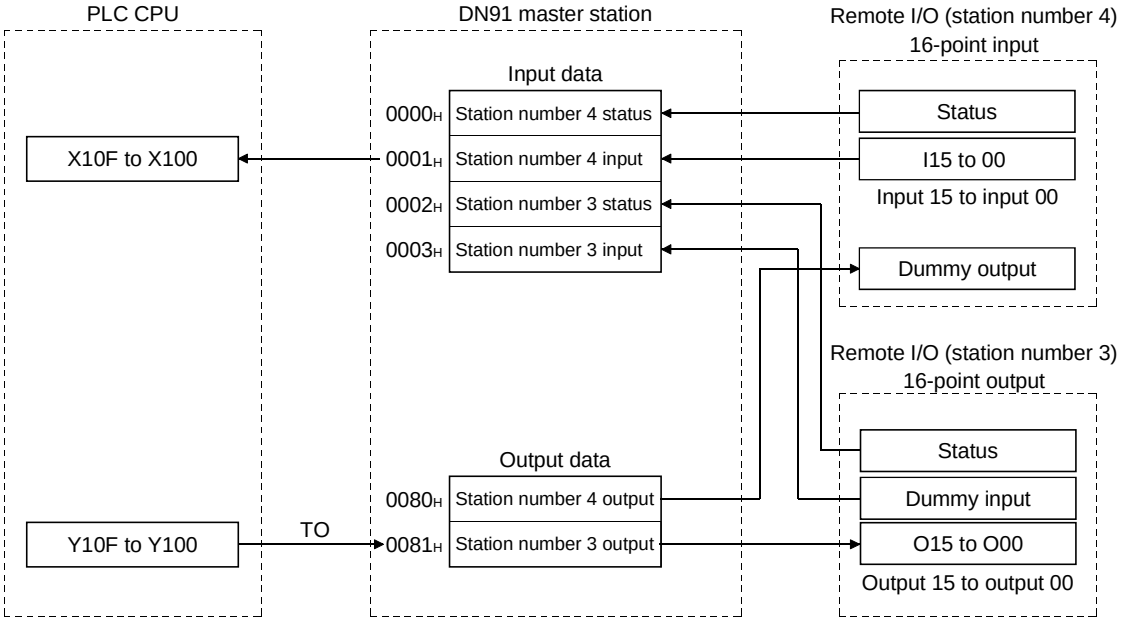
The program described in this section is based on the system described below.

1) DN91 is set to station number 1, the first remote I/O is set to station number 4, and the second remote I/O is set to station number 3.
2) Bit strobe communication is made between the DN91 and the remote I/O of station number 4, and polling communication is made between the DN91 and the remote I/O of station number 3.
3) Input data is assigned from X100 to X10F and output data is assigned from Y100 to Y10F.
   Remote I/O : Inputs X100 to X10F
   Remote I/O : Outputs Y100 to Y10F
4) The communication status of each station is stored in M4 and M3.
5) If an error occurs, the error information is read to D500, the station number where the error occurred to D501, and the error code to D502.
6) Message communication write attribute data is set in D30 to D39.
7) DN91 is mounted in slot 0 of the main base unit.



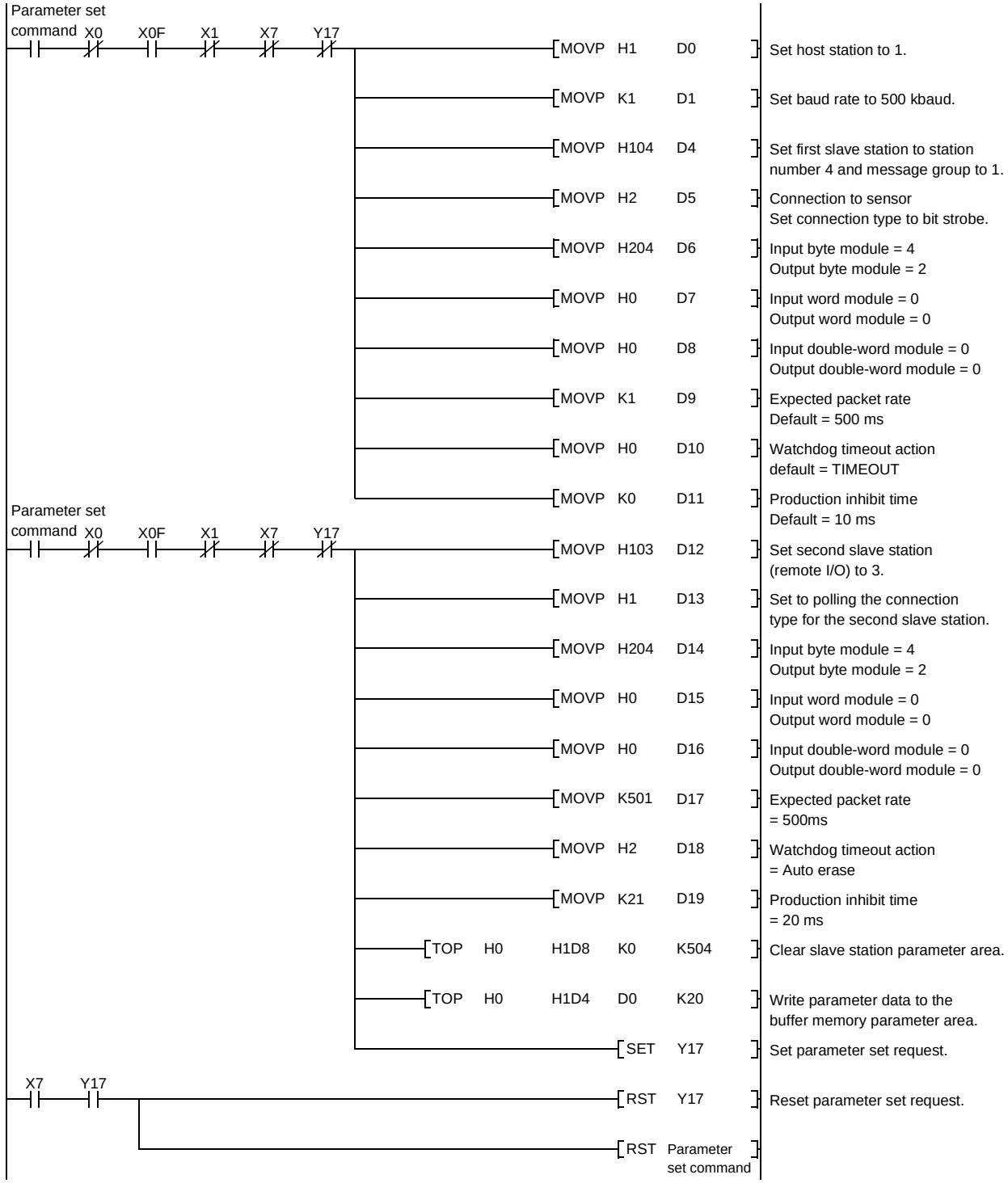
∗: The Flex I/O DeviceNet adaptor of Rockwell Automation Japan has 2-byte input data as a status. Both IB16 and OB16 have 2-byte input data and 2-byte output data.

The relationship between the PLC CPU, master station buffer memory, first slave station (remote I/O), and second slave station (remote I/O) is shown below.



7.3 Setting Parameters with a Sequence Program

This section describes a sample sequence program to set parameters.

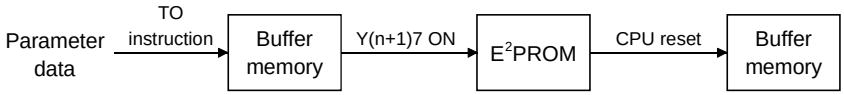


The relationship between PLC CPU and master station buffer memory and the meaning of buffer memory data is shown below.

PLC CPU	TO	Buffer memory		
D0	→	$01D4_H$	H1	← Stores host station number 1
D1	→	$01D5_H$	K1	← Stores baud rate = 500 kbaud
D2	→	$01D6_H$	—	← Unused
D3	→	$01D7_H$	—	← Unused
D4	→	$01D8_H$	H104	← Stores station number of first slave station = 4
D5	→	$01D9_H$	H2	← Stores connection type of first slave station = bit strobe
D6	→	$01DA_H$	H204	← Stores input/output byte modules of first slave station
D7	→	$01DB_H$	H0	← Stores input/output word modules of first slave station
D8	→	$01DC_H$	H0	← Stores input/output double-word modules of first slave station
D9	→	$01DD_H$	K0	← Set expected packet rate of first slave station to default value
D10	→	$01DE_H$	H0	← Stores watchdog timeout action type of first slave station = TIMEOUT
D11	→	$01DF_H$	K0	← Set production inhibited time of first slave station to default value
D12	→	$01E0_H$	H103	← Stores station number of second slave station = 3
D13	→	$01E1_H$	H1	← Stores connection type of second slave station = polling
D14	→	$01E2_H$	H204	← Stores input/output byte modules of second slave station
D15	→	$01E3_H$	H0	← Stores input/output word modules of second slave station
D16	→	$01E4_H$	H0	← Stores input/output double-word modules of second slave station
D17	→	$01E5_H$	K501	← Stores expected packet rate of second slave station = 500 ms
D18	→	$01E6_H$	H2	← Stores watchdog timeout action type of second slave station = AUTO DELETE
D19	→	$01E7_H$	K21	← Stores production inhibited time of second slave station = 20 ms

POINT

(1) Parameter data flows as shown below.

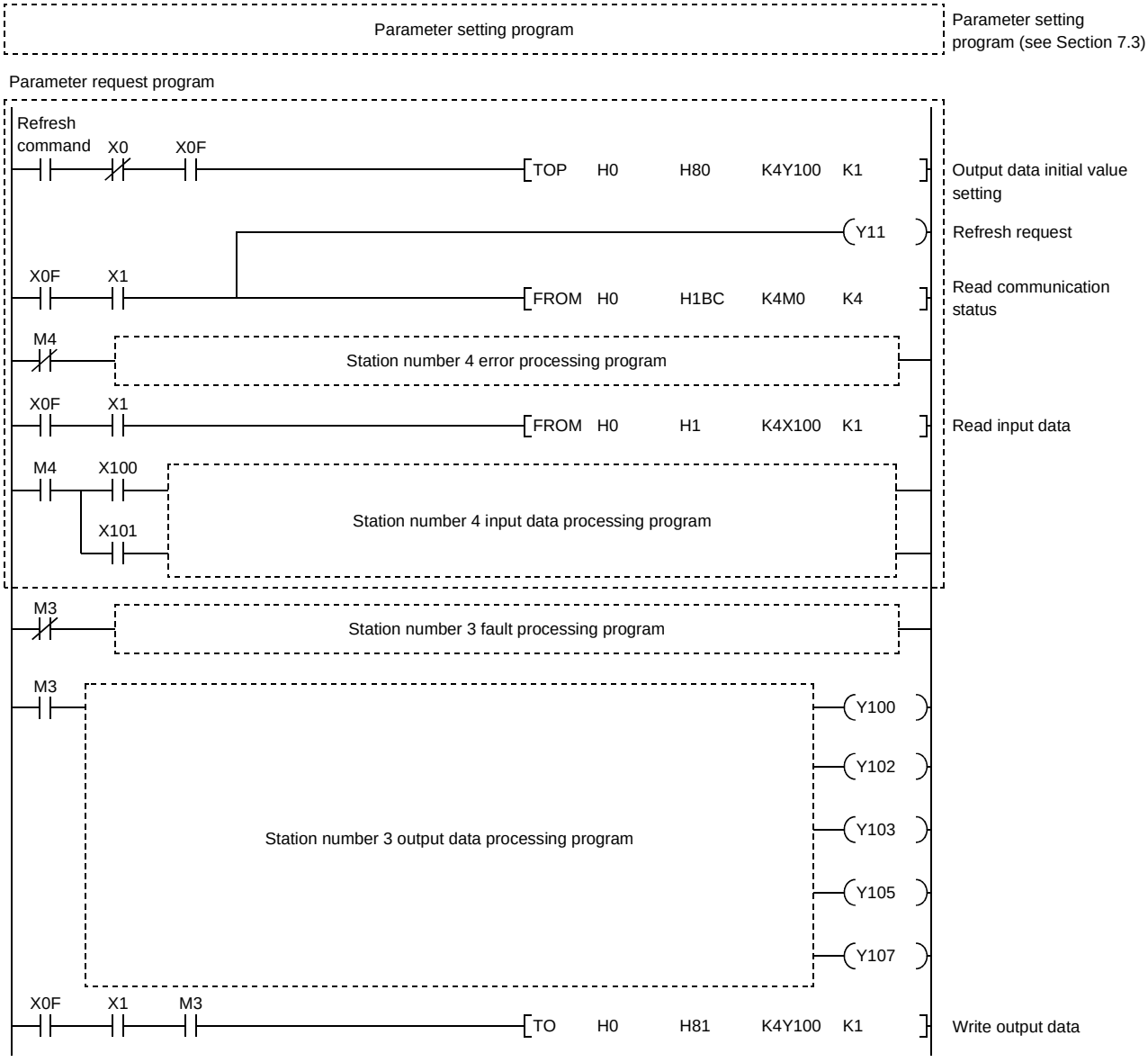


Since E^2PROM has a restriction on the number of write times, execute the parameter set request (Y(n+1)7) only when parameters are created newly or changed.

(2) When creating parameters, write "0" to the unnecessary parameter area. The previous data remaining there may cause an error.

7.4 I/O Communication with Slave Stations

This section describes a sample sequence program to conduct I/O communication.

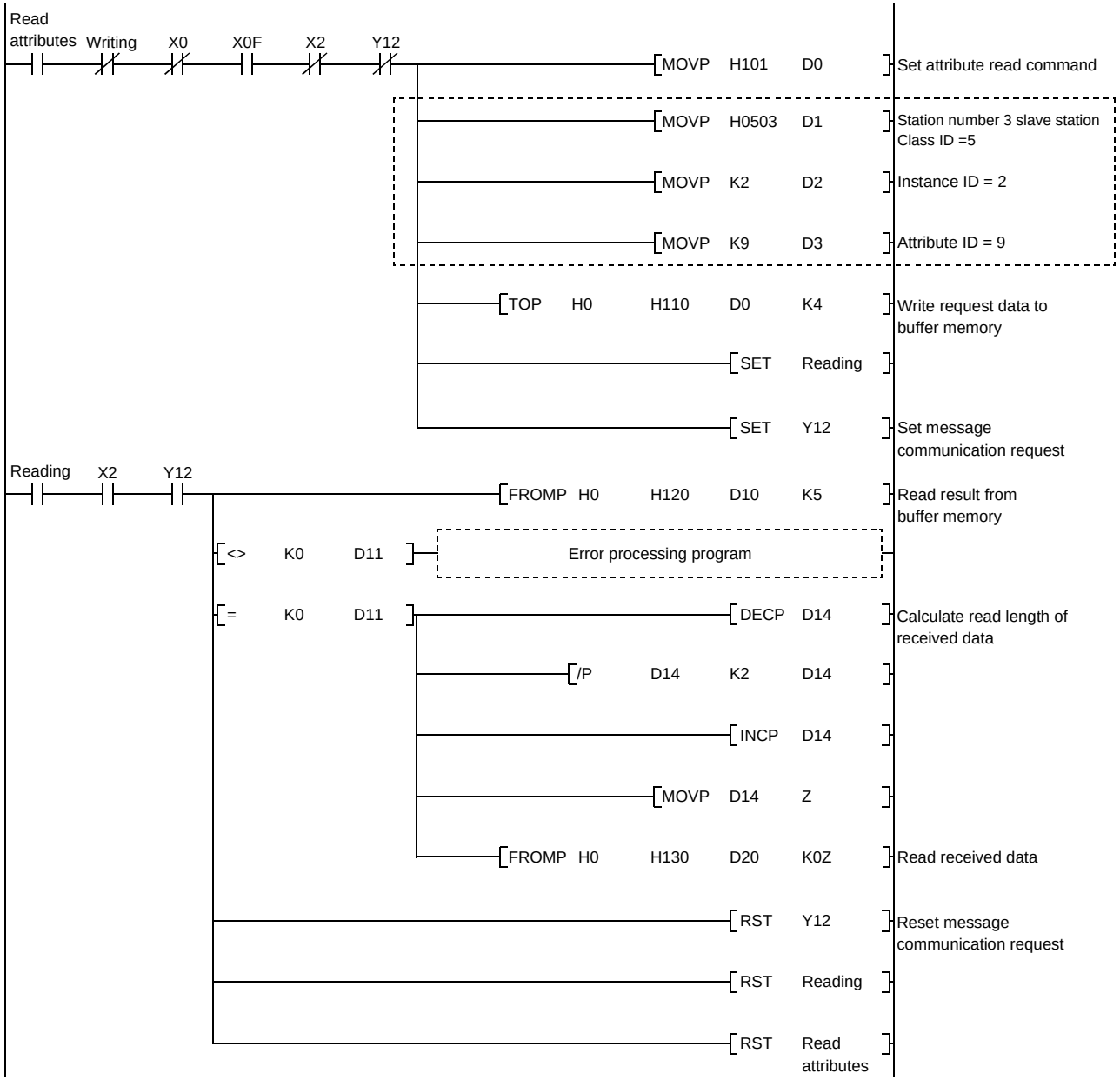


7.5 Message Communication

This section describes a sample sequence program to conduct message communication.
For the broken line area where the class ID, instance ID and attribute ID change with the actually accessed area and slave station, refer to the slave station manual.

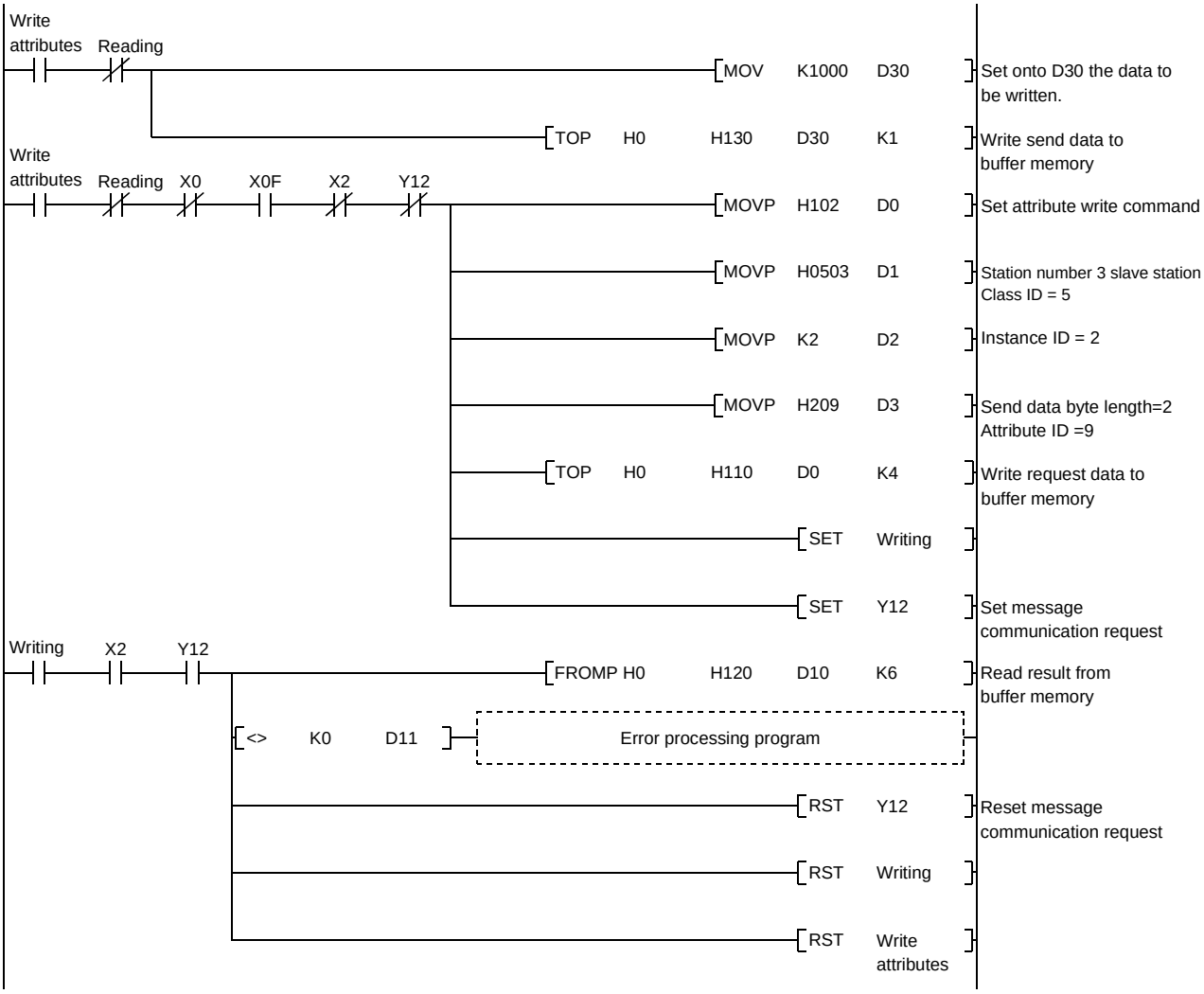
7.5.1 Message communication - reading

The following sample program represents a case of reading attributes of expected packet rate for the polling connection from the station number 3.



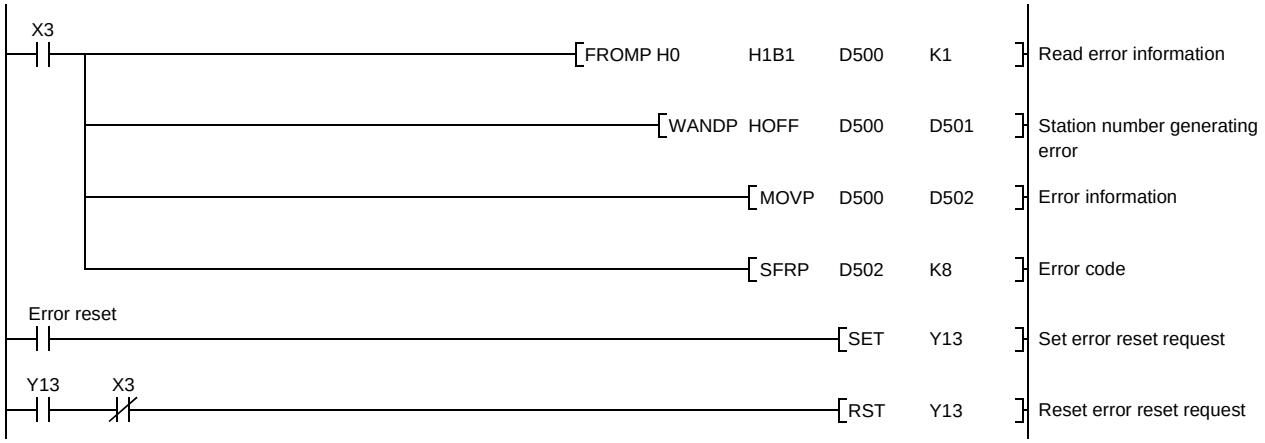
7.5.2 Message communication - writing

The following sample program represents a case of writing attributes of expected packet rate for the polling connection from the station number 3.



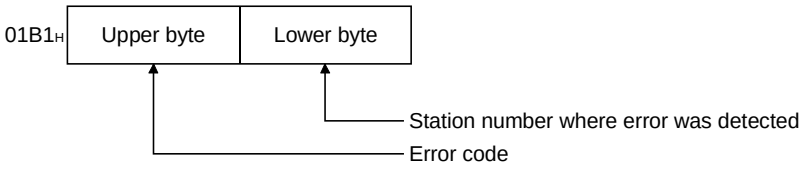
7.6 Acquiring Error Information

This section describes a sample sequence program to acquire error information.



POINT

The error code and the station number which detected the error code are stored into buffer memory 01B1H as shown below.



For details, refer to Section 8.3.1.

MEMO

8. TROUBLESHOOTING

This section describes errors which may occur when using a DN91 master unit and the troubleshooting procedures.

This section is divided into the following sub-sections.

Section 8.1 Troubleshooting Tables
Determine the appropriate remedy from the symptom of the problem.

Section 8.2 Troubleshooting using LED Indications
Determine the appropriate remedy from the LED indicator status.

Section 8.3 Troubleshooting using Error Codes
Determine the appropriate remedy from the error codes.
The timing to check the error codes and the reference buffer memory are shown below.

Timing to Check Error Codes	Error Codes to Check	Remedy
When the error set signal (Xn3) turns ON	Communication error code ($01B1_H$, upper byte)	Take remedial actions in accordance with Section 8.3.1 "Communication error codes".
When the message communication complete signal (Xn2) turns ON.	Error code (0121_H) after conducting message communication.	See 8.3.2 Execution Error Codes for Message Communication.

8.1 Troubleshooting Tables

Determine the appropriate remedy from the symptom of the problem.

8.1.1 Troubleshooting by symptom type

Refer to the following tables to determine the appropriate remedy for the symptom.

Symptom	Check Item	Remedy
No Communication With Any Slave Station	No Communication With Any Slave Station Is communication cable connected to the DN91 DeviceNet interface connector? Are cable locking screws fully tightened? Check that the communication cable is correctly connected, referring to 5.5 Connecting Communication Cable to DN91.	Correctly connect the cable.
	Is the network power supply connected? Is the power turned ON?	Turn ON the network power supply.
	Is the network power supply capacity sufficient?	Replace with a power supply of larger capacity.
		Add a power supply.
		Reduce the network load.
	Is the position where the network power supply is connected OK? Determine whether the network power supply is connected to a suitable position, referring to 5.6 Instructions for Connecting the Network Power Supply.	Change the position where the network power supply is connected.
	Does any slave station have the same station number as the DN91?	Set the station numbers to avoid duplication.
	Is refresh request (Y(n+1)1) ON?	Turn ON refresh request (Y(n+1)1) with a sequence program.
	Is a termination resistance correctly connected to each end of the network?	Check if termination resistances are connected and if they are connected correctly.
	Is the same baud rate set for each station?	Make sure that the same baud rate is set for each station.
	Does the cable length exceed the permitted limit? Check the cable length restrictions appropriate for the cable thickness and baud rate, referring to 3.2 Performance Specifications.	Reduce the cable length.
		Reduce the baud rate.
		If thin cable is used in the trunk line, replace it with thick cable.
	Check the parameter settings.	See 8.1.2 Problems Due to Incorrect Parameter Settings
	Check the error codes. See 8.3 Troubleshooting using Error Codes.	Remedy for error code

Symptom	Check Item	Remedy
No Communication With Slave Stations After A Certain Station	Is the power supply connected to that station?	Turn ON the slave station power supply.
	Is the network power supply capacity sufficient?	Replace with a power supply of larger capacity.
		Add a power supply.
		Reduce the network load.
	Is the position where the network power supply is connected OK? Determine whether the network power supply is connected to a suitable position, referring to 5.6 Instructions for Connecting the Network Power Supply.	Change the position where the network power supply is connected.
	Is the communication cable correctly connected to that slave unit (no discontinuity)?	Correctly connect the cable.
	Are the slave stations set in the parameters?	Set the slave stations in the parameters. If a station is set as a reserved station, change the parameter setting to actively communicating station.
	Is a termination resistance correctly connected to each end of the network?	Check if termination resistances are connected and if they are connected correctly.
	Is the same baud rate set for each station?	Make sure that the same baud rate is set for each station.
	Does the cable length exceed the permitted limit? Check the cable length restrictions appropriate for the cable thickness and baud rate, referring to 3.2 Performance Specifications.	Reduce the cable length.
		Reduce the baud rate.
		If thin cable is used in the trunk line, replace it with thick cable.
	Check the parameter settings.	See 8.1.2 Problems Due to Incorrect Parameter Settings
	Check the error codes. See 8.3 Troubleshooting using Error Codes.	Take the remedy described for the error code.
No Communication With A Certain Station	Is the power supply connected to that station?	Turn ON the slave station power supply.
	Is the network power supply capacity sufficient?	Replace with a power supply of larger capacity.
		Add a power supply.
		Reduce the network load.
	Is the position where the network power supply is connected OK? Determine whether the network power supply is connected to a suitable position, referring to 5.6 Instructions for Connecting the Network Power Supply.	Change the position where the network power supply is connected.
	Is the communication cable correctly connected to that slave unit?	Correctly connect the cable.
	Is the slave station set in the parameters?	Set the slave station in the parameters.
	Is the slave station set as a reserved station in the parameters?	Change the slave station from a reserved station to an actively communicating station.
	Does any slave station have the same station number as another slaves station?	Set the station numbers to avoid duplication.
	Station number in the parameters differs from the station number of the actual slave station.	Set the station number in the parameters to match the station number of the actual slave station.
	Do the I/O data length and I/O communication connection type in the parameters match those of the actual station?	Set the I/O data length and I/O communication connection type in the parameters to match those of the actual station.

Symptom	Check Item	Remedy
No Communication With A Certain Station	Is the correct I/O data area referred to in buffer memory? Check that the I/O data area is correct, referring to 3.4.2 Details of the Buffer Memory.	Set the correct reference area.
	Is the correct baud rate set for the slave station?	Make the baud rate setting match the baud rate setting at the slave station.
	Is a termination resistance correctly connected to each end of the network?	Check if termination resistances are connected and if they are connected correctly.
	Does the cable length exceed the permitted limit? Check the cable length restrictions appropriate for the cable thickness and baud rate, referring to 3.2 Performance Specifications.	Reduce the cable length.
		Reduce the baud rate.
		If thin cable is used in the trunk line, replace it with thick cable.
	Check the parameter settings.	See 8.1.2 Problems Due to Incorrect Parameter Settings
	Check the error codes. See 8.3 Troubleshooting using Error Codes.	Take the remedy described for the error code.
Cannot Read Message Communication	Is Get Attribute (0101_H) stored in the message communication command area of buffer memory? Also, are the correct station number of the slave station, class ID, instance ID, and attribute ID stored in the message communication command area of buffer memory?	Modify the sequence program to store the correct values.
	Is message communication write processing or message communication error read processing conducted at the same time as the message communication read program is executed?	Modify the sequence program so that these are executed at different times.
Cannot Write Message Communication	Is Set Attribute (0102_H) stored in the message communication command area of buffer memory? Also, are the correct station number of the slave station, class ID, instance ID, and attribute ID stored in the message communication command area of buffer memory?	Modify the sequence program to store the correct values.
	Is message communication read processing or message communication error read processing conducted at the same time as the message communication write program is executed?	Modify the sequence program so that these are executed at different times.
Cannot Read Message Communication Errors	Is Read Communication Error Information (0001_H) stored in the message communication command area of buffer memory? Also, is the correct station number of the slave station stored in the message communication command area?	Modify the sequence program to store the correct values.
	Is message communication read processing or message communication write processing conducted at the same time as the message communication error read program is executed?	Modify the sequence program so that these are executed at different times.
A Communication Error Occurs when DeviceNet is Started Up	Are parameters set by the configuration software and parameters set by the sequence program both valid?	Disable one set of parameters, referring to 6.2 Setting with a Sequence Program.

8.1.2 Problems due to incorrect parameter settings

Refer to the following tables to determine the appropriate remedy for problems arising due to incorrect parameters or an incorrect sequence program.

Symptom	Check Item	Remedy
Parameters Cannot be Set by Sequence Program (Parameter set complete (Xn7) does not turn ON after parameter set request (Y(n+1)7) turns ON.)	Is refresh request (Y(n+1)1) ON before parameter set request (Y(n+1)7) turns ON? Also, is refresh request (Y(n+1)1) ON before parameter set complete (Xn7) turns ON?	Ensure refresh request (Y(n+1)1) does not turn ON between parameter set request (Y(n+1)7) turning ON and parameter set complete (Xn7) turning ON.
Parameter settings made by the sequence program are ignored.	Is FFFF$_H$ stored in the host station number storage area of buffer memory?	Store a station number from 0 to 63 in the host station number storage area of buffer memory.
Parameter settings made by the configuration software are ignored.	Have parameter settings made by the sequence program been disabled?	Set FFFF$_H$ as the host station number in buffer memory with the sequence program.
	Have the parameter settings made by the configuration software been disabled using the configuration software settings?	Change the parameter settings, referring to 6.3 Setting Parameters with the Configuration Software.

8.2 Troubleshooting Using LED Indications

Determine the cause of the error from the LED indicator status and take the appropriate remedy.

8.2.1 Errors caused by the master unit

RUN LED	L.RUN LED	MS LED	NS LED	Status	Check Item	Remedy
●	●	Green ●	Green ●	Normal operation	None	None
○	○	—	—	PC power supply is not turned ON.	Is PC power supply turned ON?	Turn ON the power supply.
				Abnormal DN91 unit	Correctly mounted in base unit?	Correctly mount in base unit.
					Is DN91 unit defective?	Repair or replace the DN91 unit.
				Error is caused by another unit.	Is another unit (including the base unit) defective?	Repair or replace the unit.
○	◎	—	—	Abnormal DN91 unit	Is DN91 unit defective?	Repair or replace the DN91 unit.
				Parameters being loaded	Wait and see	DN91 unit is defective if flashing continues. Repair or replace the DN91 unit.

● : Lit ○ : not lit ◎: Flashing ◎ r: Flashing (random) — : Undetermined

8.2.2 Errors caused by incorrect parameter settings or abnormal network

RUN LED	L.RUN LED	MS LED	NS LED	Status	Check item	Remedy
●	●	Green ●	Green ●	Normal	—	—
●	○	—	—	Communication stopped	Are parameters set?	Set parameters.
●	◎	—	—	Communication ready	Wait and see	Continuation of the flickering status indicates a parameter error or a connection fault of the termination resistor. Correct the corresponding parameter value or check the connection of the termination resistor.
●	◎ r	—	—	Parameter error	Check the parameters.	Correct the parameters.
●	—	Green ◎	—	Parameter error	Check the parameters.	Correct the parameters.
●	●	Green ●	Red ◎	Timeout occurred at a connection.	Wrong connection type for a slave station?	Correct the parameters.
					Is the slave station power turned ON?	Turn ON the slave station power.
					Is the same baud rate set for all slave stations?	Set the same baud rate for all slave stations.
					Is a termination resistance connected?	Connect a termination resistance.
					Is the communication cable correctly connected?	Correctly connect the communication cable.
					Does the total cable length exceed the permitted limit?	Reduce the baud rate.
						Reduce the total cable length.
					Does the drop line length or total drop line length exceed the permitted limit?	Reduce the baud rate.
						Reduce the drop line length or total drop line length.
					Is the network power supply correctly connected?	Correctly connect the network power supply.
					Is the network power supply capacity sufficient?	Increase the network power supply capacity.
						Change the position of the network power supply.
					Is the production inhibit time set too short in the parameters?	Correct the parameters.
					Is the expected packet rate set too short in the parameters?	
					Incorrect slave I/O data length in the parameters?	

● : Lit ○ : not lit ◎: Flashing ◎ r: Flashing (random) — : Undetermined

RUN LED	L.RUN LED	MS LED	NS LED	Status	Check item	Remedy
●	●	Green ●	Red ●	Duplicate station number error	Is a station number used for more than one station?	Correct the station numbers.
				Bus-off error	Is the same baud rate set for all stations?	Set the same baud rate for all stations.
					Is a termination resistance connected?	Connect a termination resistance.
					Is the communication cable correctly connected?	Correctly connect the communication cable.
					Does the total cable length exceed the permitted limit?	Reduce the baud rate.
						Is the network power supply capacity sufficient?
					Reduce the total cable length.	Increase the network power supply capacity.
						Change the position of the network power supply.
●	●	Green ●	Green ◎	Online communication not established	Wrong connection type for a slave station?	Correct the parameters.
					Is the slave station power turned ON?	Turn ON the slave station power.
					Is the same baud rate set for all stations?	Set the same baud rate for all stations.
					Is a termination resistance connected?	Connect a termination resistance.
					Is the communication cable correctly connected?	Correctly connect the communication cable.
					Does the total cable length exceed the permitted limit?	Reduce the baud rate.
						Reduce the total cable length.
					Does the drop line length or total drop line length exceed the permitted limit?	Reduce the baud rate.
						Reduce the drop line length or total drop line length.
					Is the network power supply correctly connected?	Correctly connect the network power supply.
					Is the network power supply capacity sufficient?	Increase the network power supply capacity.
						Change the position of the network power supply.
					Is the production inhibit time set too short in the parameters?	Correct the parameters.
					Is the expected packet rate set too short in the parameters?	
					Incorrect slave I/O data length in the parameters?	

● : Lit ○ : not lit ◎: Flashing ◎ r: Flashing (random) — : Undetermined

8.3 Troubleshooting Using Error Codes

Determine the problem and the appropriate remedy from the error codes.
Error codes include communication error codes and execution error codes for message communication.

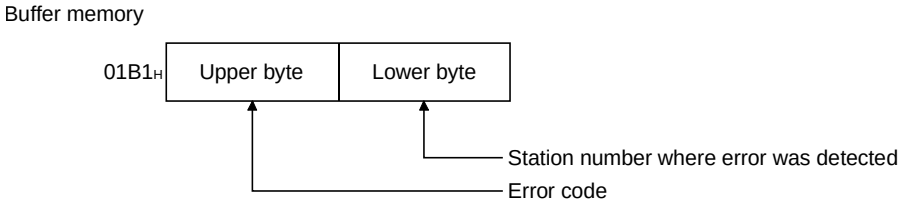
(1) Check the details of the communication error codes by turning on the error reset signal (Xn3) to read the error codes.

(2) Check the details of the message communication execution error codes by turning ON the message communication complete signal (Xn2) to read the error codes.

8.3.1 Communication error codes

Error information is stored at address 01B1H in buffer memory. It is separated into an upper byte and a lower byte.

Upper byte: Error code
Lower byte: Station number where error was detected



(1) In case the error-detected station number (lower byte of the error data) is FFH:

Error Code	Error Detected	Details	Remedy
35 H	DN91	Baud rate setting is out of range.	• Properly set the baud rate.
36 H	DN91	Host station number (MAC ID) is out of range.	• Set the host station number in a range of 0 to 63.
39 H	DN91	There are two or more stations in the network that have the same station number (MAC ID).	• Set station numbers to avoid duplication.
D2 H	DN91	No configuration software-based parameters are set.	• Set the parameters with the configuration software. (When the parameters are set with the sequence program, the error code has no significance.)

(2) In case the error-detected station number (lower byte of the error data) is FE$_H$:

Error Code	Error Detected	Details	Remedy
01 $_H$	DN91	Host station number (MAC ID) in the buffer memory is out of range.	• Set the host station number within 0000$_H$ to 0003$_H$ or FFFF$_H$.
02 $_H$	DN91	Baud rate in the buffer memory setting is out of range.	• Set the value within 1 to 3.
03 $_H$	DN91	Lower byte of the slave station in the buffer memory setting is out of range.	• Set within 0 to 63.
04 $_H$	DN91	Upper byte of the slave station in the buffer memory setting is out of range.	• Set at 01$_H$ or 80$_H$.
05 $_H$	DN91	Connection type in the buffer memory setting is out of range.	• Set one of 0001$_H$, 0002$_H$, 0004$_H$, and 0008$_H$.
06 $_H$	DN91	There is a slave station set in the buffer memory having the same station number as with the host station.	• Set the station numbers to avoid any overlap among all stations.
07 $_H$	DN91	No slave station is set.	• Set at least one slave station.
08 $_H$	DN91	Total length of all input data for all slave stations is too large.	• Keep the total length of 256 bytes or less for all slave stations.
09 $_H$	DN91	Total length of all output data for all slave stations is too large.	• Keep the total length of 256 bytes or less for all slave stations.
0A $_H$	DN91	Watchdog timeout action value in the parameters is illegal.	• Set one of 0000$_H$, 0001$_H$, 0002$_H$, and 0003$_H$.
0B $_H$	DN91	Expected packet rate in the buffer memory is smaller than the production inhibit time.	• Set the value of Expected packet rate >= Production inhibit time.
0C $_H$	DN91	E^2PROM check-sum error.	• Rewrite the parameters. • Avoid powering OFF or resetting in the midst of writing the parameters.

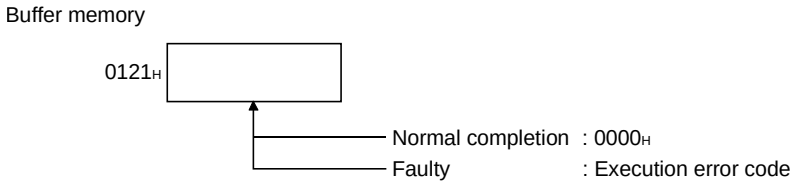
(3) In case the error-detected station number (lower byte of the error information) is any value other than FFH and FEH:

Error Code	Error Detected	Details	Remedy
01 H	DN91	A fault has been detected with the network after communication being started.	• Check if cables are properly connected.
1E H	DN91	The slave station did not respond.	• Inspect the state of the network and slave stations closely: Are MAC IDs and baud rate properly set? Any faulty slave stations? Any missing terminal resistance? etc.
20 H	Slave station	The slave station responded with an error that is not defined.	• Read the communication error information, and take remedial actions thereupon.
23 H	Slave station	The slave station responded with an error when establishing a connection.	• Read the communication error information, and take remedial actions thereupon.
24 H	DN91	Input data size of the parameters differs from the size of the actual slave station	• Refer to the operation manual of the slave station, and set a proper input data size.
25 H	DN91	Output data size of the parameters differs from the size of the actual slave station.	• Refer to the operation manual of the slave station, and set a proper output data size.
26 H	DN91	Received response data for the function that is not supported by DN91.	• Refer to the operation manual of the slave station, and avoid sending from the slave station any function that is not supported by DN91. • Inspect the state of the network and slave stations closely as for any missing terminal resistance.
27 H	Slave station	The connection is already in the designated mode.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
28 H	DN91	Unexpected illegal data has been received when establishing a connection.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
29 H	Slave station	Connection is already established with the slave station.	• Wait and observe for a while, and if the connection is not established, reset the slave station.
2A H	DN91	Polling response data length differs from the length of data that has been read from the slave station when establishing a connection.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
2B H	DN91	The first division data has been received twice during divided receipt of polling response.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
2C H	DN91	Division data number that has been received is not what is expected during divided receipt of polling response.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
2D H	DN91	Intermediate or the last data has been received before receiving the first division data during divided receipt of polling response.	• Inspect the state of the network and slave stations closely as for any missing terminal resistance.
3B H	DN91	Two or more station numbers of the same MAC ID have been detected in the parameters.	• The parameters contain two or more slave stations having the same station number. Correct the station numbers. • The parameters contain slave station(s) of the same station number as the host station number.
45 H	DN91	O-address in the parameters exceeds 255.	• Set the O-address at 255 or less.
46 H	DN91	I-address in the parameters exceeds 255.	• Set the I-address at 255 or less.
47 H	DN91	Illegal connection type is designated.	• Check if the connection type value is correct.
49 H	DN91	The value of the expected packet rate is less than that of the production inhibit time.	• Set the expected packet rate value greater than that of the production inhibit time.

8.3.2 Execution error codes for message communication

The execution error codes are stored at address 0121H in buffer memory.

Normal completion : 0000H
Faulty : Execution error code



(1) Reading communication error information

Error Code	Error Detected	Details	Remedy
161	DN91	Designated slave station number is outside the range 0 to 63.	• Designate from 0 to 63.

(2) Reading/writing attributes

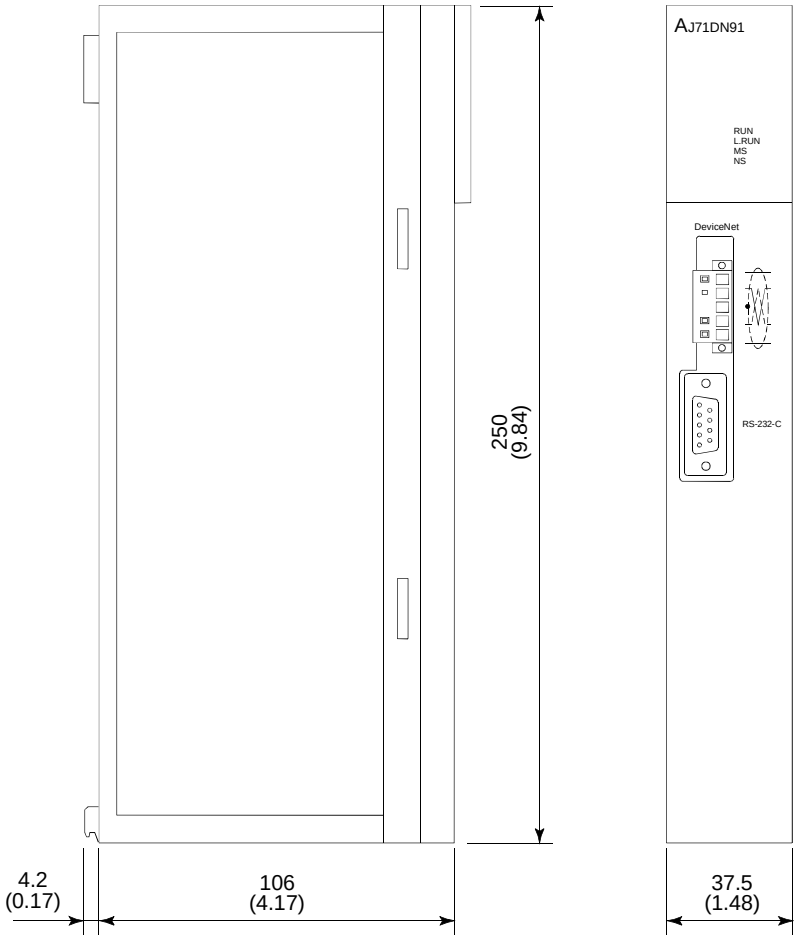
Error Code	Error Detected	Details	Remedy
2	Slave station	The required resources could not be used for the object to execute a requested service.	• Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
8	Slave station	The requested service was not mounted or was not defined for this object class or instance.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
9	Slave station	Invalid attribute data was detected.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
11	Slave station	The object is already in the mode or status requested by the service.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Use Get Attribute to confirm the current status. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
12	Slave station	The object cannot execute the requested service in the current mode or status.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Use Get Attribute to confirm the current status. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
14	Slave station	A request was received to change a protected attribute.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.

Error Code	Error Detected	Details	Remedy
15	Slave station	The enabled/privilege check failed	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
16	Slave station	The requested service cannot be executed in the current device status.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
17	DN91	The slave station did not respond.	• Investigate overall status of network and slave station. Is the slave station down, or the termination resistance disconnected, for example?
19	Slave station	Insufficient data supplied after the designated operations were conducted.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • For Set Attribute, check if the designated data is insufficient and the data length is correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
20	Slave station	The designated attribute is not supported.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
21	Slave station	The service supplied more data than expected.	• Set the data returned by the slave station to 240 bytes maximum.
22	Slave station	The designated object does not exist in the slave station.	• Check if the designated station number, class ID, instance ID, and attribute ID are correct. • Refer to the slave station manual to determine the conditions for the slave station to notify this error, and take the appropriate remedy.
50	DN91	Incorrect response data format.	• Investigate overall status of network and slave station. Is the termination resistance disconnected, for example?
55	DN91	Designated slave station number is outside the range 0 to 63.	• Designate from 0 to 63.
57	DN91	Incorrect sequence during packet receipt.	• Investigate overall status of network and slave station. Is the termination resistance disconnected, for example?
200	DN91	No parameters set for the designated slave station.	• Designate a slave station with set parameters.
257	DN91	Data length set in buffer memory exceeds 241.	• Set the data length 240 or less.
258	DN91	Incorrect value was set in command number of buffer memory message communication command area.	• Set the command number at one of 0001_H, 0101_H, and 0102_H.

APPENDICES

APPENDIX 1 External View

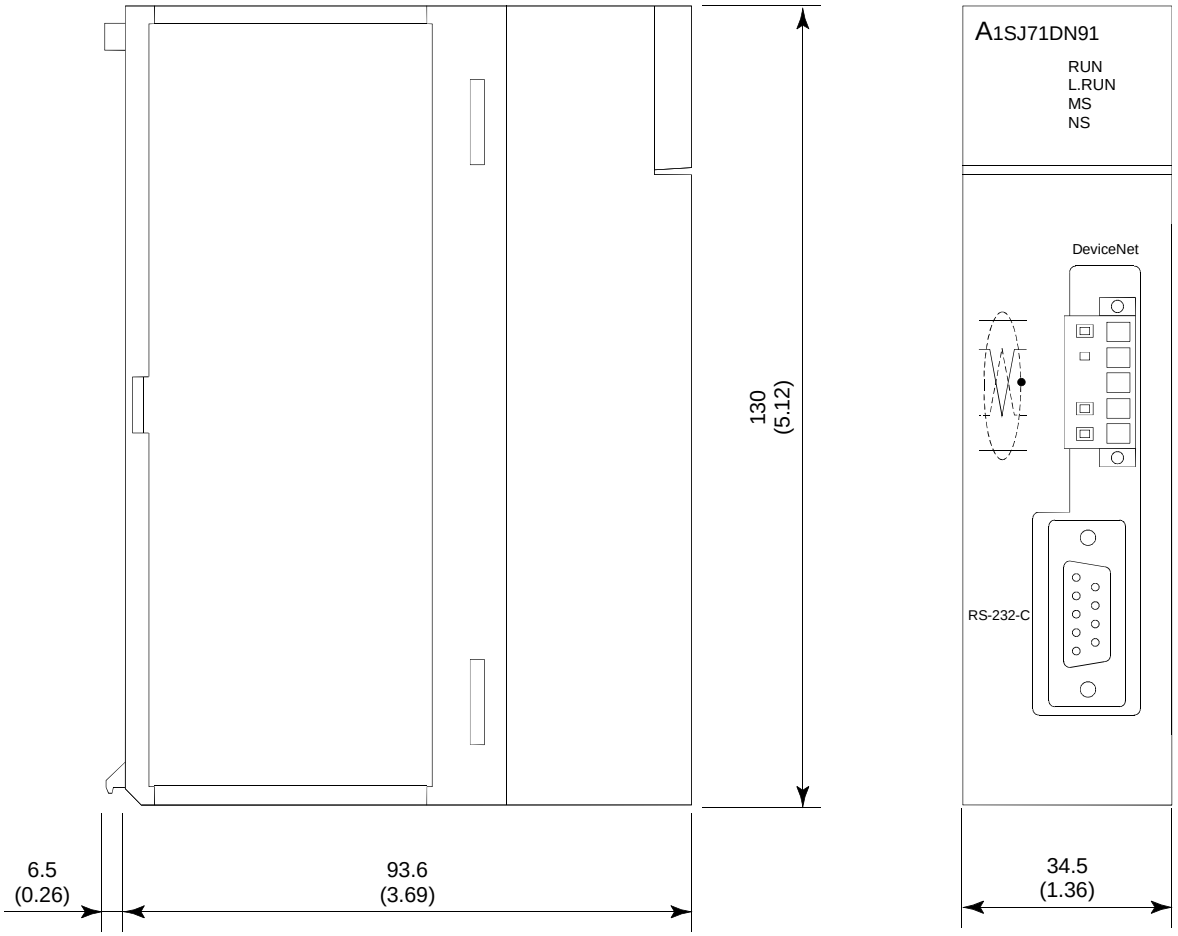
1.1 AJ71DN91



Unit : mm (inch)

APP

1.2 A1SJ71DN91



Unit : mm (inch)

APPENDIX 2 Parameter Setting Sheet

Item	Setting Range	Buffer Memory Address	Comments	Set Value
Host station number (host station MAC ID)	0000_H to $003F_H$ (0 to 63)	$01D4_H$	Station numer of DN91.	
Baud rate	1 to 3	$01D5_H$	1: 500kbaud 2: 250kbaud 3: 125kbaud	
Station number and message group of □ th station	Upper byte: 01_H to 04_H or 80_H	$01D8_H$ + (□ -1) x 8	01_H: Station that supports UCMM and uses the message group 3. 02_H: Station that supports UCMM and uses the message group 2. 03_H: Station that supports UCMM and uses the message group 1. 04_H: Station that does not support UCMM (Server dedicated to group 2) 80_H: Reserved station	
	Lower byte: 00_H to $3F_H$ (0 to 63)		Station number of nth slave station	
Connection type of □ th slave station	0001_H, 0002_H, 0004_H, 0008_H	$01D9_H$ + (□ -1) x 8	Connection type for I/O communication 0001_H: Polling 0002_H: Bit strobe 0004_H: Change of state 0008_H: Cyclic	
Number of byte module points in □ th slave station	Upper byte: Number of output byte modules	$01DA_H$ + (□ -1)x 8	Units: Bytes (for both)	
	Lower byte: Number of input byte modules			
Number of word module points in □ th slave station	Upper word: Number of output word modules	$01DB_H$ + (□ -1) x 8	Units: Words (for both)	
	Lower word: Number of input word modules			
Number of double-word module points in □ th slave station	Upper double-word: Number of output double-word modules	$01DC_H$ + (□ -1)x 8	Units: Double-words (for both)	
	Lower double-word: Number of input double-word modules			
Expected packet rate for □ th slave station	Communication watchdog timer value for slave station (ms)	$01DD_H$ + (□ -1) x 8	Set the communication watchdog timer value for the slave station. Sets the slave station communication watchdog timer. If the communication between the master station and the first slave station ceases during this set time, the first slave station takes the action designated in buffer memory address $01DE_H$. If set value = 0000_H (default value), setting = 500 ms If set value ≠ 0000_H, communication watchdog timer setting = (set value - 1) ms	
□ th Slave Station Watchdog Timeout Actions	0000_H, 0001_H, 0002_H, 0003_H	$01DE_H$ + (□ -1) x 8	Slave station watchdog timeout action Set value = 0000_H (default value) Set value = 0001_H: TIMEOUT Set value = 0002_H: AUTO DELETE Set value = 0003_H: AUTO RESET	
□ th Slave Station Production Inhibit Time	Slave station minimum send interval (ms)	$01DF_H$ + (□ -1) x 8	The slave station minimum send interval sets the minimum time that the slave station can prepare the data to send. The master station sends polling requests and bit strobe requests to the slave station during this interval. If set value = 0000_H (default value), setting = 10 ms If set value ≠ 0000_H, minimum send interval = (set value - 1) ms	

Notes:1) □ = 1 to 63

2) Copy this sheet for use when setting the parameters.

APPENDIX 3 List of Communication Parameter with Each Maker's Slave Station

Examples of parameter setting for communicating with each maker's slave station are listed below. Contact each maker for inquires about the details of parameter setting.

Maker Name	Type	Name	Set Value (in brackets set value when parameters are set with a sequence program is indicated)									Remark	
			Connection Type	Number of Byte Modules		Number of Word Modules		Number of Double Word Modules		Expected Packet Rate	Watchdog Timeout Action	Production Inhibit Time	UCMM	Message Group
				Output	Input	Output	Input	Output	Input					
Mitsubishi Electric Corporation	FR-A5ND	A500 series inverter DeviceNet option	Polling (H1)	04_H	04_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	Yes	3
Rockwell Automation Japan	1794ADN	Flex I/O DeviceNet adapter	Polling (H1)	00_H	02_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	Yes	3
			Bit strobe (H2)							1000 ms (K1001)		10 ms (K11)		
			Change of state (H4)							0 ms (H0)		0 ms (H0)		
			Cyclic (H8)							30 ms (K31)		25 ms (K26)		
	1794-IB16	Flex I/O input modules	—	02_H	02_H	00_H	00_H	00_H	00_H	—	—	—	—	—
	1794-OB16	Flex I/O output modules	—	02_H	02_H	00_H	00_H	00_H	00_H	—	—	—	—	—
OMRON Corporation	DRT1-ID08	CompuBus/D 8 points input	Polling (H1)/ Bit strobe (H2)	00_H	01_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	DRT1-ID16	CompuBus/D 16 points input	Polling (H1)/ Bit strobe (H2)	00_H	02_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	DRT1-OD08	CompuBus/D 8 points output	Polling (H1)	01_H	00_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	DRT1-OD16	CompuBus/D 16 points output	Polling (H1)	02_H	00_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	CompoBus/D 4 points analog input	DRT1-AD04	Polling (H1)/ Bit strobe (H2)	00_H	00_H	00_H	04_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	CompoBus/D 2 points analog output	DRT1-DA02	Polling (H1)	00_H	00_H	02_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
Izumi Electric Co., Ltd.	DeviceNet 16 points digital input	SX5D-SBN16S	Polling (H1)	00_H	02_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	DeviceNet 16 points digital output	SX5D-SBT16K	Polling (H1)	02_H	00_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—
	DeviceNet 8 points digital input/8 points digital output	SX5D-SBM16K	Polling (H1)	01_H	01_H	00_H	00_H	00_H	00_H	1000 ms (K1001)	Timeout (H1)	10 ms (K11)	No	—

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.
However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
(2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

Model AJ71DN91/A1SJ71DN91 DeviceNet Master Module

User's Manual

MODEL	AJ71DN91-U-S-E
MODEL CODE	13JL69
SH(NA)-4004-D(0407)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : 1-8-12, OFFICE TOWER Z 14F HARUMI CHUO-KU 104-6212,JAPAN
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