DeviceNet Module DN211 for

PROSEC - T2/T2E/T2N

Instruction Manual

(Appendix3 DN211A)

REQUIREMENTS

- Read this instruction manual carefully before operating.
- Keep the manual aside to use when necessary.
- Pack the manual with the DN211 when transferring or reselling.

January, 2001

TOSHIBA CORPORATION

Important Information

Misuse of this equipment can result in property damage or human injury. Because controlled system applications vary widely, you should satisfy yourself as to the acceptabillity of this equipment for your intended purpose. In no event will Toshiba Corporation be responsible or liable for either indirect or consequential damage or injury that may result from the use of this equipment.

No patent liability is assumed by Toshiba Corporation with respect to the use of information, illustration, circuits equipment, of application examples in this publication.

Safety Precautions

Thank you for purchasing Toshiba's DeviceNet module (DN211) for programmable controllers PROSEC-T2 series (T2/T2E/T2N). This instruction manual describes the handling, precautions and operation of the DN211.

Be sure to carefully read this manual and all of other related documents to learn the safety precautions, notes, and knowledge about the DN211 before its installation, operation, or inspection. This will allow you to operate your DN211 comfortably.

Important Information

1. Toshiba's DN211 is designed and manufactured for use with general industrial equipment(manufacture line control devices, machine tools, etc.); it is not intended for use with equipment and systems which will endanger people's life during operation.

   Contact the Toshiba dealer in advance when you are going to use your DN211 for special applications such as transport vehicles(train, etc.), medical equipment, aerospace equipment, nuclear power control equipment, underwater relay equipment, or other similar applications.

2. Toshiba's DN211 is manufactured under strict quality control. However, be sure to install safety systems to minimize the effect of a possible accident before you apply your DN211 to the equipment which will endanger people's life or cause serious damage on the surroundings if the DN211 should break down.

3. Toshiba's DN211 is meant for those who have general knowledge of handling control equipment, especially the knowledge about installation, wiring, operation, and maintenance of the DN211. Incorrect handling of the DN211 can cause electric shock, fire, failure, or/and malfunction. Therefore, don't engage in the installation, wiring, operation, or maintenance of the DN211 if your knowledge including electrical knowledge is not enough to handle control equipment. Instead, ask the qualified person to do such work.

4. This instruction manual and accompanying documents are meant for those who have general knowledge about the programmable controller and how to handle control equipment. If you have any questions on the content of this manual, don't hesitate to contact the Toshiba dealer.

Safety Precautions (continued)

[Warning indication]

This instruction manual has the following important indications and symbols to prevent bodily injury and property damage during operation. Be familiar with these safety indications to follow during operation. After reading the text, keep the manual aside to consult when necessary.

Description of Safety Signs

Indication	Meaning
⚠ **DANGER**	**Indicates misuse of the handling could cause a fatal accident or serious injury.**
⚠ **CAUTION**	**Indicates misuse of the handling could cause injury or material damage.**

Injury means a hurt, burn, or electric shock, which requires neither hospitalization nor long-term medical treatment by visits. Some of the **CAUTION** items, however, could bring about grave consequences depending on the situation. So be sure to always follow the CAUTION instructions.

Safety Precautions (continued)

· **Precaution for operation**

⚠ DANGER

1. Configure an emergency-stop circuit, interlock circuit, and/or other similar safety circuits outside the PC and DN211.

   If the PC or DN211 gets failed or malfunctioned, it can cause an accident which will lead to bodily injury and/or mechanical damage.

   T2/T2E/T2N User's Manuals
   3. Preparation for Operation (hardware)

⚠ CAUTION

2. Secure the safe environment before executing program modification, forcible output, RUN, or HALT instruction during operation. An operational mistake can cause mechanical damage or accident.

   T2/T2E/T2N User's Manuals
   3. Preparation for Operation (hardware)

· **DIP switch for setting the operating mode/communication rate**

⚠ CAUTION

1. Set and keep "OSEN" on the DIP switch to OFF. Setting it to ON can get failed or malfunctioned.
2. When you set "BUSOFF" on the DIP switch to OFF, transmission will restart automatically even when busoff occurs. Unless the cause of the DN211's busoff (cause of communication error) is solved, however, busoff may get repeated.
3. When you set both of communication rate DR0 and DR1 to ON and turn on the power of the T2/T2E/T2N, "Communication Rate Setting Failed" will appear with the following indications:
   - The "MS" LED is blinking red.
   - "F7" and the local station node address are being displayed alternately on the 7-segment LED.

   To clear these indications, set DR0 and DR1 correctly and, issue a reset request or turn OFF and ON the power.
4. Set the communication rates of your nodes being connected to the network, to the same communication rate. **Setting different communication rates on your different nodes will cause slave devices or the DN211 to get malfunctioned, resulting in no communication started.**

   Read the relevant manuals and descriptions to set the communication rate of your slave devices.
5. Don't change over the communication rates while your T2/T2E/T2N is rising just after the turning on power. In particular, never change the communication rate while communicating with slave devices. Failing to do so will cause "Communication Rate Setting Failed" to appear.

   To clear this indication, set the DIP switch to the correct setting and, issue a reset request or turn OFF and ON the power.

   3.2.1 DIP Switch for Setting the Operation Mode/Communication Rate

Safety Precautions (continued)

· **Rotary switch for setting the node address**

⚠ CAUTION

1. When you set a value within 64 to 99 to the node address of your DN211 and turn ON the power of your T2/T2E/T2N, "Node Address Setting Failed" will appear with the following indications:
   - The "MS" LED is blinking red.
   - "F6" and the local station node address are being displayed alternately on the 7-segment LED.

   To clear these indications, set the correct value to the node address and, issue a reset request or turn OFF and ON the power.
2. If your DN211 node address has the same value with another node and when the DN211 comes into run state, "Node Address Duplicated" will appear with the following indications:
   - The "MS" LED is lighting red and/or the "NS" LED is lighting red.
   - "70" and the local station node address are being displayed alternately on the 7-segment LED.

   To clear these indications, set the correct value to the node address and, issue a reset request or turn OFF and ON the power.

3.2.2 Rotary Switch for Node Address Setting

· **Mounting in the base unit**

⚠ CAUTION

1. Since the DN211 is designed for Toshiba's T2 series, be sure to mount your DN211 in the base unit, instead of using it in stand-alone; don't use it for other applications. Unauthorized applications can cause electric shock, bodily injury, and/or mechanical malfunction.
2. Be sure to turn OFF the power (on the T2 side and network side) before attaching or detaching the DN211 and/or the terminal block. Failing to do so will cause electric shock, malfunction, and/or failure.
3. Keep the DN211 free from foreign matter such as electric-wire waste. Failing to do so could cause fire, failure, and/or malfunction.
4. Check the connectors, cables, and base unit of the DN211, for their firm connection and mounting using stoppers and screws. Note loose connection or mounting can be shaky or easily disconnected off, resulting in failure or malfunction of the DN211.

3.3 Mounting in the Base Unit

Safety Precautions (continued)

· **Connection with the network**

⚠ CAUTION
1. Don't engage in attaching or detaching the DeviceNet cable with the network side connector during network operation. Failing to do so can cause reverse connection or short circuit of the network power, resulting in no communication with other nodes.
2. When you connect the DeviceNet cable with the network side connector, be sure not to make the wrong connection. Failing to do so can cause short circuit of the network power, resulting in no communication with other nodes.
3. Neither attach nor detach the network side connector with the device side connector on the DN211 front panel while T2/T2E/T2N is rising just after the power is turned ON. Failing to do so can cause the DN211 to fail or malfunction.
4. Attaching the opposite end of the network side connector with/from the device side connector is not possible because of the specific form. Trying connecting the wrong end by excessive force can damage both the network side connector and the device side connector.
5. Be sure not to wire the cable in too tightly stretched state or in bent state. Also, don't put heavy stuff on the cable. Otherwise, the cable could break.
6. Ask the qualified expert for the installation work of the DeviceNet cables because it requires sufficient safety and noise-suppression measures. Refer to DeviceNet Volume I, Release 1.3, for the standard installation.
3.4 Connection with the Network

Safety Precautions (continued)

· **Turning ON/OFF the power of master/slave and the network**

⚠ CAUTION

1. Be sure to turn ON the network power before turning ON the power of the DeviceNet devices.

   Some nodes of the slave devices use the network power as the operation power while other slave devices indicate an error when their work power is not supplied. Therefore, be sure to switch ON the network power. Also note unless the network power is switched ON, your DN211 cannot start communication with slave devices.

2. Be sure the network power is supplied to all the nodes being connected with the network. The node to which no network power is supplied could cause communication obstacle to other nodes.

3. Make sure the power of all slave devices is switched ON before the DN211 begins communication. When the DN211 begins communication while the power of a slave device is not switched ON, the DN211 will display an error message of no response from that device.

4. While network communications are operating, don't shut OFF the network power. Failing to do so will cause the entire network communications to stop and, one of the nodes become busoff state.

5. Switch OFF the T2/T2E/T2N side power at last after the DN211 begins communications. This helps the master device (DN211) to be recognized from the network and prevents slave devices from malfunctioning.

3.5 The Network Power/Grounding

Safety Precautions (continued)

Relating to the following sections:

- **How to handle your DN211 (software)**
- **Examples of DN211 applications**
- **RAS information**

⚠ CAUTION

1. Chapter 4 describes the subjects necessary for using diverse functions of the DN211 from the T2/T2E/T2N. Chapter 5 describes, based on the subjects explained in Chapter 4, setting the DN211 parameters, activating transmission, inputting/outputting data with slave devices, and the procedure for reading RAS information including event history, and sample programs.

   Write programs after understanding the contents. As sample programs are basic, you need to examine your programs from beginning to end before applying them to actual systems.

   4. How to Handle Your DN211 (software)
   5. Examples of DN211 Applications
   6. RAS Information (except RAS area on communication memory)

- **Allocation of slave device data to input/output data area**

⚠ CAUTION

1. When a slave device has odd transmission/reception bytes in size, **the actual size plus 1 byte are allocated to the DN211 input/output area.**
2. When you add a new slave device, enter a new value larger than the node addresses of the present slave devices. For Figure 4.8, enter a value larger than "41" for the node address of a new slave. If the node address of a new slave device is set to "18", allocating data area of node addresses 20/30/40 will be shifted.
3. Don't change the input/output data size for slave devices (FLEX-I/O, etc.) which are flexible in data allocation size. If changed, the slave devices with a node address larger than that of the slave device changed data size will be shifted in their data allocation.

   4.4 Allocating Slave Device Data to the Input/Output Data Area

- **Operating mode of the T2/T2E/T2N and the DN211**

⚠ CAUTION

1. If the T2/T2E/T2N turns into HALT/ERROR mode, the DN211 in run mode becomes standby mode.

   4.6.1 DN211 Operation Mode
   5. Examples of DN211 Applications

Safety Precautions (continued)

· **Action when your DN211 is reset**

⚠ CAUTION

1. Neither issue a request from the T2/T2E/T2N to DN211 while the DN211 is being reset nor execute data input/output. Otherwise, the instruction requested will be completed abnormal (error of station mode abnormal), or the module self-check will fail turning into down mode.

[4.6.2 Reset Request]

· **Setting slave device parameters**

⚠ CAUTION

1. The parameter setting request (slave device) sets the parameters of slave devices on to the non-volatile memory in the DN211. As long as the slave devices configuration is unchanged, you don't need to execute this request every time when the power is switched ON. In addition, when the parameters of the slave device requested and the parameters of the slave device in the non-volatile memory are same, this setting request is not executed.
2. When the slave devices configuration needs to be changed, delete the salve devices parameters using a reset request before setting new slave devices parameters.
3. The number of times available for setting slave devices parameters in the non-volatile memory of the DN211 is 300 times.
4. The DN211 has the following restriction for transmitting "0 byte" to a slave device from the DN211.
   - When a slave device comes into no communication state with the DN211 due to some reason (for example, the power of the slave device is OFF; the connector is disconnected, etc.), the DN211 cannot recognize the slave device is abnormal. Even after the cause of the failed communications is solved, the DN211 and the slave device cannot communicate with each other.

   Note: The above restriction of the present DN211 will be solved by a version-up of the internal software.

4.6.4 Parameter Setting Request (slave device)

· **Installation environment and mounting in the base unit**

⚠ CAUTION

1. Apply the environment specified in the User's Manual of the T2/T2E/T2N.

   When using your DN211 in the environment other than specified, the DN211 can cause electric shock, fire, failure, and/or malfunction.
2. Mount your DN211 in the way specified in the User's Manual of the T2/T2E/T2N.

   If mounted in the direction other than specified or if mounted incorrectly, the DN211 could fall off, or cause fire, failure, and/or malfunction.

8.1 Installation Environment and Mounting in the Base Unit

Safety Precautions (continued)

· **Mounting/removing the module**

⚠ CAUTION
1. Since the DN211 is designed for the T2 series, be sure to attach it to the base unit. Don't use your DN211 in stand-alone state or to other applications. Failing to do so could cause electric shock, injury, and/or failure. 2. Be sure to turn OFF the power before mounting, removing, wiring, or un-wiring the DN211. Failing to do so can cause electric shock, malfunction, and/or failure. 3. Keep your DN211 free from foreign matter such as electric-wire waste. Failing to do so could cause fire, failure, and/or malfunction. 4. Check the connectors and cables and the DN211 mount in the base unit, for their firm connections and mount using stoppers/screws. Loose connection and mounting becomes shaky and disconnected, resulting in failure or malfunction. 8.2 Mounting/Removing the Module

· **Wiring the power and grounding**

⚠ CAUTION
1. Be sure to turn OFF the power before wiring cables. Failing to do so could cause electric shock. 2. Use crimp-on connectors with sheath or cover the conducting part with tape when wiring your T2/T2E/T2N power module. Also, handle the terminal block cover correctly to avoid fall-off and damage when fixing. Be sure to fix the cover on the terminal block when completing the wiring. If the conducting part is exposed, you can have electric shock. 3. Be sure to have grounding. When not grounded, electric shock and/or malfunction can occur. 4. Make sure the wiring is correct when connecting the DeviceNet cables to the network side connector. The short circuit of the network power, etc. can fail communication with other nodes. 5. When you are going to detach or connect the network side connector to/from the device side connector on the DN211 front panel, don't engage yourself while the T2/T2E/T2N side power is rising. Failing to do so can cause the DN211 to fail or malfunction. 6. Attaching the opposite end of the network side connector with/from the device side connector is not possible because of the specific form. Trying connecting the wrong end by excessive force can damage both the network side connector and the device side connector. 7. Ask a qualified person to wire cables. Incorrect wiring can cause fire, failure, and/or electric shock. 8.3 Power Unit Wiring/Grounding

Safety Precautions (continued)

· **Basic caution in network Installation**

⚠ CAUTION
1. Ask the qualified subcontractor for sufficient safety and noise-suppression measures when installing the DeviceNet cable. Refer to DeviceNet Volume I, Release1.3, for the standard installation. 2. It is recommended to consign a subcontractor specialized in safety measures and standards. 3. Avoid the network components of the DeviceNet cable from being installed in a noisy environment. When installing, be sure to furnish noise-suppression measures as described in the following section. 8.4 Network Installation

· **Maintenance**

⚠ CAUTION
1. Be sure to turn OFF the power mounting or removing the module, terminal block, and cable. Failing to do so can cause electric shock, malfunction, and/or failure. 2. Carry out daily check, periodical check, and cleaning to keep the system in normal condition. 3. If your DN211 does not operate normally, refer to "7. Troubleshooting" to identify the cause of the trouble. Contact a Toshiba's branch office (or dealer) or service agency for returning your DN211 for repair when failed. Operation and safety of your DN211 can be guaranteed only when repaired by Toshiba or a Toshiba's authorized service agency. 4. Neither try to disassemble nor modify the hardware of the module. Similarly, don't modify the software by any means. Failing to do so could cause fire, electric shock, and/or injury due to failure or malfunctioning. 5. Make sure you are safe when measuring the voltage on the connector of the module. Failing to do so could cause electric shock. 6. Stop the network and turn OFF the T2/T2E/T2N side power before replacing the module. Failing to do so could cause electric shock, malfunction, and/or failure. 7. Don't use your DN211 in abnormal condition such as smoking or nasty smelling. Failing to do so could cause fire, electric shock, and/or failure. If such an abnormal condition happens, turn OFF all the power supplies immediately and contact a Toshiba branch office (or dealer) or authorized service agency. Since it is very dangerous, don't engage yourself in modifying or repairing your DN211 by any means. Appendix (maintenance)

Usage Recommendations

This section puts together the knowledge and handling manners necessary for correct operation. Read the section carefully and be familiar with equipment knowledge, safety information, and notes.

· **Network cnfiguration**

Usage Recommendation
1. Don't make a network configuration whose extended trunk line and drop lines have no node being connected. 2. Don't attach a terminal resistor to the node. It could cause communication error. 3. Attach a terminal resistor to both ends of the trunk line; don't attach a terminal resistor on the end of a drop line. Attach only to both ends of the trunk line. 1.2 Network Configuration of the DeviceNet

· **Switch setting**

Usage Recommendation
1. Use a small minus screwdriver for changing the value of the DIP switch. 3.2.1 DIP Switch for Setting the Operation Mode/Communication Rate

Usage Recommendation
1. Use a small minus screwdriver for changing values of the rotary switch. 3.2.2 Rotary Switch for Node Address Setting

· **Connecting your DN211 with the network side connector**

Usage Recommendation
1. Loosen the cable fixing screws on the connector before inserting a cable into the network side connector. The cable cannot be fixed when the screws are kept tightened. 2. Colors corresponding to cable colors are printed by the device side connector of the DN211. Match the cable colors with the printed colors to have correct wiring. 3. The DN211 and the DN311 (DeviceNet module for T3/T3H) have different directions for attaching the network side connector. 4. DeviceNet cable, power tap, and device tap (connecting the trunk line with drop lines) are necessary when constructing a system using a DeviceNet. Refer to "3.6 The Network Components" for detail. Some of the network components must be prepared by the user. 5. When you use the network side connector that has the upper and lower rows with holes for cables (at the left-side Figure 3.5), the connector protrudes from the left-side DN211 about 5mm. When you attach or detach the left-side module of DN211, you must detach the connector from DN211. 3.4.2 Connecting Network Side Connector to the DN211

Usage Recommendations (continued)

· **Network power configuration**

Usage Recommendation
1. Consider not only current capacity of the trunk line but also current capacity of drop lines when you install a node on a drop line. 2. In particular, when you are connecting nodes in daisy chain on a drop line, be careful not to have insufficient current capacity. 3. Use a network power whose capacity is much larger than the total current consumption necessary for the network. 3.5.2 How to Configure Network Power Units

· **Network power unit**

Usage Recommendation
1. Use a network power whose capacity is much larger than the total current consumption necessary for the network. 3.5.3 The Network Power Unit(24Vdc)

· **Registering your DN211 module**

Usage Recommendation
1. When your DN211 is going to be I/O registered in the T2/T2E/T2N, leave blank for the slot where the DN211 is installed. After automatic allocation is performed, the DN211-installed slot is left blank. 4. How to Handle Your DN211 (software)

· **Node address of your DN211**

Usage Recommendation
1. Set the node address of your DN211 to a value smaller than the node addresses of slave devices(because of the feature of CAN currently used in the DeviceNet). 4.6.3 Parameter Setting Request (local node)

· **How to solve overrun errors**

Usage Recommendation
1. Reduce the network communication speed when an overrun error occurs (500 kbps -> 250 kbps -> 125 kbps). 7. Troubleshooting (Data Communication with Slave Devices)

About This Manual

Thank you for purchasing Toshiba's programmable controller PROSEC-T2 series (T2/T2E/T2N).

This manual describes the specification, handing manners, and sample programs of the DeviceNet module (called as the "DN211") used for PROSEC-T2 series. Read this manual to handle and operate your DN211 correctly.

This manual consists of the following chapters:

Chapter 1: Overview of the DeviceNet Module

Outlines functions of the DN211, specification, and application systems, etc. Read this chapter to know basic performances of the DN211.

Chapter 2: Names and Functions of DN211 Parts

Describes the names and functions of DN211 parts. Read this chapter carefully since important information, required for hardware settings in the next chapter, is included in this chapter.

Chapter 3: Preparation for Operation (hardware)

Describes the hardware preparation and setting necessary for your DN211 operation.

Chapter 4: How to Handle Your DN211 (software)

Explains accessing the DN211 from the T2/T2E/T2N and software settings.

Chapter 5: Examples of DN211 Applications

Describes sample programs of handling the DN/211 explained in Chapter 4.

Chapter 6: RAS Information (except RAS area on communication memory)

Describes the formats and contents of RAS information on the DN211 (except for RAS area on communication memory).

Chapter 7: Troubleshooting

Explains possible causes and solutions when your DN211 malfunctions.

Chapter 8: Installation/Wiring Work

Explains how to install your DN211 and T2/T2E/T2N, how to wire transmission cables, and how to arrange other preparation work.

Appendix

Describes the maintenance and check items and the execution time of READ/WRITE instructions of the T2/T2E/T2N.

In addition to this instruction manual, the following descriptions about the T2/T2E/T2N, instruction words, programmer, and computer link procedure transmission are also prepared for your reading.

- T2 User's Manual Basic Hardware and Function (UM-TS02***-E001)
  Describes hardware (basic unit, basic I/O) and the main unit functions of the T2.
- T2E User's Manual Basic Hardware and Function (UM-TS02E**-E001)
  Describes hardware (basic unit, basic I/O) and the main unit function of the T2E.
- T2E User's Manual Enhanced Communication Function(UM-TS02E**-E003)
  Describes the functions and how to handle the optional communication card for the T2E.
- T2N User's Manual Basic Hardware and Function (UM-TS02N**-E001)
  Describes hardware (basic unit, basic I/O) and the main unit functions of the T2E.
- Instruction Manual TOSLINE-S20LP T2N/T3H Stations (6F3B0356)
  Describes the system configuration of the T2N built-in data link system "TOSLINE-S20LP" and its device configuration, and the functions, performances, and handling of "TOSLINE-S20LP."
- Built-in Ethernet Module for T2N (PU235N/245N) Instruction Manual (6F3B0362)
  Describes the Ethernet built-in T2N and the handling.
- T-Series Instruction Set (UM-TS03***-E004)
  Explains a detailed specification of instruction words about the ladder diagram and SFC programming languages, which are supported by Toshiba's T-series.
- T-Series Computer Link Operation Manual (UM-TS03***-E008)
  Describes the specification and operating manners for the computer link function built in Toshiba's T-series CPU.

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- DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).
- PowerTap, T-Port Tap, DeviceBox Tap, and FLEX I/0 are registered trademarks of RockWell Automation Co., Ltd.
- COMBICON is a registered trademark of Phoenix Contact Corporation.

Contents

1. Overview of the DeviceNet Module

1.1 Features and System Configuration Examples of the DeviceNet Module (DN211)

This section describes the features and system configuration examples of the DeviceNet module (DN211) for the programmable controller PROSEC-T2 series (T2/T2E/T2N). The DN211 is an interface module for connecting the DeviceNet, which is a device level network for FA, to the PROSEC-T2 series.

Hereafter, the programmable controllers PROSEC－T2, PROSEC-T2E, and PROSEC-T2N are respectively called the "T2", "T2E", and "T2N". Likewise, the DeviceNet module for the T2 series is also called the "DN211."

(1) Conformed with DeviceNet

DeviceNet is a standardized device level network for factory automation(FA), developed by RockWell Automation Co. in USA. A nonprofit organization, called ODVA (Open DeviceNet Vendor Association), is serving as the center for the maintenance/extension of the DeviceNet specification and for conformable products introduction.

The DN211, functioning as the master (parent station) device on a DeviceNet, performs data input/output between the master device and the DeviceNet slave (child station) devices, which are developed by different makers (vendors) in and outside Japan and conform with the DeviceNet, to interface such slave devices with the T2/T2E/T2N .

(2) Input/Output Data Size, Number of Slave Devices, communication Rate and Network Length

A DN211 allows a DeviceNet to have one network to be connected. The sizes of inputting and outputting data, allowed between a DN211 and slave devices are 128 words for input and 128 words for output (one word = 16 points).

Input data and output data, so far as each of them is within 128 words in total, can be exchanged data with up to 63 slave devices. (Since the amount of data outputted to a slave device and the amount of data inputted from a slave device vary depending on the slave device, check the slave device specification of data size).

The definition of input data and output data, dealt in this book, is shown in the following figures.

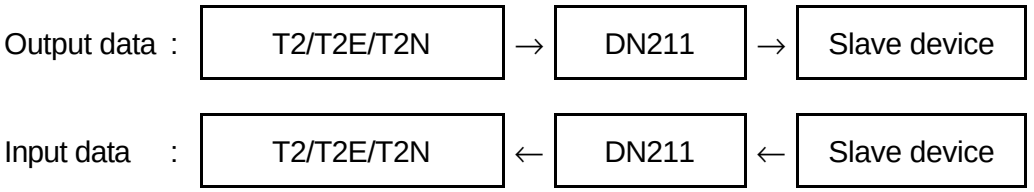


Figure 1.1 Definition of Output Data and Input Data

Three types of communication rates, namely 500 kbps, 250 kbps and 125 kbps are available. The maximum network length varies depending on the communication rate (l00 m for 500 kbps, 250 m for 250 kbps, and 500 m for 125 kbps).

The detail is explained in "1.2 Network Configuration of DeviceNet."

(3) Means of Inputting/Outputting Data

The DN211 supports "polling instruction/response" and "bit strobe instruction/response," both of which are specified in the DeviceNet specification as the means of inputting/outputting data to/from slave devices. The details of "polling instruction/response" and " bit strobe instruction/response" are explained in "1.4 The Basic Functions."

(4) Examples of the System Configuration

This section describes a typical system configuration using the DN211, which is mounted on the I/O slot of the T2/T2E/T2N. The DN211 allows the T2/T2E/T2N to exchange data with slave devices on the DeviceNet.

In the following example, the DN211 is connected with slave devices, such as input/output devices, sensor, and drive unit, which conforms with the DeviceNet specification. Moreover, a Toshiba's original control LAN (TOSLINE-S20) is used to connect the T2/T2E/T2N with a higher-rank controller.

A number of wiring combinations meeting the installation environment are available because the T branch topology and the multi-drop topology are combinable when wiring a DeviceNet.

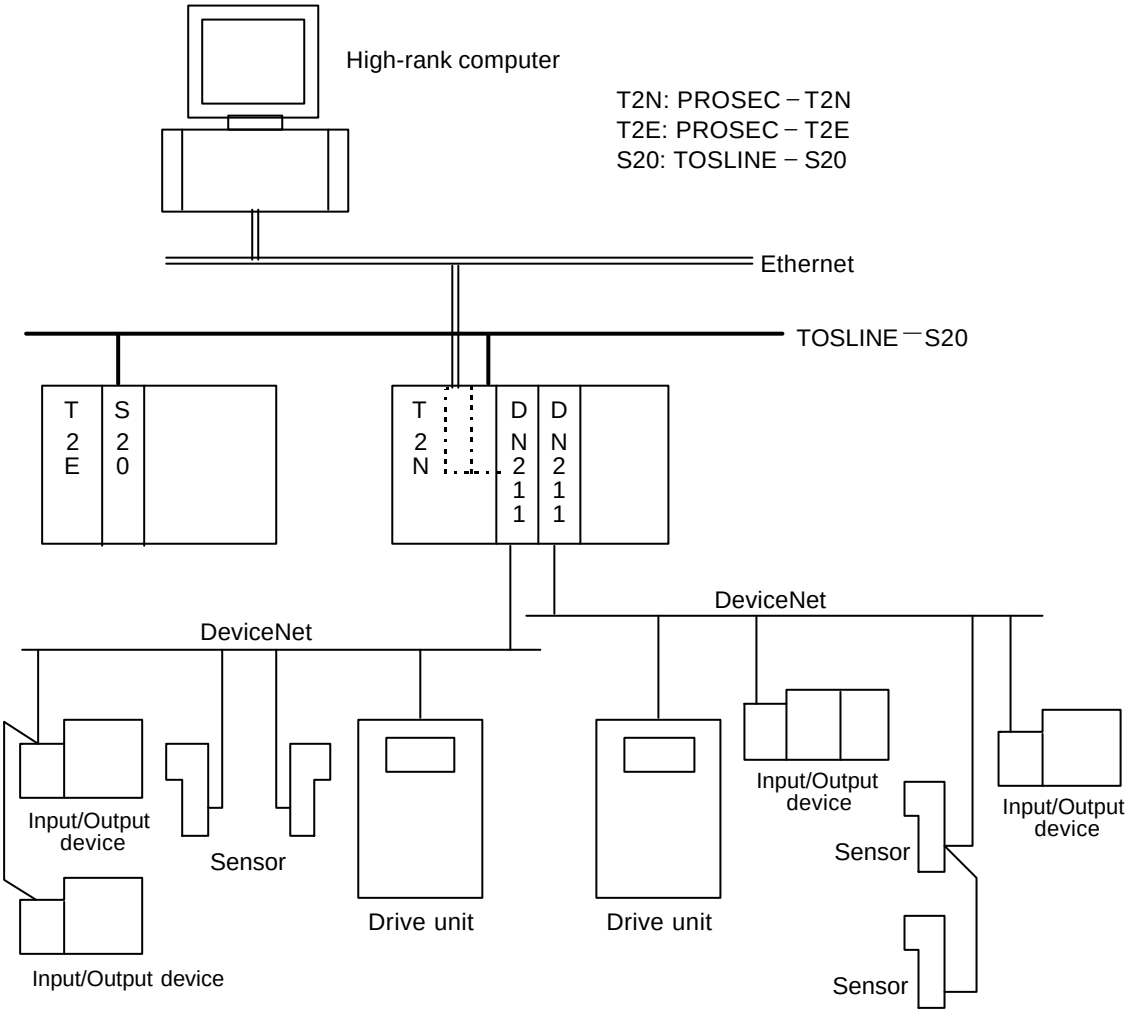


Figure 1.2 Example of the System Configuration

1.2 Network Configuration of DeviceNet

This section describes the network configuration of the DeviceNet.

1.2.1 The Network Configuration

The network configuration of a DeviceNet consists of a trunk line and drop lines as shown in Figure 1.3.

(1) The Nodes

The nodes of the DeviceNet in Figure 1.3 have slave devices such as input/output devices, sensors, and drive units, and a master device such as the DN211, to exchange data with each other. One network can have up to 64 nodes and one master device. Physical arrangement of a master device and slave devices has no particular restrictions.

Each of the DeviceNet devices on a network has a unique number (NA: node address) to identify the node from the other nodes. The node address values must be within 0 to 63 in decimal scale, and the node addresses in the network must be different from the others.

(2) The Trunk Line

According to the DeviceNet specification, a trunk line is a cable which connects nodes located most distant. The trunk line can have nodes directly-connected with it (connection with no drop line). The length of the trunk line varies depending on the communication rate of the network. The both ends of the trunk line need a terminal resistor.

(3) The Drop Line

All the cables branched from taps on the trunk line fall on drop lines. The drop line has a maximum length of 6 meters (from tap to most distant node) regardless of the communication rate on the network (The total extension of drop lines varies depending on the communication rate on the network). A drop line can have one or more nodes connected. The following three types of node configurations are available, as shown in Figure 1.3.

a) Configuration of drop lines short from the tap/multiport tap

b) Configuration of multidrops on a drop line

c) Configuration of branches on a drop line (no branch configuration for the trunk line)

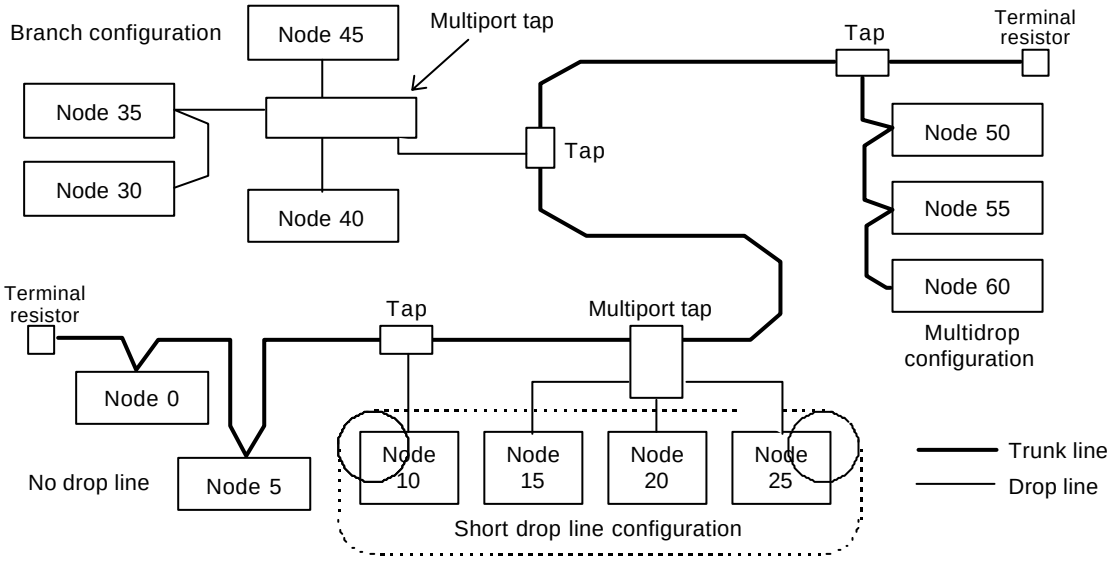


Figure 1.3 Example of DeviceNet Network Configuration

1.2.2 Trunk Line/Drop Line and Maximum Cable Length

The DeviceNet specification stipulates the Thick Cable and the Thin Cable. For detail, see DeviceNet Volume I. Currently, cables conforming with the standards of the Thick Cable and Thin Cable are available in the commercial market. Buy ones which meet the configuration of your network (Details are explained in "3.6 The Network Components").

(1) The Trunk Line

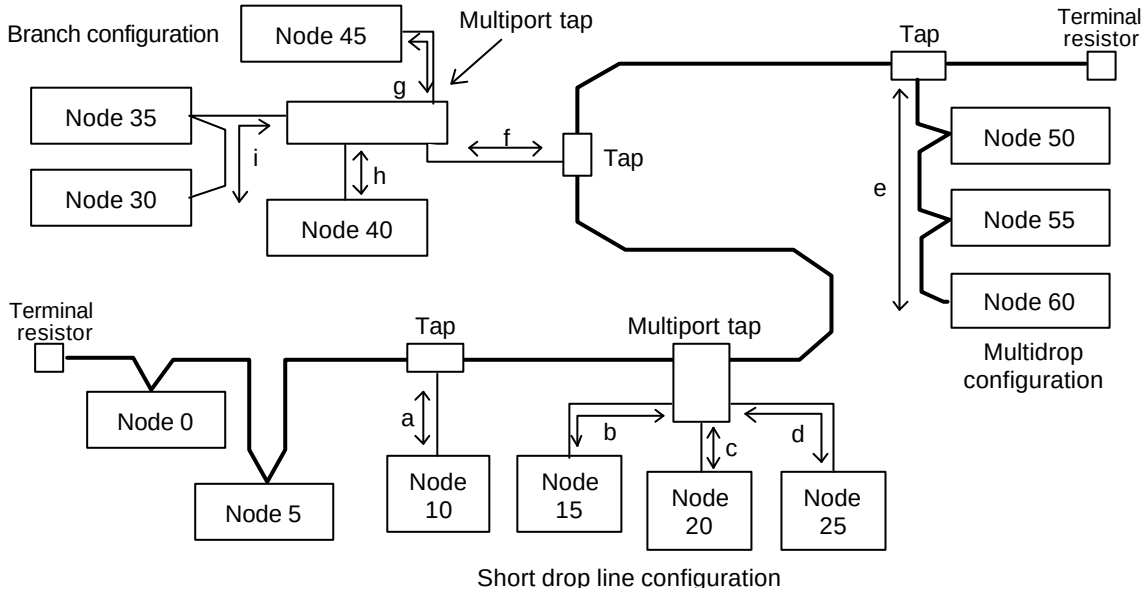
The trunk line of a DeviceNet consists of a Thick Cable or a Thin Cable (their mixture is also possible). Since the Thin Cable is flexible compared with the Thick Cable, wiring the cable is easy. Conversely, the Thick Cable allows longer network cabling than the Thin Cable. A maximum of the trunk line length varies depending on the type of cable used and the communication rate on the network. For details, see "3 The Maximum Network Length."

(2) The Drop Line

The drop lines of a DeviceNet consists of Thin Cables. Table 1.1 lists the length of drop lines and the total length. A node on a drop line can be configured in a short drop line configuration/multi-drops configuration/short brunch configuration. Figure 1.4 shows how to calculate the drop line length and the total length by different configurations.

Table 1.1 Maximum Drop Line Length

Communication Rate	Drop Line	Total Extension by Network
125 kbps	6 meters	156 meters
250 kbps		78 meters
500 kbps		39 meters



Individual drop line length: a ≤ 6 m, b ≤ 6 m, c ≤ 6 m, and d ≤ 6 m (short drop line configuration)
e ≤ 6 m (multi-drops configuration)
f + g ≤ 6 m, f + h ≤ 6 m, f + i ≤ 6 m (branch configuration)

Total of drop lines extended : a + b + c + d + e + f + g + h + i

Figure 1.4 Example of Calculating the Drop Line Length

(3) The Maximum Cable Length

The distance between two nodes on the network cannot exceed the "Maximum cable length" specified in the DeviceNet specification. In Figure 1.4, the distance from node 0 to node 60 is not allowed to exceed the "Maximum cable length."

The "Maximum cable length" varies depending on the communication rate of the network and the type of the cable used for the trunk line.

a) Table 1.2 lists the maximum cable length for the case that the trunk line consists of a Thick Cable alone and no drop line is connected on it (that is, all nodes are connected on the trunk line), as shown in Figure 1.5. In this case, "maximum trunk line length between node 0 and node n" = "maximum cable length."
Moreover, when the "maximum trunk line length between node 0 and node n" = "maximum cable length," no new node can be attached outside node 0 and node n..

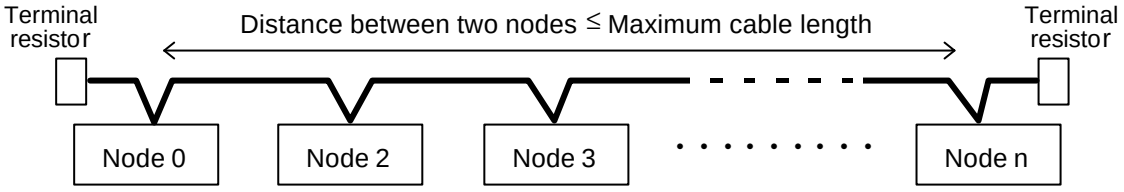


Figure 1.5 Distance Between Two Nodes on a Network With No Drop Line

Table 1.2 Maximum Cable Length (Thick Cable/Thin Cable alone)

Communication Rate	Thick Cable alone	Thin Cable alone
125 kbps	500 m	100 m
250 kbps	250 m	100 m
500 kbps	100 m	100 m

b) Figure 1.6 shows the **maximum distance between two nodes** in the case that a Thick Cable or Thin Cable alone is used for the trunk line and that drop lines are used.
Table 1.2. lists the **maximum cable length.** In this case, the "**maximum trunk line length** between two nodes" is as follows:

Maximum trunk line length between two nodes
= Maximum cable length
(value in Table 1.2)

– Total length of drop lines for both ends nodes of trunk line

For Figure 1.6, the maximum trunk line length between node 0 and node n is equal to the maximum cable length (value in Table 1.2) minus total length of drop lines for node 0 and node n.

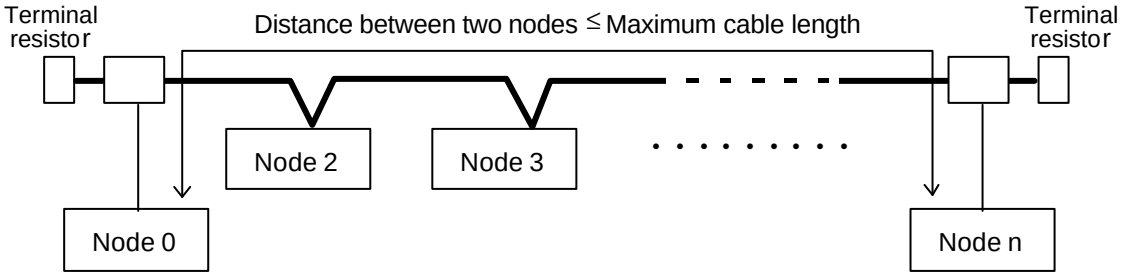


Figure 1.6 Distance Between Two Nodes on a Network with Drop Lines

c) Figure 1.7 shows the **maximum distance between two nodes** in the case that the trunk line consists of Thick Cable and Thin Cables and that drop lines are connected. Use the formulas in Table 1.3. for calculating the **maximum cable length.**

In this case, the '**maximum trunk line length** between two nodes" is represented in the following formula:

Maximum trunk line length between two nodes
= Maximum cable length (value in Table 1.3)
– Total length of drop lines for the nodes at both ends of trunk line

For Figure 1.7, the maximum trunk line length between node 0 and node n is equal to the maximum cable length (value in Table 1.3) minus the total length of the drop lines for node 0 and node n.

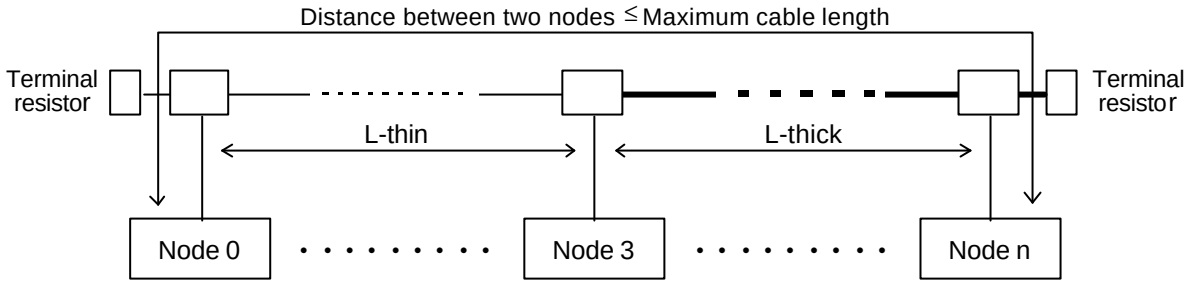


Figure 1.7 Distance Between Two Nodes on a Network with Drop Lines

Table 1.3 Maximum Cable Length (Mixture of Thick Cable/Thin Cable)

Communication Rate	Calculation Formula
125 kbps	**L-thick** + 5 × **L-thin** ≤ 500 m
250 kbps	**L-thick** + 2.5 × **L-thin** ≤ 250 m
500 kbps	**L-thick** + **L-thin** ≤ 100 m

L–thin: Length of trunk line using thin cable (m)
L–thick: Length of trunk line using thick cable (m)

1.2.3 The Terminal Resistor

The DeviceNet needs a terminal resistor on both ends of the trunk line in order to reduce signal reflections and stabilize communications. The specifications of the terminal resistor are as follows:

- 121Ω
- 1% of the metal film
- 1/4 W

Terminal resistors conforming with the above specifications are available in the commercial market. See "3 .6 The Network Components."

Usage Recommendation
1. Don't make a network configuration whose extended trunk line and drop lines have no node being connected.
2. Don't attach a terminal resistor to the node. It could cause communication error.
3. Attach a terminal resistor to both ends of the trunk line; don't attach a terminal resistor on the

end of a drop line. Attach only to both ends of the trunk line.

1.3 Conformity Specification and Trademarks

DeviceNet is a standardized device level network for factory automation (FA), which is developed by RockWell Automation Co., Ltd. in USA. Currently, a nonprofit organization called ODVA (Open DeviceNet Vendor Association) is serving as the center for the maintenance and extensions of DeviceNet and introduction of conformable products.

The DeviceNet specification has Volume I: DeviceNet Communication Model and Protocol, and Volume II: DeviceNet Device Profiles and Object Library, in which the hardware and software specifications are defined.

The DeviceNet specification that the DN211 conforms with is found in Volume I, Release 1.3, and Volume II, Release 1.2.

Trademarks:

- DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).
- PowerTap, T-Port Tap, DeviceBox Tap, and FLEX I/0 are registered trademarks of RockWell Automation Co., Ltd.
- COMBICON is a registered trademark of Phoenix Contact Corporation.

1.4 The Basic Functions

This section describes the following two functions for communicating between the DN211 and slave devices.

1) Polling instruction/response mode

2) Bit strobe instruction/response mode

1.4.1 The Polling Instruction/Response Mode

The polling instruction/response mode is used for exchanging an arbitrary size of data between the master device ⇔ slave devices. The master device has information on slaves devices (items of scan list, such as node address, input/output data volume, etc.) on the network.

For polling instructions, based on such information, the master device outputs an arbitrary size of data to slave devices. Slave devices transmit response data (arbitrary data size) to a polling instruction to the master device (polling response).

It depends on the specification of a slave device how the slave device interprets the polling instruction and what data the slave device transmits as the polling response. For this communication function, it is prerequisite that the slave device supports the polling instruction/response mode. (Almost all the slave devices on the DeviceNet support this communication system).

(1) The Polling Instruction

The example in Figure 1.8 indicates the DN211 is polling sensors, inputting sensor input information, and trying to send output control data to the actuator. How to write polling output data to the DN211 from the T2/T2E/T2N is found in "5. Communication with Slave Devices."

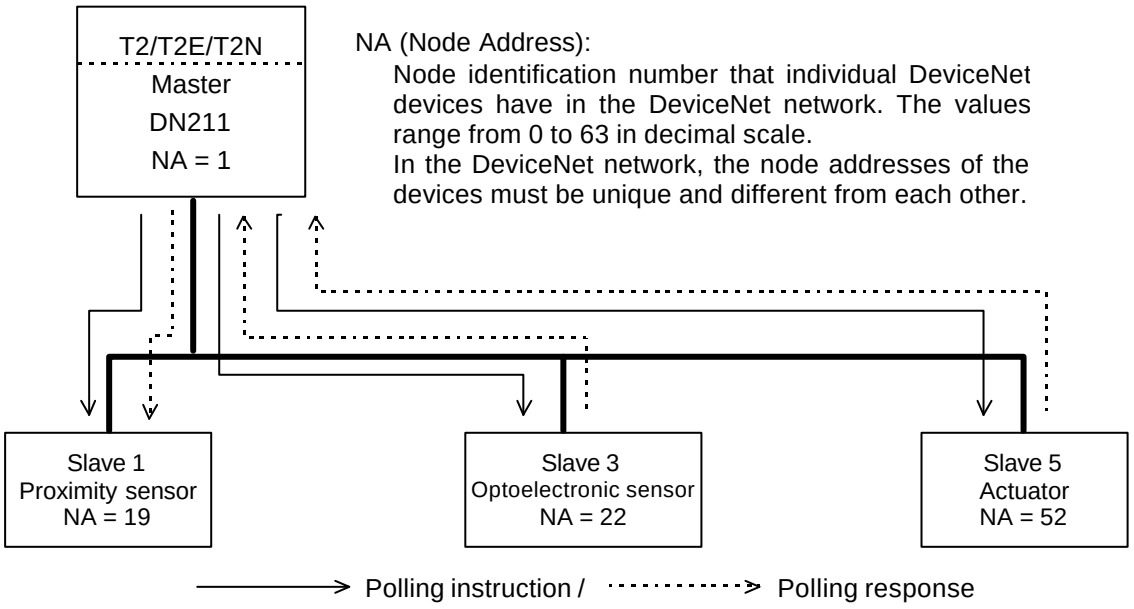


Figure 1.8 Example of Polling Instruction/Response Mode

(2) The Polling Response

A slave device which received a polling instruction transmits an arbitrary size of response data to the master device. The content of response data varies depending on the specification of the slave device. The mechanism the T2/T2E/T2N reads polling response data from the DN211 is explained in"5. Communication with Slave Devices."

1.4.2 The Bit Strobe Instruction/Response Mode

The bit strobe instruction/response mode is used for exchanging a small size of data between the master device ⇔ slave devices. In the bit strobe instruction, based on the information obtained from the scan list, the master device broadcasts 1-bit output data to individual slave devices.

These individual devices transmit data (0–8 bytes) in response to the bit strobe instruction to the master device (bit strobe response).

It depends on the specification of a slave device how the salve device interprets a bit strobe instruction and what data the slave device transmits to the bit strobe response.

For this communication function, it is prerequisite that the slave device supports the bit strobe instruction/response mode.

(1) The Bit Strobe Instruction

Broadcasts data to bit strobe instruction/response mode supporting slave devices on the network. The bit strobe instruction contains 64–bit output data, and each of the 64 bits is assigned to individual node addresses on the network (Figure 1. 9).

The example in Figure 1.9 indicates the DN211 is inputting sensor information by the bit strobe mode and trying to send output control data to the actuator. The way of writing output data in bit strobe from the T2/T2E/T2N to the DN211 is explained in "5. Communication with Salve Devices."

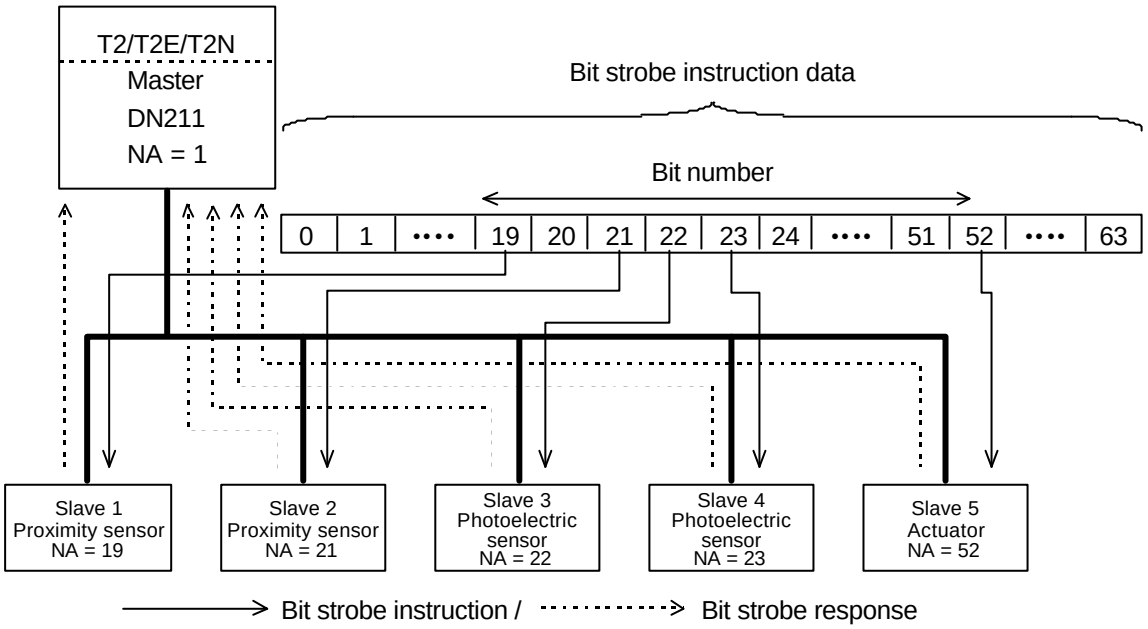


Figure 1.9 Example of the Bit Strobe Instruction/Response Mode

(2) The Bit Strobe Response

A slave device which received the bit strobe instruction transmits 0 to 8 byte response data to the master device. The contents of response data varies depending on the specification of the slave device. The way the T2/T2E/T2N reads bit-strobe response data from the DN211 is described in "5. Communication with Slave Devices."

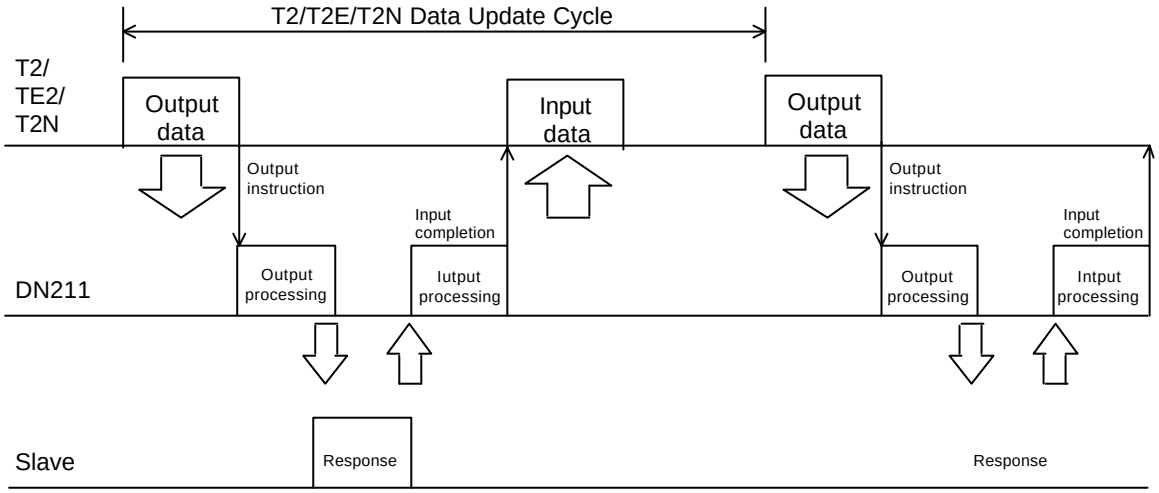
1.4.3 Synchronization/Asynchronous Mode and Data Update Cycle

As explained in the preceding section, the communication function between the DN211 and slave devices has the polling instruction/response mode and the bit strobe instruction/response mode. Data can be exchanged between the T2/T2E/T2N and the DN211 in synchronous mode or asynchronous mode. This section describes the synchronous mode/asynchronous mode.

(1) The synchronous mode

At output: The T2/T2E/T2N writes output data to slave devices into the DN211 beforehand, and activates a polling instruction/bit strobe instruction. When the polling instruction/bit strobe instruction is activated, the DN211 sends the output data to slave devices.

At input: The DN211 receives data from slave devices by a polling response/bit strobe response. After having received data from all slave devices, the DN211 arranges input data before notifying the input completion to the T2/T2E/T2N. If the T2/T2E/T2N is reading input data, it will check for the input completion by the DN211 before reading the input data.

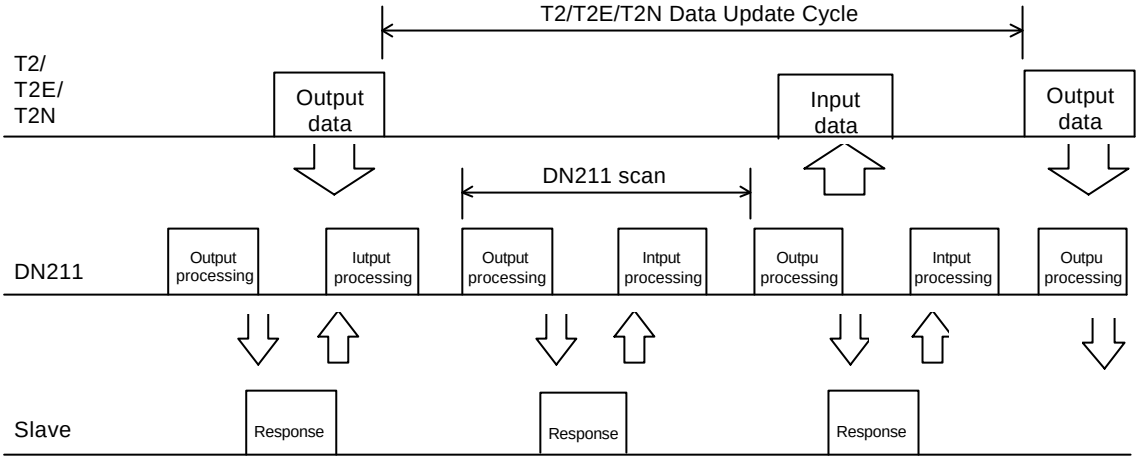


Output data and input data exchanged between the T2/T2E/T2N ⇔ the DN211 are synchronizing with the output/input cycles of the T2/T2E/T2N side program. For this reason, the size of synchronous data value is equal to one-time output/input data to all slave devices.

(2) The asynchronous mode

At output: The T2/T2E/T2N writes output data to slave devices into the DN211. Disregarding the timing of the T2/T2E/T2N's output data writing, the DN211 sends, by the scanning cycle at the local station, written output data to a slave device. Unless output data is updated by the T2/T2E/T2N, the DN211 sends the same data to slave devices.

At input: The DN211 receives data from slave devices by a polling response/bit strobe response. After having received data from all slave devices, the DN211 updates input data. The DN211 doesn't notify the completion of the data reception to the T2/T2E/T2N. Disregarding the timing of input data update by the DN211, the T2/T2E/T2N reads input data.



Transfer of output data and input data between the T2/T2E/T2N ⇔ the DN211 and the transfer between the DN211 ⇔ slave devices are asynchronous. Transfer between the T2/T2E/T2N ⇔ the DN211 are synchronizes with the scan cycle by the T2/T2E/T2N side, while the transfer between the DN211 ⇔ slave devices are synchronizes with the scan cycle in the DN211.

Although data are secured by the byte (8 bits), the sequence program is simplified for data transfer processing, compared with the synchronous mode. When the scan cycle by the DN211 side is shorter than the scan cycle by the T2/T2E/T2N, delay of data update time between the T2/T2E/T2N ⇔ slave devices becomes smaller.

The scan time by the DN211 varies depending on the number of slave devices being connected, size of transmission data by the slave device, and the performances of the slave device being connected.

1.5 The DN211 Specification

1.5.1 The Function Specification

Table 1.4 lists the function specification of the DN211. The general specification of the DN211 conforms with the T2/T2E/T2N main unit.

Table 1.4 Function Specification

Item		Specification		
Module form (pet name)		DN211		
Transmission specification		Conformed with the DeviceNet		
	Media access system	CSMA/NBA system (note)		
	Modulation	Baseband		
	Transmission path	Bus topology		
	Data rate	125 kbps	250 kbps	500 kbps
	Max. network length	500 m	250 m	100 m
	Max. number of nodes	64 units/network (1 master device, 63 slave devices)		
	Connector	MSTBP 2.5/5-STF-5.08 AB GY AU SO TMSTBP 2.5/5-STF-5.08 AB GY AU Phoenix Contact Corporation		
	Connection cable	DeviceNet THICK cable (thick cable) DeviceNet THIN cable (thin cable)		
Communication function		1. Polling instruction/response mode (synchronous/asynchronous) 2. Bit strobe instruction/response mode (synchronous/asynchronous)		
RAS function		1. Self-check when the power is ON ROM, RAM, and CAN controllers DN211 communication memory for T2/T2E/T2N 2. RAS information on the T2/T2E/T2N interface buffer memory 3. Information by reading RAS information • Event trace • CAN controller (circuit) information 4. Time setting function 5. Displaying the module status/network status on the 7-segment LED on the front panel		
Current consumption [mA]		T2/T2E/T2N side (DC5V): 500 mA Network side (DC 24 V): 90 mA		
Outer dimensions [mm]		32.5 (W) × 138 (H) × 102.1 (D)		
Weight [g]		200		
Board specification		One slot (slot width)		
Mounting		T2/T2E/T2N base unit (basic/extension) I/O slot		
Number of modules		See "1.5.2 Number of Mounting Modules."		
Access		READ/WRITE instruction (module control, data input/output)		

Note: CSMA/NBA : Carrier Sense Multiple Access with Non-destructive Bitwise Arbitration

1.5.2 Number of Mounting Modules

This section describes the number of the DN211 units available on the T2/T2E/T2N and the instruction execution time when accessing the DN211 from the T2/T2E/T2N.

(1) Number of DN211 Units Available

The number of the DN211 units available on the T2/T2E/T2N system varies depending on the power capacity of the T2 power module and the current consumption of the entire T2/T2E/T2N system.

Table 1.5 5Vdc Power/Current consumption

Power module (PS261)	5 Vdc power 2500 mA (when no external 24 Vdc is used)	
T2 CPU module (PU224)	5 Vdc current consumption	800 mA
T2E CPU module (PU234E) with optional card	5 Vdc current consumption	800 mA
T2N CPU module (PU245N) with optional card	5 Vdc current consumption	2000 mA
DN211	5 Vdc current consumption	500 mA

For the T2/T2E:

Number of mounting basic base units: (2500-800) ÷ 500 = 3.4 → 3 units
Number of extended base units: 2500 ÷ 500 = 5 → 5 units

The maximum configuration of the T2 and the T2E is equal to basic base unit × 1 unit + extended base unit × 3 unit; thus, the number of mounting DN211 units available reaches 18 units.

For the T2N:

Number of mounting basic base units: (2500-2000) ÷ 500 = 1 → 1 unit
Number of extended base units: 2500 ÷ 500 = 5 → 5 units

The maximum configuration of the T2N is equal to basic base unit × 1 unit + extended base unit × 3 unit; thus, the number of mounting DN211 units available reaches 16 units.

The maximum number of the DN211 units available on your system varies depending on the number of non-DN211 modules mounted.

(2) Instruction execution time when accessing the DN211 from the T2/T2E/T2N

When outputting data to slave devices from the T2/T2E/T2N through the DN211, the WRITE instruction writes the output data in the DN211 from the T2/T2E/T2N. When inputting data from slave devices through the DN211, the READ instruction reads from the DN211.

Table 1.6 lists the instruction execution times of the T2/T2E/T2N.

The DN211 has 128 words for the output data area (area where output data to slave devices are stored) and 128 words for the input data area (area where input data from slave devices are stored).

Table 1.7 lists the execution times for the WRITE/READ instructions by the T2/T2E/T2N when accessing 128 words. When input/output data with slave devices is smaller than 128 words, the instruction execution time becomes shorter.

Conversely, when accessing the output data area/input data area several times, the sum of instruction execution times increases depending on the number of accessed times (the output data area/input data area is explained in "4.2 The Input/Output Data Area.")

Table 1.6 READ/WRITE Instruction Execution Time (µs)

	T2	T2E/T2N
READ instruction	720 + 9.0 × N	430 + 5.6 × N
WRITE instruction	721 + 15.0 × N	427 + 10.6 × N

N: Number of transfer words

Table 1.7 Maximum Execution Time for DN211 Access (ms) (128 words for input/output)

	T2	T2E/T2N
READ instruction	1.87	1.15
WRITE instruction	2.64	1.78
Total	4.51	2.93

The values in Table 1.7 indicate times for accessing the DN211. When you are mounting more than one DN211 unit, **calculate and total the instruction execution times to access individual DN211 units.**

One unit of T2/T2E/T2N cannot cover the entire DN211 units being mounted when the total of the sum times necessary for the T2/T2E/T2N's accessing the DN211 units and the sum time necessary for input, output, and internal processing except for accessing the DN211 units are larger than the response time that your system requires.
In this case, divide your T2/T2E/T2N to mount DN211 units, depending on your system configuration.

2. Names and Functions of DN211 Parts

This chapter explains the names and functions of DN211 parts.

2.1 Outer Dimensions and Sizes

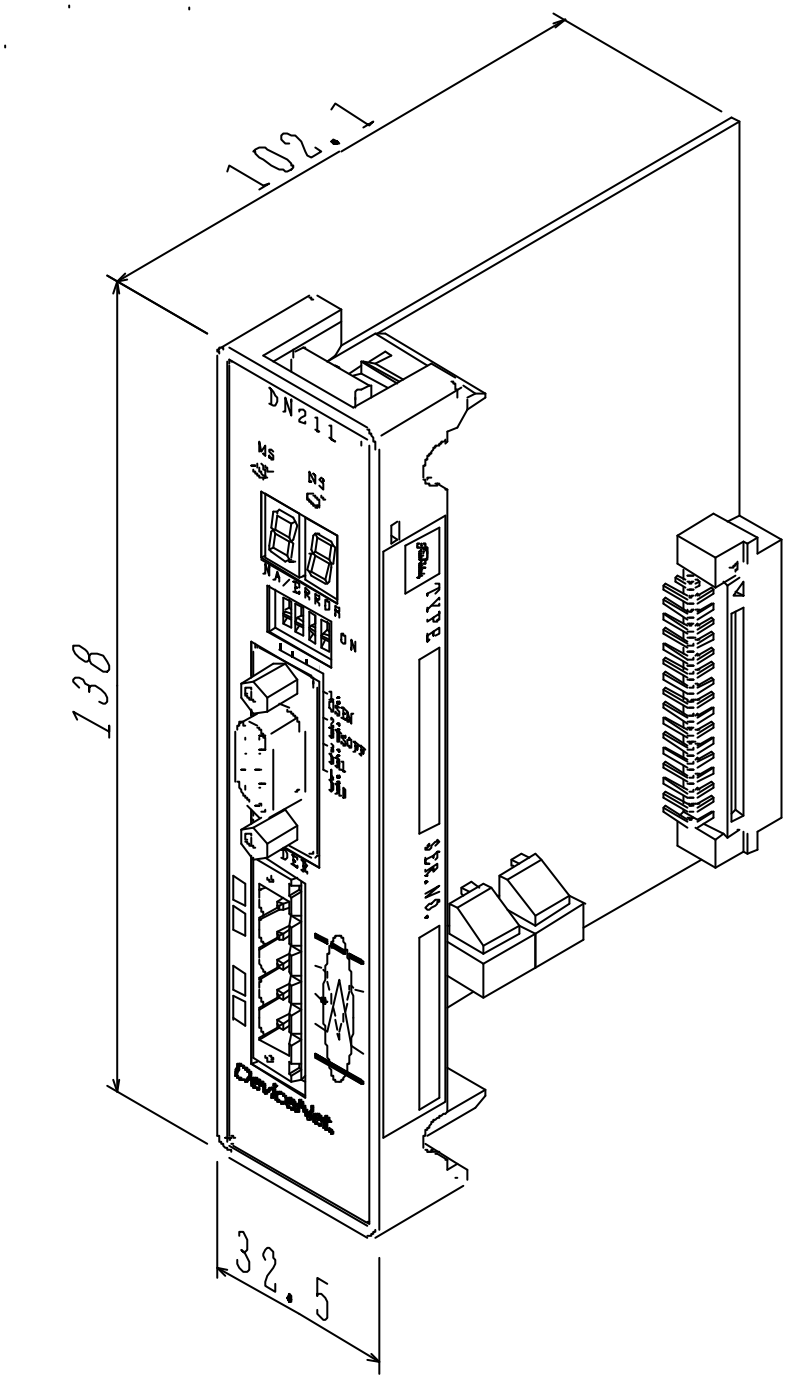
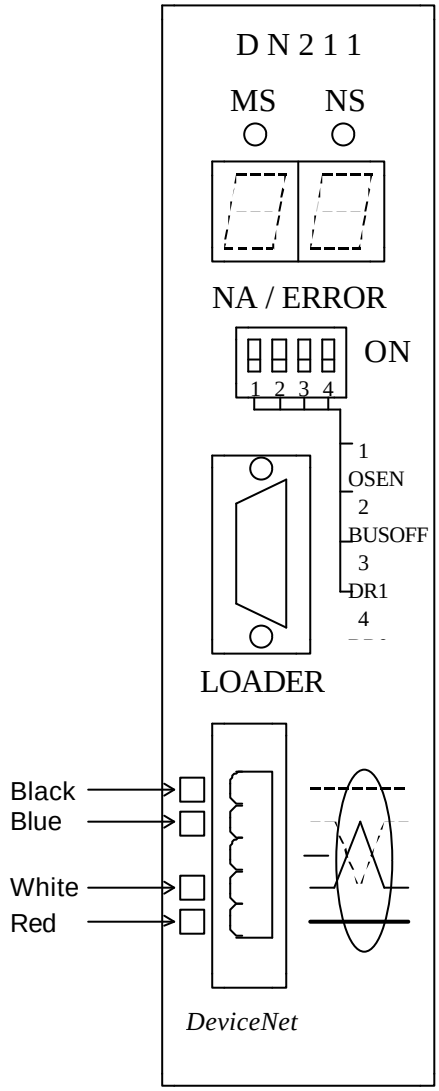


Figure 2.1 Outer Dimensions and Sizes (unit: mm)

2.2 Names of DN211 Parts



LED for module status / network status indication

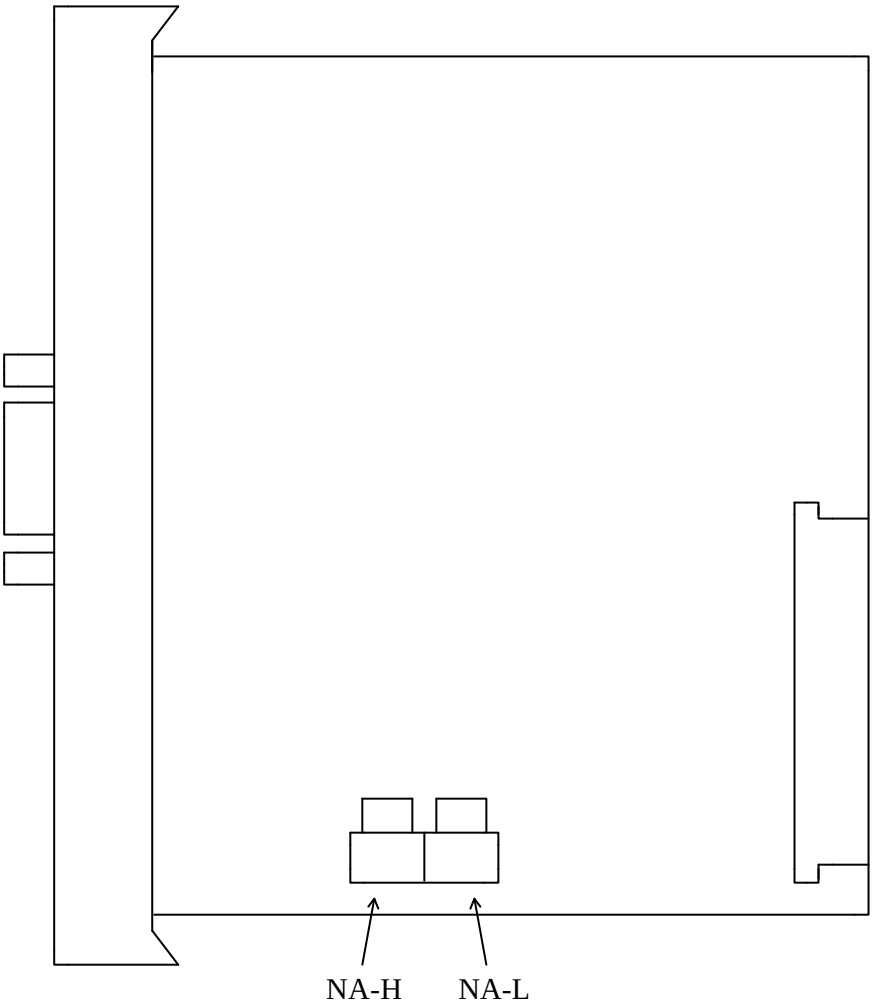
7-segment LED for node address / error code indication

DIP switch for operation mode / communication rate setting

Test connector (D-Sub, 9-pin)

Device side connector (connecting the DeviceNet)

Figure 2.2 Appearance (front panel)



Rotary switch for setting node addresses

Figure 2.3 Appearance (side view)

2.3 Functions of DN211 Parts

(1) LED for module status/network status indication (MS/NS)

This LED can light green/red. By making a distinction between green and red and lighting and blinking, the DN211's module status (MS) and network status (NS) are indicated.

LED	Indication status	Meaning of the indication (main trouble)
MS	Not lit	• No power is supplied to the DN211. • Though the power is supplied to the DN211, the module doesn't become run mode (* 1).
		When the 7-segment LED for node address/error code indicates the local station node address, the power is supplied.
	Green lighting	• The DN211 is operating normally.
	Green blinking	• The DN211 is reading switch settings.
	Red blinking	• The DN211 is encountering a recoverable trouble. → Switch setting abnormal (DIP switch/rotary switch), etc.
	Red lighting	• The DN211 is encountering a non-recoverable trouble (down status). You may need to replace the module.
NS	Not lit	• No power is supplied to the DN211 (check MS). • Though the power is supplied to the DN211, the module doesn't become run mode (* 1); check MS. • The DN211 is encountering a non-recoverable trouble (down status); check MS. • No network power is supplied to the DN211.
	Green lighting	• The DN211 is normally communicating with slave devices.
	Green blinking	• No communication between the DN211 and slave devices is established. • No slave devices are registered in the DN211.
	Red blinking	• No communication is established with more than one slave devices.
	Red lighting	• The DN211 communication is stopped due to busoff (* 2). • Communication is stopped due to the node address duplicated.

(* 1) See "4.6 Requests to the DN211" for the run mode.

(* 2) Busoff: Individual nodes on the DeviceNet check for abnormal transmission paths; when the local node is judged to be the cause of the abnormal transmission path, the local node is separated from the transmission path. This state is called busoff.

(2) 7-Segment LED for Node Address/Error Code Indication (NA/ERROR)

While the DN211 is normally transmitting data with slave devices the local station node address is displayed.

Node address:	A node identification number that the DeviceNet devices (nodes) linked to the network have. The values range within 0 to 63 in decimal scale. In a DeviceNet, the node address of a node linked to the network must be unique.

In the following cases, module or network status is displayed in combination of this LED and the LED for module status/network status indication.

- A trouble occur on the DN211 or on the network.
- An error occurs when the T2/T2E/T2N requests.
  (Parameter setting and operation mode controlling, etc. are performed by the request from the T2/T2E/T2N.)
- The DN211 is downed.

See "6.2 Indications of the 7-Segment LED" for the combinations and meanings of this LED and the LED for module status/network status indication.

(3) DIP switch for setting the operation mode/communication rate

This DIP switch is used for setting the operation mode at DN211 busoff and a communication rate on the network (500 kbps/250 kbps, 125 kbps).

"3.2 Switch Setting" explains the contents of the DIP switch and how to set it.

(4) Rotary switch for node address setting (NA-H/NA-L)

Is used for setting node addresses in the network of the DeviceNet.

The DN211 can have a node address within 0 to 63 (decimal scale) unless the node address doesn't duplicate with another node address (slave device) in the network.

"3.2 Switch Setting" explains how to set the rotary switch.

(5) The test connector

This connector is only for maintenance. You may not use it.

(6) The device side connector (for DeviceNet connection)

This connector is for connecting the DeviceNet cable to the DN211.

"3.4 Connection with the Network" explains how to connect cables.

3. Preparation for Operation (hardware)

3.1 DN211 Setting Flowchart (hardware)

⚠ DANGER
1. Configure an emergency-stop circuit, interlock circuit, and/or other similar safety circuits outside the PC and DN211. If the PC or DN211 gets failed or malfunctioned, it can cause an accident which will lead to bodily injury and/or mechanical damage.

⚠ CAUTION
2. Secure the safe environment before executing program modification, forcible output, RUN, or HALT instruction during operation. An operational mistake can cause mechanical damage or accident

The following flowchart shows the DN211 setting.

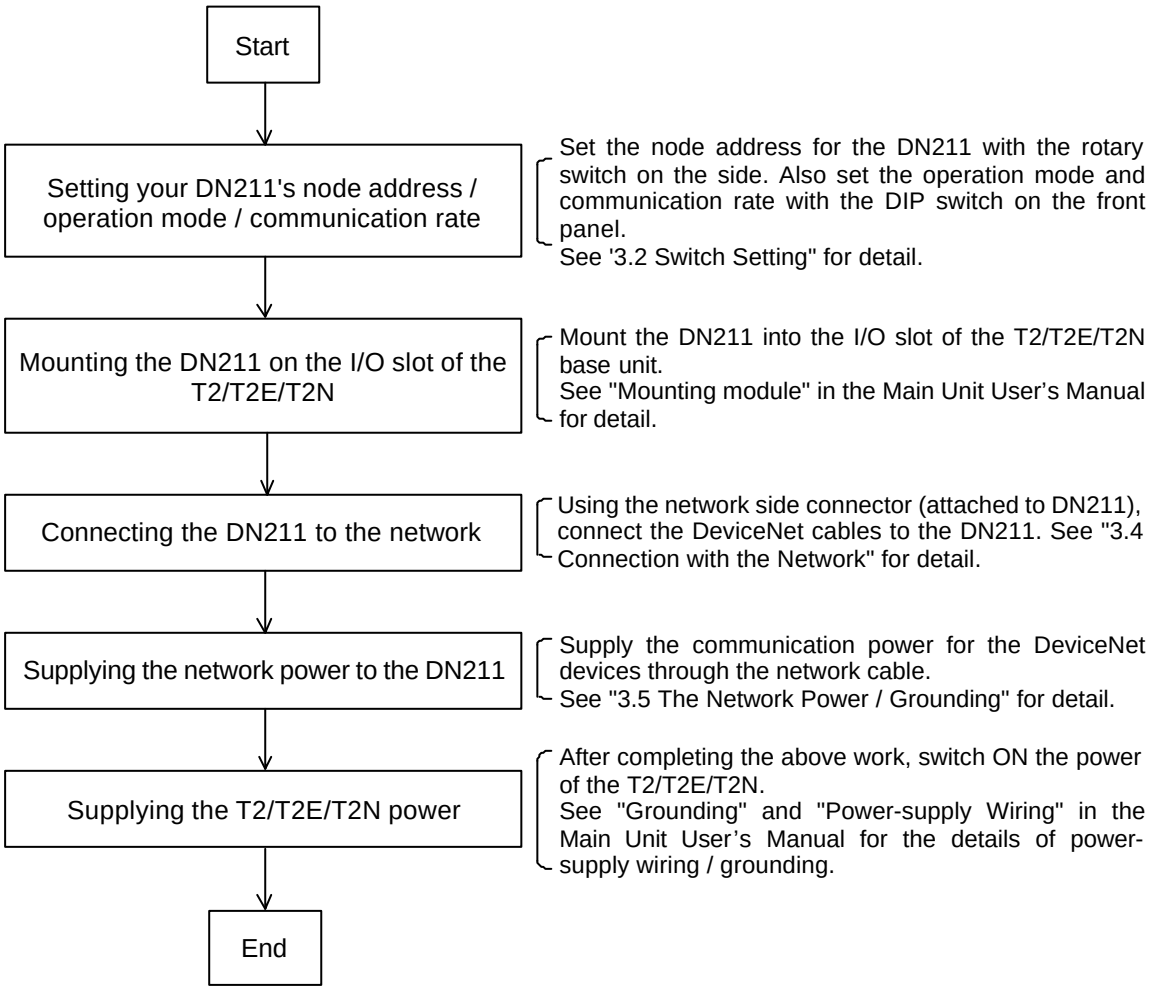
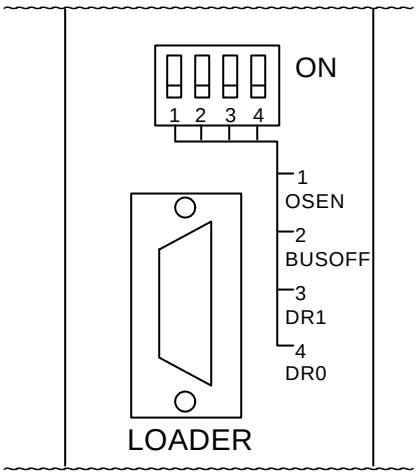


Figure 3.1 DN211 Setting Flowchart

3.2 Switch Setting

The DN211 has a DIP switch on the front panel and a rotary switch on the side. These switches are used for setting the operation mode, communication rate, and node address of the DN211.

3.2.1 DIP Switch for Setting the Operation Mode/Communication Rate



← DIP switch for setting the operation mode/communication rate

Factory setting: OFF

Figure 3.2 DIP Switch for Setting the Operation Mode/Communication Rate

Table 3.1 DIP Switch Setting

DIP Switch Name		Function
1	OSEN	Is reserved for the system. Set to OFF and keep it.
2	BUSOFF	Specifies the operation mode when the DN211 turns busoff (*1). ON: When turned busoff, the DN211 initializes the internal network controller to become standby mode. After solving the cause of the busoff state, resume transmission with the instruction from the T2/T2E/T2N. OFF: When turned busoff, the DN211 initializes the internal network controller before resuming transmission (factory setting).
3 4	DR1 DR0	Sets the communication rate. Refer to Table 3.2.

(*1) Busoff: Individual nodes on the DeviceNet check for abnormal transmission paths; when the local node is judged to be the cause of abnormal transmission path, the local node is separated from the transmission path. This state is called busoff.

Table 3.2 Communication Rate Setting

Communication Rate	DR1	DR0	
125 kbps	OFF	OFF	← Factory setting
250 kbps	OFF	ON	
500 kbps	ON	OFF	

Setting disabled	ON	ON

⚠ CAUTION

1. Set and keep "OSEN" on the DIP switch to OFF. Setting it to ON can get failed or malfunctioned.
2. When you set "BUSOFF" on the DIP switch to OFF, transmission will restart automatically even when busoff occurs. Unless the cause of the DN211's busoff (cause of communication error) is solved, however, busoff may get repeated.
3. When you set both of communication rate DR0 and DR1 to ON and turn on the power of the T2/T2E/T2N, "Communication Rate Setting Failed" will appear with the following indications:
   - The "MS" LED is blinking red.
   - "F7" and the local station node address are being displayed alternately on the 7-segment LED.

   To clear these indications, set DR0 and DR1 correctly and, issue a reset request or turn OFF and ON the power.
4. Set the communication rates of your nodes being connected to the network, to the same communication rate. **Setting different communication rates on your different nodes will cause slave devices or the DN211 to get malfunctioned, resulting in no communication started.**

   Read the relevant manuals and descriptions to set the communication rate of your slave devices.
5. Don't change over the communication rates while your T2/T2E/T2N is rising just after the turning on the power. In particular, never change the communication rate while communicating with slave devices. Failing to do so will cause "Communication Rate Setting Failed" to appear.

   To clear this indication, set the DIP switch to the correct setting and, issue a reset request or turn OFF and ON the power.

Usage Recommendation

1. Use a small minus screwdriver for changing the value of the DIP switch.

3.2.2 Rotary Switch for Node Address Setting

The DN211 board has a rotary switch for node address (0 to 63 in decimal scale) setting (Figure 3.3). NA-H is used for setting a 10-order figure while NA-L is used for setting a 1-order figure. Since both of NA-H and NA-L can set a value from 0 to 9, the value can range within 0 to 99. When a value within 64 to 99 is set, however, a "Node Address Setting Abnormal" error occurs with the DN211 when the T2/T2E/T2N power is switched ON.

To clear the error, set the correct node address and, issue a reset request or switch OFF and ON the power. In the DeviceNet, each of the node address values in the network must be unique.When the DN211's node address duplicates with another node address, a "Node Address Duplicated" error occurs with the DN211 when it turns run status. To clear the error, allocate the correct node address and, issue a reset request or switch OFF and ON the power.

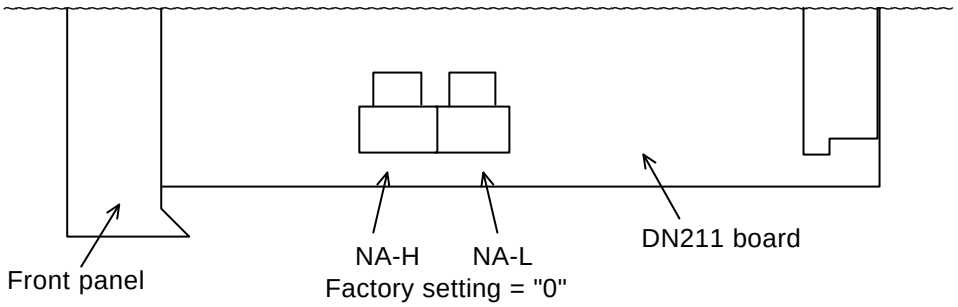


Figure 3.3 Rotary Switch for Node Address Setting

⚠ CAUTION
1. When you set a value within 64 to 99 to the node address of your DN211 and turn ON the power of your T2/T2E/T2N, "Node Address Setting Failed" will appear with the following indications: • The "MS" LED is blinking red. • "F6" and the local station node address are being displayed alternately on the 7-segment LED. To clear these indications, set the correct value to the node address and, issue a reset request or turn OFF and ON the power.
2. If your DN211 node address has the same value with another node and when the DN211 comes into run state, "Node Address Duplicated" will appear with the following indications: • The "MS" LED is lighting red and/or the "NS" LED is lighting red. • "70" and the local station node address are being displayed alternately on the 7-segment LED. To clear these indications, set the correct value to the node address and, issue a reset request or turn OFF and ON the power.

Usage Recommendation
1. Use a small minus screwdriver for changing values of the rotary switch.

3.3 Mounting in the Base Unit

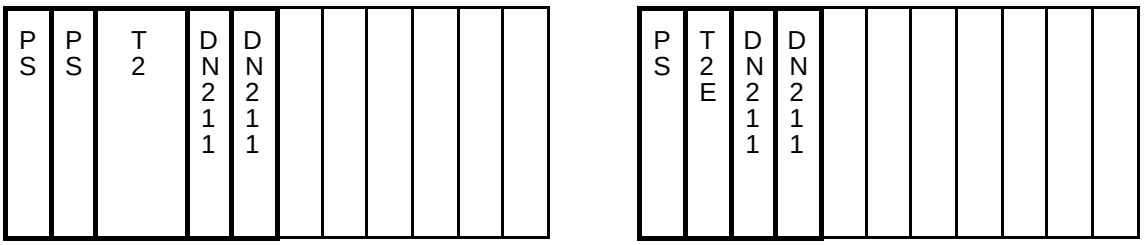
Mount your DN211 in the I/O slot of the base unit for the T2/T2E/T2N and lock the master device. See "Mounting/Removing the Module" in the Main Unit User's Manual for detail.

⚠ CAUTION

1. Since the DN211 is designed for Toshiba's T2 series, be sure to mount your DN211 in the base unit, instead of using it in stand-alone; don't use it for other applications. Unauthorized applications can cause electric shock, bodily injury, and/or mechanical malfunction.
2. Be sure to turn OFF the power (on the T2 side and network side) before attaching or detaching the DN211 and/or the terminal block. Failing to do so will cause electric shock, malfunction, and/or failure.
3. Keep the DN211 free from foreign matter such as electric-wire waste. Failing to do so could cause fire, failure, and/or malfunction.
4. Check the connectors, cables, and base unit of the DN211, for their firm connection and mounting using stoppers and screws. Note loose connection or mounting can be shaky or easily disconnected off, resulting in failure or malfunction of the DN211.

More than one unit of DN211 can be mounted for one unit of the T2/T2E/T2N, as explained in "1.5.2 Number of Mounting Modules." The DN211 can be mounted in the basic base unit and an extended base unit.

Since the DN211 falls in a low-voltage I/O unit, place it at the left side of the unit, whereas arrange high-voltage I/O units at the right side of the unit. Separate low-voltage units from high-voltage units when wiring them ("8.4 Network Installation" explains network cables wiring).



Using the Basic Base Unit (BU218) for 8-Boards I/O Unit

Figure 3.4 Example of Mounting on the Base Unit

The current consumption of the T2/T2E/T2N side power of the DN211 (DC5V) is 0.5 A. To examination the power capacity, refer to "Examining the Power Capacity" of the T2 User's Manual/T2E User's Manual/T2N User's Manual, besides "1.5.2 Number of Mounting Modules."

3.4 Connection with the Network

This section describes how to connect the DeviceNet cable to the DN211.

⚠ CAUTION

1. Do not engage in attaching or detaching the DeviceNet cable with network side connector during network operation. Failing to do so can cause reverse connection or short circuit of the network power, resulting in no communication with other nodes.
2. When you connect the DeviceNet cable with the network side connector, be sure not to make the wrong connection. Failing to do so can cause short circuit of the network power, resulting in no communication with other nodes.
3. Neither attach nor detach the network side connector with the device side connector on the DN211 front panel while the T2/T2E/T2N is rising just after the power is turned ON. Failing to do so can cause the DN211 to fail or malfunction.
4. Attaching the opposite end of the network side connector with/from a device side connector is not possible because of the specific form. Trying connecting the wrong end by excessive force can damage both the network side connector and the device side connector.
5. Be sure not to wire the cable in too tightly stretched state or in bent state.Also, don't put heavy stuff on the cable. Otherwise, the cable could break.
6. Ask the qualified expert for the installation work of the DeviceNet cables because it requires sufficient safety and noise-suppression measures.

   Refer to DeviceNet Volume I, Release 1.3, for the standard installation.

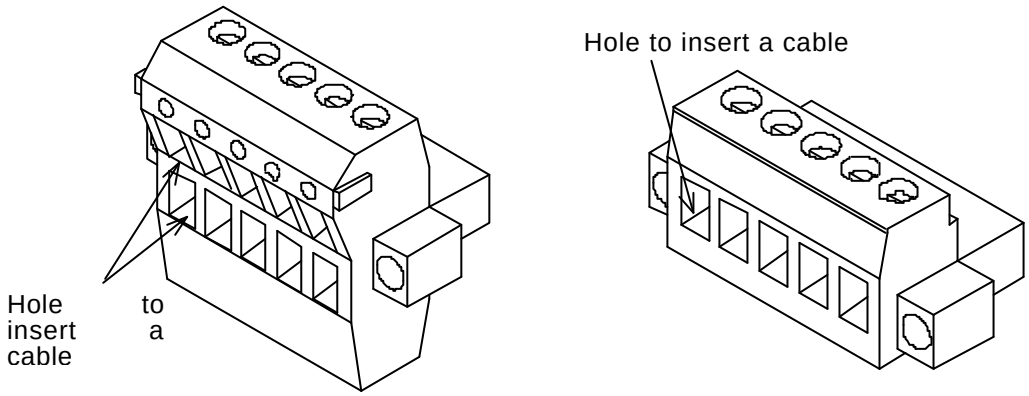
   Also see "8.4 Network Installation" in this manual.

The DN211 supports the plug connection connector(open type). It has two types of network side connectors attached, as shown in Figure 3.5. Follow the order stated below to connect the DeviceNet cable to the DN211.

1) Connect the Devicenet cable to the network side connector and fix it.
2) Insert the network side connector into the device side connector on the front panel of the DN211.

The connector at the left-side figure below has the upper and lower rows with holes for cables so that the DN211 can be connected in the middle of the network daisy chain.

Meanwhile, the connector at the right-side figure below has a row with holes for cables so that the DN211 can be connected at the network end. Select either of the connectors after discussing the point you are going to connect your DN211 in the network.



Phoenix Contact
TMSTBP2.5/5-STF-5.08 AB GY AU

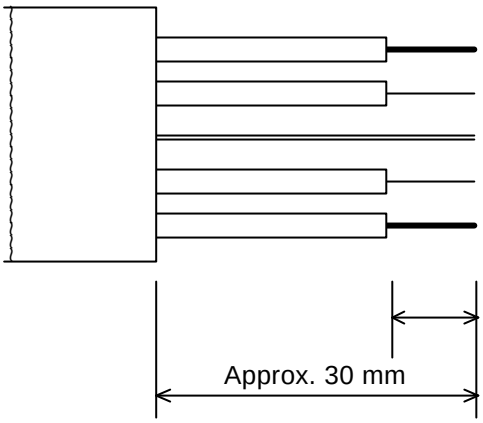
Phoenix Contact
MSTBP2.5/5-STF-5.08 AB GY AU SO

Figure 3.5 Network Side Connectors Attached to the DN211

3.4.1 Connecting DeviceNet Cables to Network Side Connector

(1) Preparing DeviceNet Cables

Use an open-type cable end (2 power cables, 2 signal cables, and 1 drain cable in discrete state) for DeviceNet cables, which will be connected with the network side connector of the DN211. Or purchase such an open-type cable end in the commercial market.



Color of cable coating	Description
Black	Power cable (V –)
Blue	Signal cable (CAN_L)
–	Shield/Drain
White	Signal cable (CAN_H)
Red	Power cable (V +)

Figure 3.6 Processing of the DeviceNet Cable End

(2) Connecting DevicNet cables to the network side connector

This section describes how to connect DeviceNet cables to network side connectors by using Figure 3.5 at the left side (upper and lower rows with holes for inserting cables) on the preceding page. As shown in Figure 3.7, loosen screws on the cable connectors beforehand. Match the colors of the cable coatings with those of the network side connector before inserting the cables into the connectors. Tighten the screws for fixing cables.

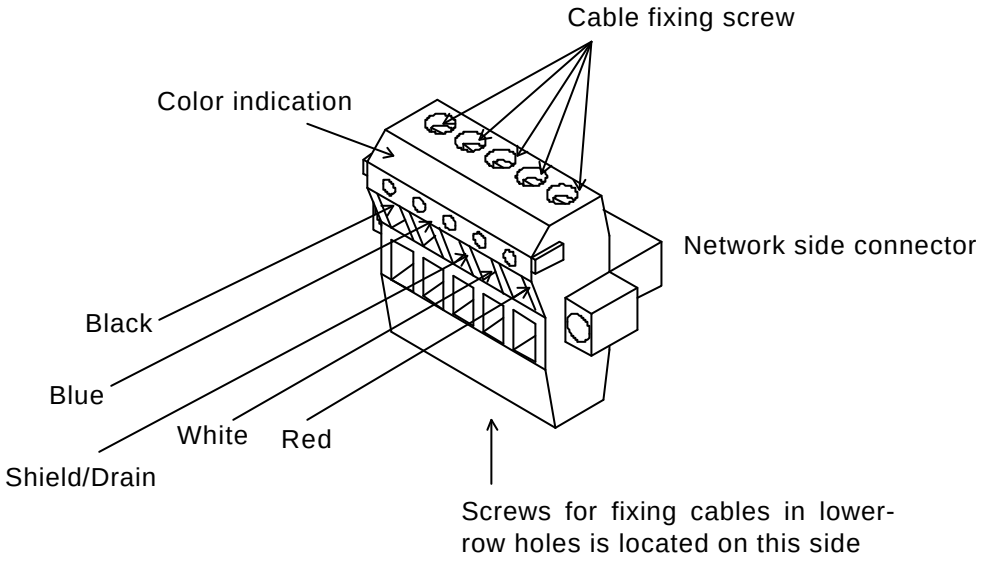


Figure 3.7 Connecting Cables with Network Side Connector

3.4.2 Connecting the Network Side Connector to the DN211

Insert the network side connector into the device side connector on front panel of the DN211. Note the network side connector cannot be attached upside down due to the specific form; don't try to connect these connectors by force. Tighten the screws for fixing the network side connector on the DN211.

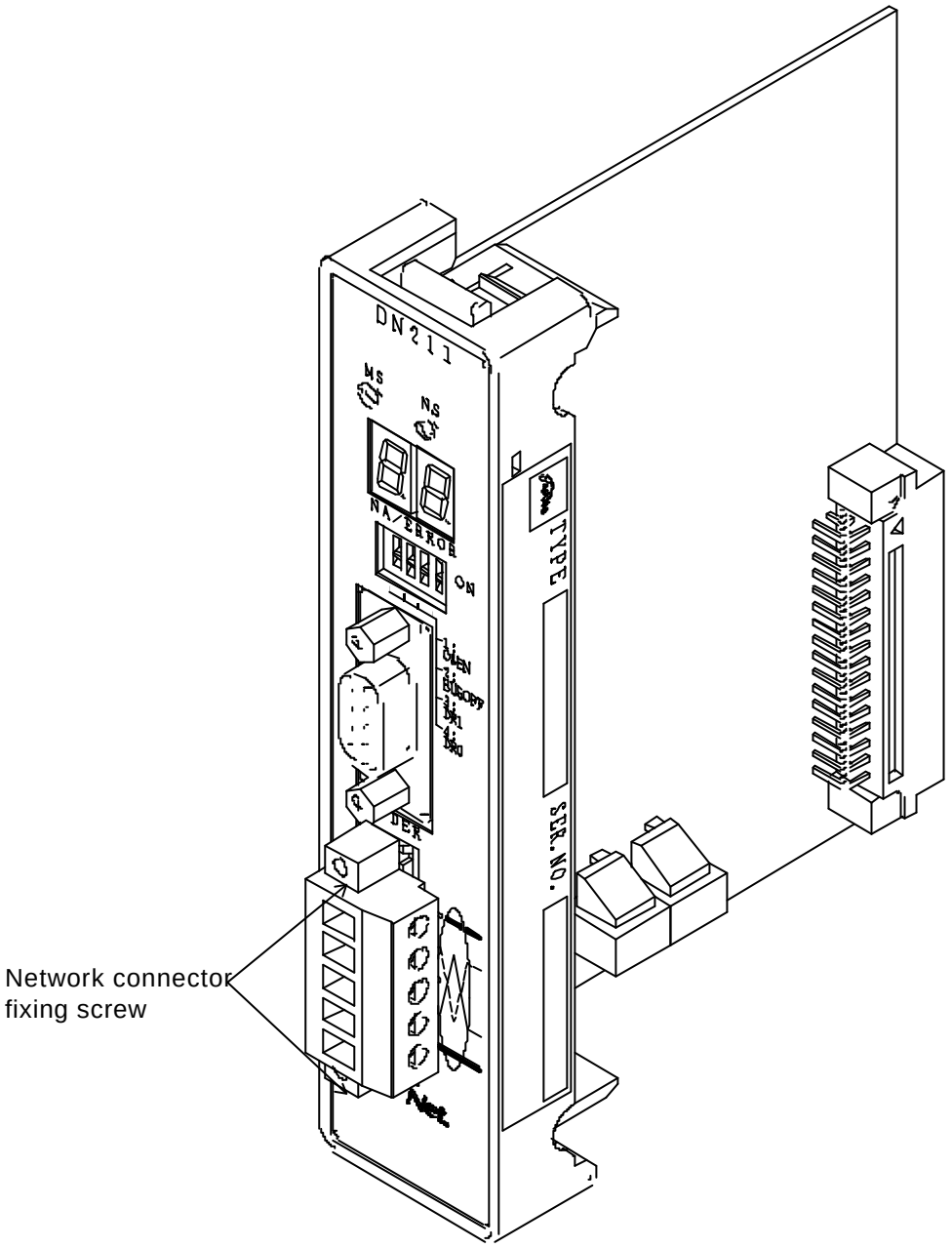


Figure 3.8 Mounting the Network Side Connector

Usage Recommendation
1. Loosen the cable fixing screw on the connector before inserting cables into the network side connector. The cable cannot be fixed when the screws are kept tightened.
2. Colors corresponding to cable colors are printed by the device side connector of the DN211. Match the cable colors with the printed colors to have correct wiring.
3. The DN211 and the DN311 (DeviceNet module for the T3/T3H) have different directions for attaching the network side connector.
4. DeviceNet cables, power tap, and device tap (connecting the trunk line with drop lines) are necessary when constructing a system using a DeviceNet. Refer to "3.6 The Network Components" for detail. Some of the network components must be prepared by the user.
5. When you use the network side connector that has the upper and lower rows with holes for cables (at the left-side Figure 3.5), the connector protrudes from the left-side DN211 about 5mm. When you attach or detach the left-side module of DN211, you must detach the connector from DN211.

3.5 The Network Power/Grounding

In the DeviceNet, the power for communication (24 Vdc) is supplied from the power cables (V+/V−) for the DeviceNet cables via the network side connector. This section describes how to supply the network power to the DeviceNet cables and how to configure network power units. Grounding the network is also explained.

3.5.1 The Network Power Mechanism

In order to supply the network power (24 Vdc) to the DeviceNet cables, the power tap (Figure 3.9) specified in the DeviceNet must to be used. The power tap is an apparatus for connecting a 24 Vdc power unit to the trunk cable. It has the following functions:

1) When more than one 24 Vdc power unit are connected to one network, the power tap prevents adverse current flow to power units by potential differences.
2) The power tap supports a maximum of 16 A from a power unit directly connected to the tap.
3) The protective circuit (fuse or circuit breaker) restricts the current flow from the power tap to the cables within 8 A.
4) Provides terminals for grounding the network.

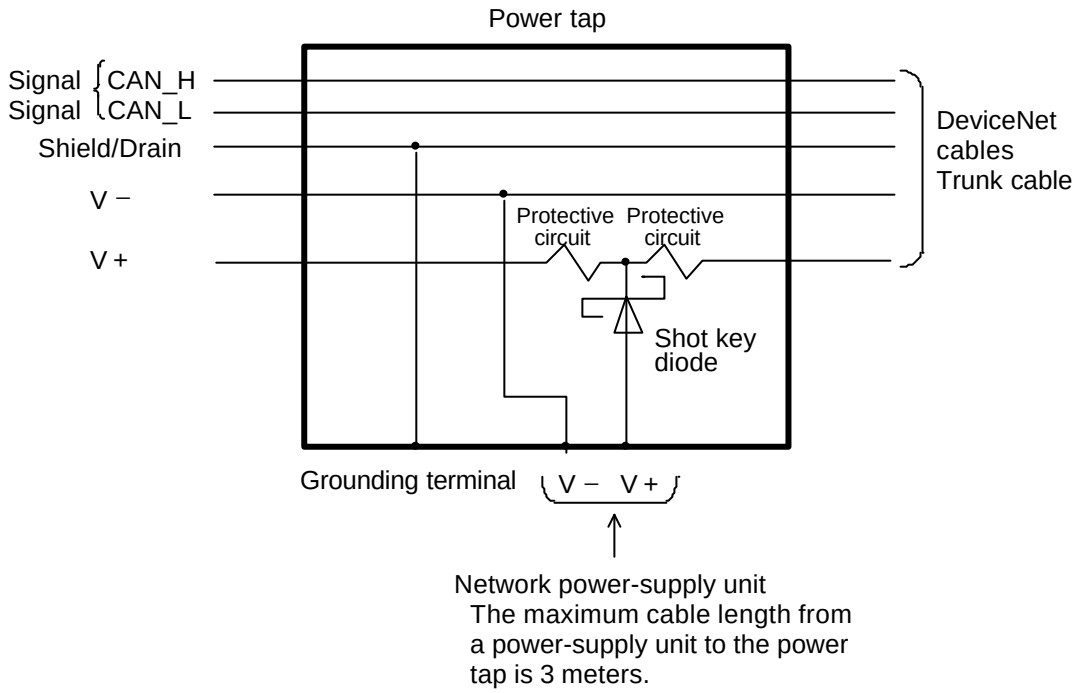


Figure 3.9 Power Tap Configuration

The following power tap products, specified in the DeviceNet, are available.

Model name	**1485T–P2T5–T5 (PowerTap)**
Manufacturer	Rockwell Automation

3.5.2 How to Configure Network Power Units

This section describes selecting and disposing power units for supplying the network power to individual nodes of the DeviceNet.

(1) Maximum Current on the DeviceNet cable

The network power of the DeviceNet is set to rated 24 Vdc. The current which can be passed on the network cable is as follows:

- Trunk line of thick cable: 8 A

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

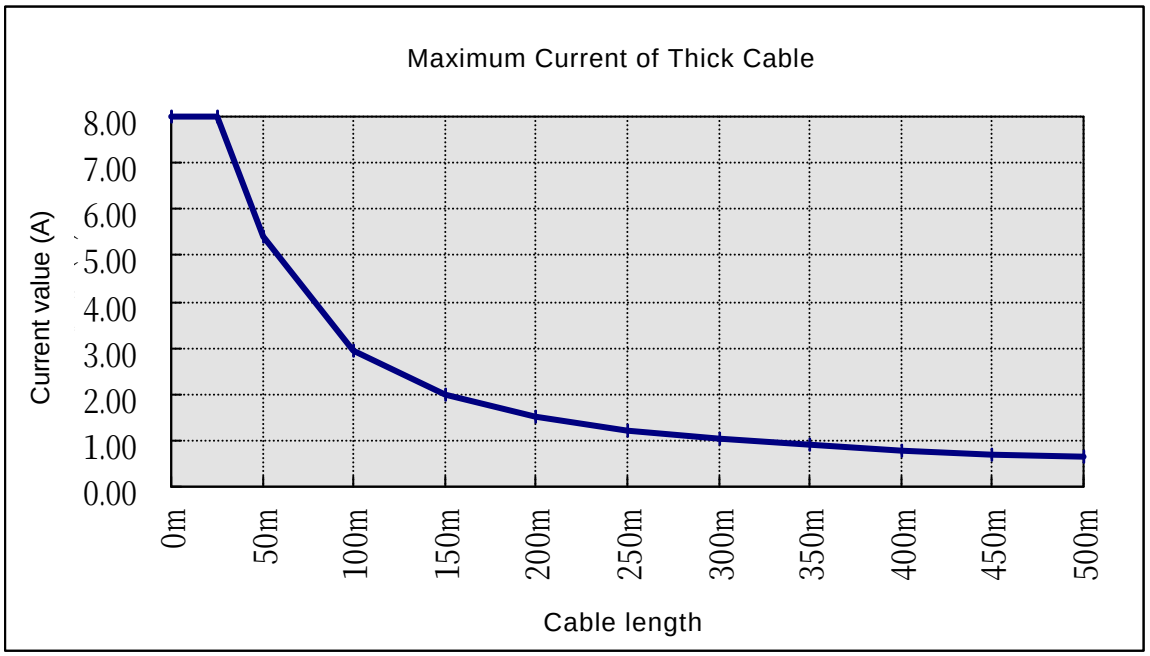


Figure 3.10 Current of the Trunk Line (thick cable)

- Trunk line of thin cable: 3 A (up to 100 m)

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

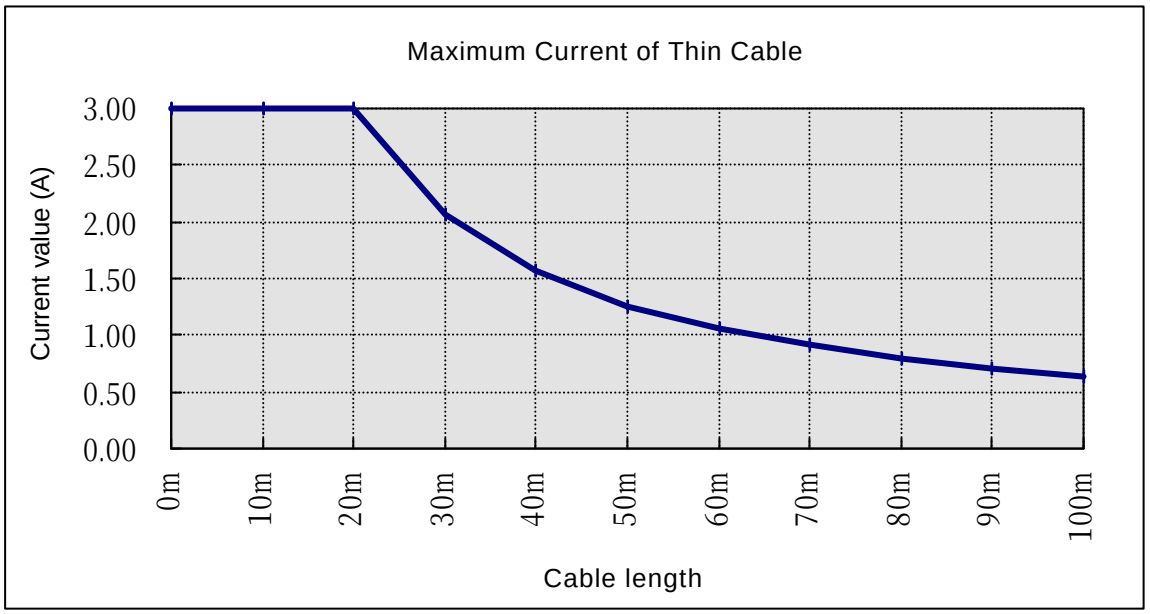


Figure 3.11 Current of the Trunk Line (thin cable)

- For drop line: 0.75 to 3.0 A

Formula: I = 4.57/L (however, I < 3 A)
I : Max. current of drop line (A)
L : Drop line length (0 to 6 m)

Usage Recommendation
1. Consider not only current capacity of the trunk line but also current capacity of a drop line when you install a node on the drop line.
2. In particular, when you are connecting nodes in daisy chain on a drop line, be careful not to have insufficient current capacity.

(2) How to Know the Optimal Arrangement of Network Power Units

Use the following procedure to know optimal arrangement of network power units.

a) Obtain the sum of the network currents consumed by individual nodes on the network. For the nodes which use the network power to operate, uses the sum of both currents.

b) Measure the full length of the network.

c) Based on the cable type (thick cable, thin cable) used for the trunk line and the full length of the network obtained through procedure b), get the maximum current value available on the cable by using Figure 3.10 and Figure 3.11

d) When the sum of the currents consumed on the network (procedure a) is smaller than the maximum current available on the cable (procedure c), a network power unit installed at the network end can be used to supply the power to all nodes (= single power unit terminal connection).

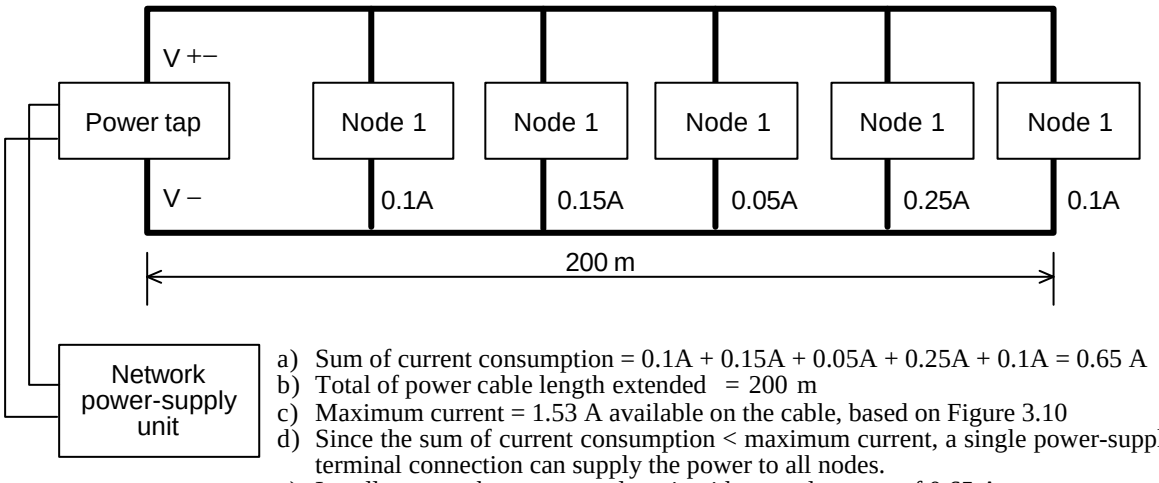
e) When the sum of the currents consumed on the network (procedure a) is larger than the maximum current available on the cable (procedure c), install a network power unit near the center of the network and examine whether it can supply the power to all nodes (= single power unit central connection).

f) If the single power central connection is insufficient to supply the network power to all nodes, install additional network power units.

Usage Recommendation
3. Use a network power whose capacity is much larger than the total current consumption necessary for the network.

(3) Single Power Unit Terminal Connection

Below is an example of a network power unit installed at the end of the trunk line (thick cable) with a total extension of 200 meters. The current consumption by the node is shown below.



a) Sum of current consumption = 0.1A + 0.15A + 0.05A + 0.25A + 0.1A = 0.65 A
b) Total of power cable length extended = 200 m
c) Maximum current = 1.53 A available on the cable, based on Figure 3.10
d) Since the sum of current consumption < maximum current, a single power-supply terminal connection can supply the power to all nodes.
e) Install a network power-supply unit with a rated current of 0.65 A or more. (Select one with ample current in considering usage conditions.)

3.12 Example of Single Power Terminal Connection

(4) Single Power Unit Central Connection

This section describes an example of installing a network power unit at the center of the trunk line (Thick cable) with a total extension of 240 meters. The current consumption by the node is shown below. Since the network power unit is installed at the center, the maximum current can be supplied to all directions of the network.

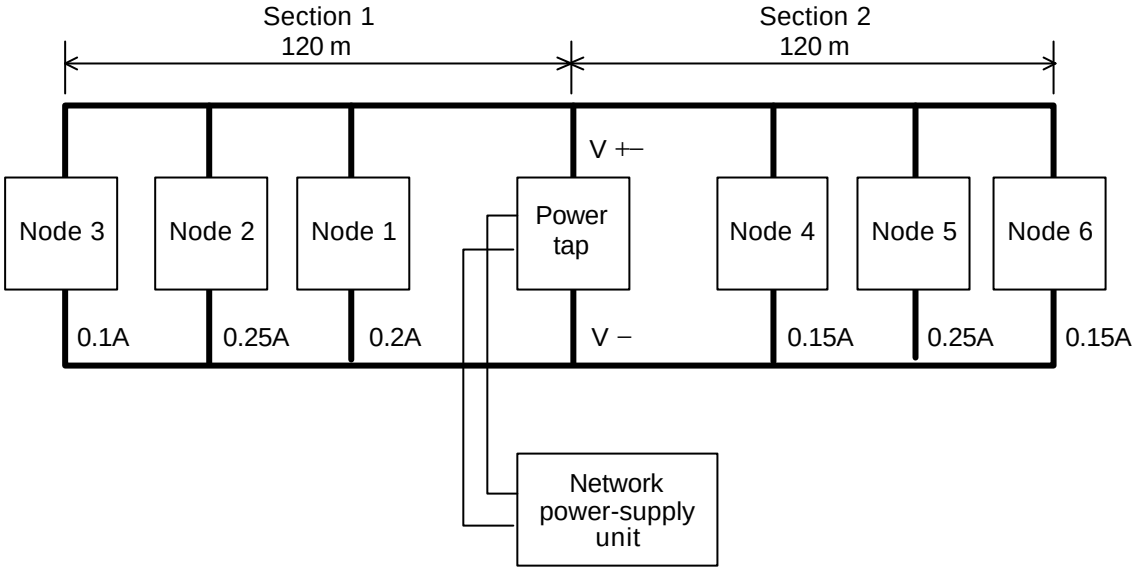


Figure 3.13 Example of Single Power Unit Central Connection

a) Sum of current consumption in section 1 = 0.1A + 0.25A + 0.2A = 0.55A

a') Sum of current consumption in section 2 = 0.15A + 0.25A + 0.15A = 0.55A

b) Total length extended in section 1 = Total length extended in Section 2 = 120 m

c) Maximum current available on the cable based on Figure 3.10 = approx. 2.56 A
(Obtain the approximate value between 100 to 150 meter straight cable.)

d) Since the sum of current consumption < maximum current, a single power unit central connection can supply the power to all nodes.

e) Install a network power unit with a rated current of 1.1A or more.
(Select one with ample current in considering usage conditions.)

When the current consumption by the section exceeds the maximum current available for the cable in single power unit central connection, take measures in the table below. Figure 3.14 indicates an example of an overloaded single power unit central connection.

Cable section where the current is applied beyond the maximum current	**Countermeasure**
Only one of the two section	Move a node in the overloaded section to the other section.
	Move the power tap closer to the section overloaded.
Both sections	Use two power taps.

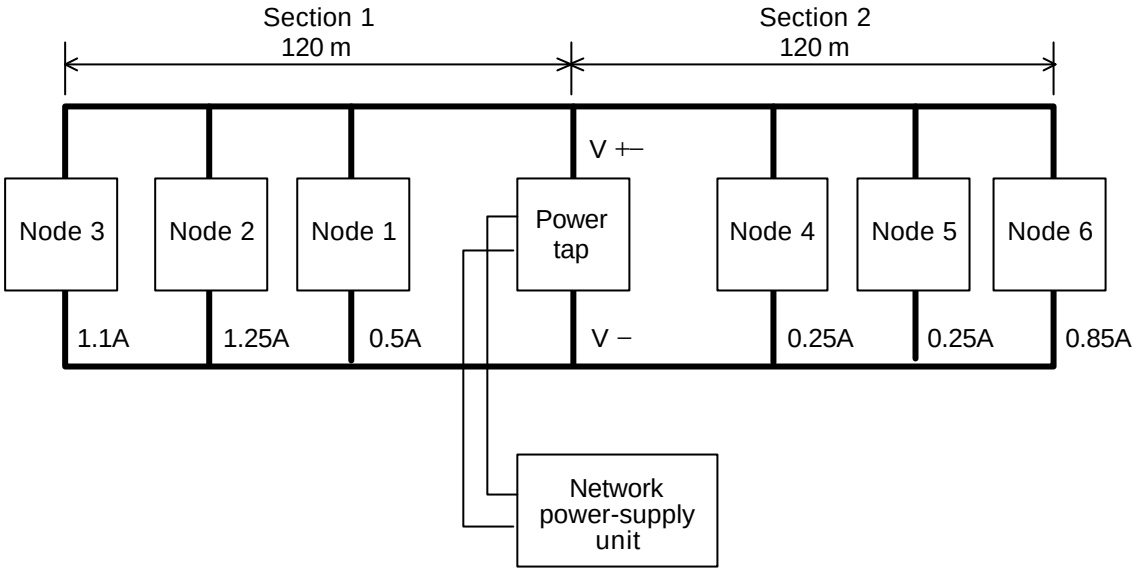


Figure 3.14 Example of Overloaded Single Power Unit Central Connection

a) Sum of current consumption in section 1 = 1.1A + 1.25A + 0.5A = 2.85A

a') Sum of current consumption in section 2 = 0.25A + 0.25A + 0.85A = 1.35A

b) Total length extended in section 1 = Total length extended in Section 2 = 120 m

c) Maximum current available on the cable based on Figure 3.10 = approx. 2.56A (Obtain the approximate value between 100 to 150 meter straight cable.)

d) Since the sum of current consumption in section 1 > maximum current, the current is overloaded.

Solution: Move the power tap to the overcurrent section. See Figure 3. 15.

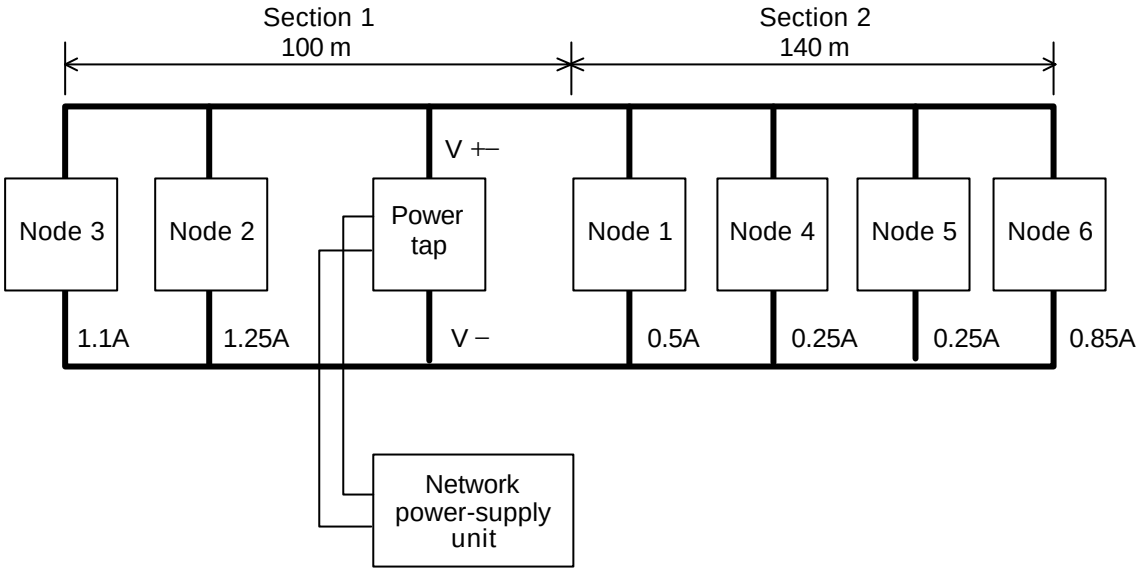


Figure 3.15 Example of Solving the Overload

a) Sum of current consumption in section 1 = 1.1A + 1.25A = 2.35A

a') Sum of current consumption in section 2 = 0.5A + 0.25A + 0.25A + 0.895A = 1.85A

b) Total length extended in section 1 = 100 m

b') Total length extended in section 2 = 140 m

c) Maximum current available on the cable in section 1, based on Figure 3.10 = approx. 2.19A
(Obtain the approximate value between 100 to 150 meter straight cable.)

d) Since both of the sums of current consumption in section 1/2 < maximum current, a single power unit central connection can supply the power to all nodes.

e) Install a network power unit with a rated current of 4.2A or more.
(Select one with ample current in considering usage conditions.)

3.5.3 The Network Power Unit (24 Vdc)

The network power unit is not attached to the DN211; you have to buy such a unit in the commercial market. Your network power unit must conform with the following specifications:

Item	Specification
Output voltage	24Vdc ± 1%
Output current	16A or less
Input fluctuation	Max. 0.3 %
Load fluctuation	Max. 0.3 %
Effects by the ambient temperature	Max. 0.03 % / °C
Input Voltage	120V ± 10 % 230V ± 10 % (if necessary) or Automatic changeover within 95 to 250V
Input frequency	47 to 62 Hz
Output ripple	250 mVp - p
Output side capacity	Max. 7000 μF
Ambient temperature	During operation: 0 to 66°C ∗ When stored: –40 to 85°C ∗ : Rated output derating at 60°C is allowed.
Instantaenious max. output current	less than 65A (at peek)
Protection against overvoltage	Yes (No value specified)
Protection against overcurrent	Yes (Max. current: 125 %)
Startup time	250 ms by the 5% value of the max. output voltage
Overshoot on startup	Max. 0.2%
Stability	0 to 100% load (for all conditions)
Insulation	Between output - AC power unit; between output - case grounding
Conformity	Required: UL Recommended: FCC Class B, CSA, TUV, VDE
Ambiant humidity	20 to 90% (no dew)
Surge current capacity	10% of reserve capacity

Usage Recommendation
1. Use a network power whose capacity is much larger than the total current consumption necessary for the network.

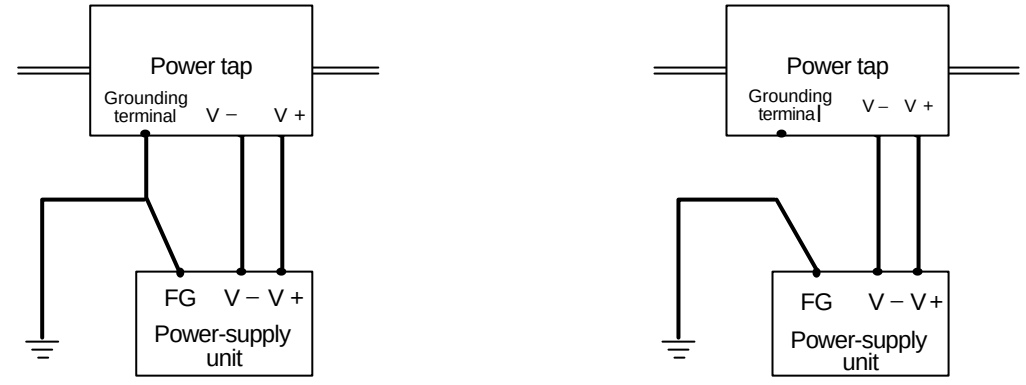
3.5.4 The Network Grounding

For the DeviceNet, use 1-point grounding (**class-3 grounding for control device only**) for the network grounding. If more than one point are grounded, the ground can loop. Conversely, the network without being grounded is likely to malfunction due to external noises.

Use the power tap as the point for 1-point grounding. Connect the ground terminal of the power tap with the FG terminal of the power unit before applying class-3 grounding for control device only as shown in Figure 3.16. (Install a power tap near the center of the network and ground from it).

When more than one power units are used in the network, apply grounding to a power tap near the center of the network.

Use a grounding line with a maximum of 3 meters (#8AWG power line).



Power tap grounded

Power tap not grounded

Figure 3.16 How to Install Your Network

3.5.5 Procedure for Switching-ON/Shutting-OFF the Power

This section describes the order of switching on the slave devices power, the network power, and the T2/T2E/T2N side power before starting up the DN211. Check all device wiring and settings are completed before switching ON in the following order.

(1) When Starting up the System

a) The network power

b) The slave device power

c) The T2/T2E/T2N side power

d) Activating the DN211 communication

The DN211 doesn't yet start communication when the T2/T2E/T2N side power is switched ON. Set the parameters of the local nodes and register the parameters of the slave devices in the scanning list before engaging in communication start processing. See "5.2 Module Setting Procedure" for detailed procedures.

⚠ CAUTION

1. Be sure to turn ON the network power before turning ON the power of the DeviceNet devices.

   Some nodes of the slave devices use the network power as the operation power while other slave devices indicate an error when their work power is not supplied. Therefore, be sure to switch ON the network power. Also note unless the network power is switched ON, your DN211 cannot start communication with slave devices.
2. Be sure the network power is supplied to all the nodes being connected with the network. The node to which no network power is supplied could cause communication obstacle to other nodes.
3. Make sure the power of all slave devices is switched ON before the DN211 begins communication.

   When the DN211 begins communication while the power of a slave device is not switched ON, the DN211 will display an error message of no response from that device.

(2) When Deactivating the System

a) The slave devices power

b) The network power

c) (HALT the operation mode of the T2/T2E/T2N.)

d) The T2/T2E/T2N side power

⚠ CAUTION

4. While network communications are operating, don't shut OFF the network power. Failing to do so will cause the entire network communications to stop and, one of the nodes become busoff state.
5. Switch OFF the T2/T2E/T2N side power at last after the DN211 begins communication. This helps the master device (DN211) to be recognized from the network and prevents slave devices from malfunctioning.

3.6 The Network Components

This section explains the network components of the DeviceNet other than the master/slave devices (Figure 3.17). Since peripheral devices are recommended on the following pages, which are available in the commercial market, buy some of them when you need.

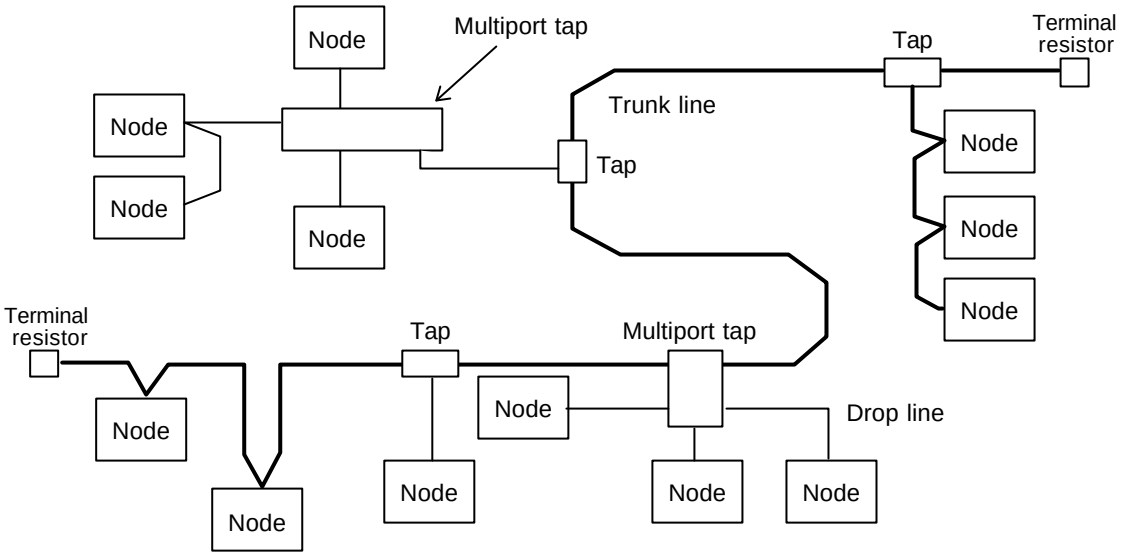


Figure 3.17 Example of DeviceNet Network Configuration

(1) Thick Cable (for trunk line)

Manufacturer: Rockwell Automation

Item name	Catalog No.	Remarks
1 m with connectors	1485C-P1N5-M5	Shieldded mini-connectors (male, female) attached
2 m with connectors	1485C-P2N5-M5	
3 m with connectors	1485C-P3N5-M5	
5 m with connectors	1485C-P5N5-M5	
10 m with connectors	1485C-P10N5-M5	
50 m with no connector	1485C-P1-A50	Shielded mini-connectors 871A-TS5-NM3 (male) and 871A-Ts5-N3 (female) for fixing
150 m with no connectors	1485C-P1-A150	
300 m with no connectors	1485C-P1-A300	

(2) Thin Cable (for trunk line and drop line)

Manufacturer: Rockwell Automation

Item name	Catalog No.	Remarks
1 m with connectors	1485R-P1M5-C	Discrete shielded mini-connector (male) and open-type connector
2 m with connectors	1485R-P2M5-C	
3 m with connectors	1485R-P3M5-C	
150 m with no connector	1485C-P1-C150	Used for linking an open-type connector to an open-type connector in daisy chain. Used when connecting the DeviceBox Tap with an open-type connector
300 m with no connectors	1485C-P1-C300	
600 m with no connectors	1485C-P1-C600	

(3) Tap/Multiport Tap

Manufacturer: Rockwell Automation

Item name	Catalog No.	Remarks
T-Port Tap	1485P-P1N5-MN5R1	T-branch (one drop line from the trunk line) Both the trunk line and drop line use a cable with shielded mini-connectors.
DeviceBox Tap (2 ports) DeviceBox Tap (4 ports) DeviceBox Tap (8 ports)	1485P-P2T5-T5 1485P-P4T5-T5 1485P-P8T5-T5	2 drop lines from the trunk line 4 drop lines from the trunk line 8 drop lines from the trunk line The trunk line cable and drop line cable, connected with a DeviceBox Tap, are open-type and discrete.

(4) Others

Manufacturer: Rockwell Automation

Item name	Catalog No.	Remarks
Power Tap	1485T-P2T5-T5	Tap power capacity for the trunk line: 7.5 A The trunk line connected with a PowerTap with overcurrent protection uses a discrete open-type connector (no shielded mini-connector).
Terminator (male) Terminator (female)	1485A-T1M5 1485A-T1N5	Terminates the trunk line. These are used for a Thick Cable with mini-connectors or T-Port Tap.

4. How to Handle Your DN211 (software)

This chapter describes the subjects necessary for using various functions of the DN211 in ladder programs for the T2/T2E/T2N. More specifically, the following subjects are explained in this chapter.

- Configuration and functions of the DN211 communication memory seeing from the T2/T2E/T2N
- Functions and usage of various request instructions for operating the DN211
- DN211's response code to various request instructions (completion status)

Based on the subjects discussed in this chapter, Chapter 5 describes the procedures in the DN211 for setting parameters, activating transmission, inputting/outputting data with slave devices, and reading RAS information including event history, and introduces sample programs.

⚠ CAUTION
1. Chapter 4 describes the subjects necessary for using diverse functions of the DN211 from the T2/T2E/T2N. Chapter 5 describes, based on the subjects explained in Chapter 4, setting the DN211 parameters, activating transmission, inputting/outputting data with slave devices, and the procedure for reading RAS information including event history, and sample programs. Write programs after understanding the contents. As sample programs are basic, you need to examine your programs from beginning to end before applying them to actual systems.

Usage Recommendation
1. When your DN211 is going to be I/O registered in the T2/T2E/T2N, leave blank for the slot where the DN211 is installed. After automatic allocation is performed, the DN211-installed slot is left blank.

4.1 Configuration of the DN211 Communication Memory

Indicated below is the configuration of the DN211 communication memory seeing from the T2/T2E /T2N.(Word address)

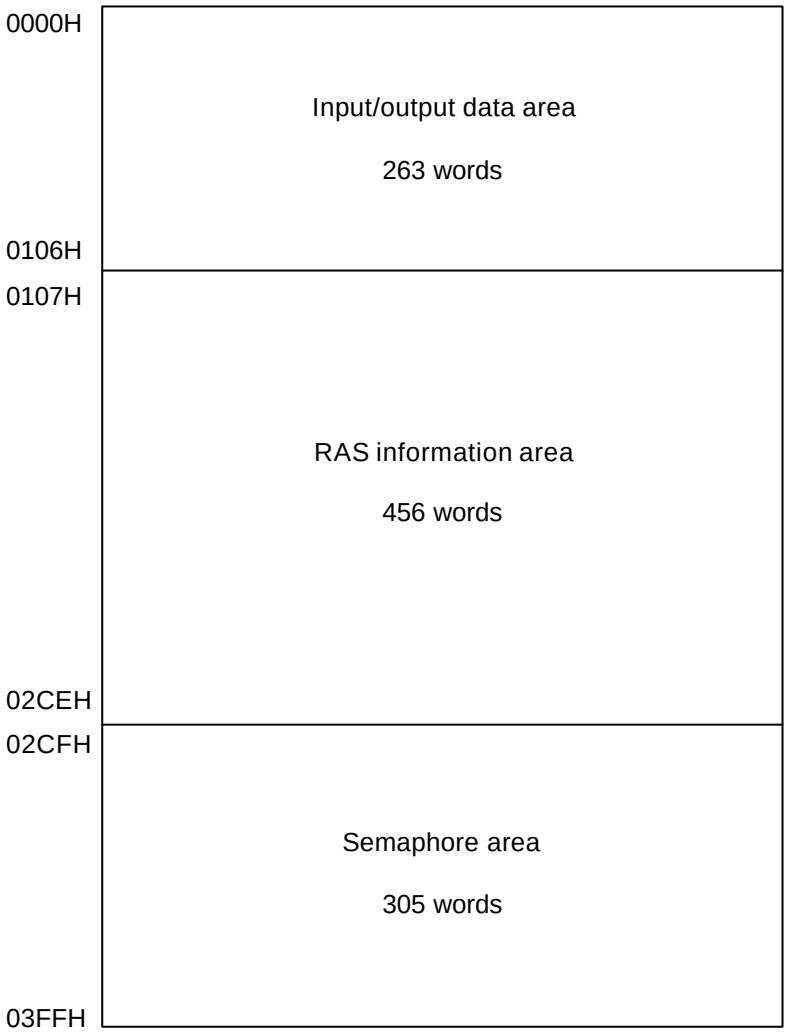


Figure 4.1 DN211 Communication Memory Map

(1) The Semaphore Area

This area is used for issuing requests from the T2/T2E/T2N to operate the DN211 and for reading the DN211 responses.

(2) The RAS information Area

This area of the DN211 displays the DN211's module status, communication status with network and slave devices.

(3) The Input/Output Data Area

This area stores data to be exchanged between the DN211 and slave devices.

Output data from the T2/T2E/T2N is written in this area, while input data is read from this area. This area also have the output and input semaphore registers used for synchronous communications between the DN211 and slave devices.

4.2 The Input/Output Data Area

This area stores data to be exchanged between the DN211 and slave devices. Output data from the T2/T2E/T2N is written in this area, while input data is read from this area.

This area also have the output and input semaphore registers used for synchronous communications between the DN211 and slave devices. The addresses in Figure 4.2 indicate the word addresses seen from the T2/T2E/T2N.

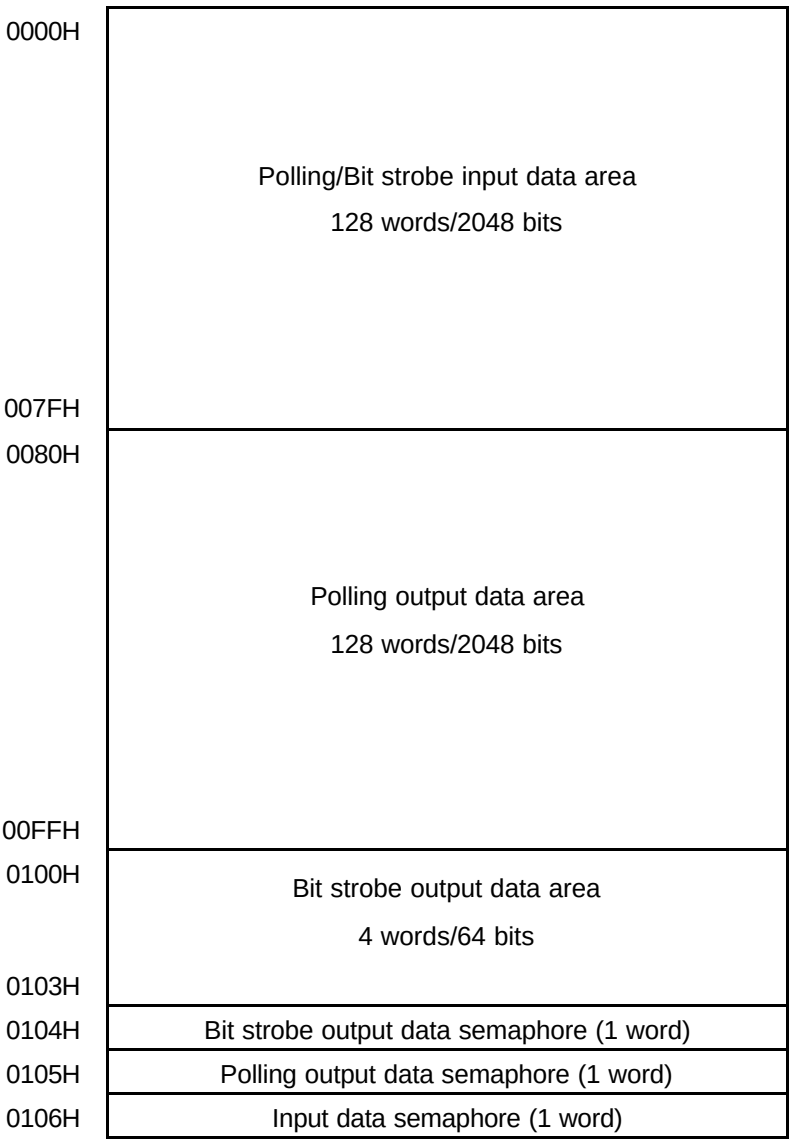


Figure 4.2 Input/Output Data Area Configuration

(1) Input Data Semaphore Register (0106H: 1 word)

This semaphore register is used when inputting data into the T2/T2E/T2N from the DN211 (effective only for synchronous transmission mode). The register is used both in the polling mode / bit strobe mode.

- DN211 side operation

  The DN211 writes data, collected from the slave devices in the polling mode or the bit strobe mode, into "polling / bit strobe input data area" before setting "1" to this register.

- T2/T2E/T2N ladder program operation

  The ladder program for the T2/T2E/T2N monitors this register. When detecting "1" is written into this register, the ladder program reads data from the "polling / bit strobe input data area" and then writes "0" in the register before notifying the DN211 of read completion.

  Write the value "0" only in this semaphore register.

(2) Polling Output Data Semaphore Register (0105H: 1 word)

This semaphore register is used when outputting polling data to the DN211 from the T2/T2E/T2N (effective only for synchronous transmission mode).

- T2/T2E/T2N ladder program operation

  The ladder program writes data, to be outputted to the "polling output data area," to slave device in the polling mode before writing "1" in this register, and then instructs the DN211 to start output.

  Write the value "1" only in this semaphore register.

- DN211 side operation

  The DN211 monitors this register in the "scan interval wait time" cycle specified from the T2/T2E/T2N. When detecting "1" is set to this register, the DN211 outputs output data in the "polling output data area" to slave devices. When the output is completed, "0" is set to the register. The "scan interval wait time" is explained in "4.6.3 Parameter Setting Request (local node)."

(3) Bit Strobe Output Data Semaphore Register (0104H: 1 word)

This semaphore register is used when outputting bit strobe data to the DN211 from the T2/T2E/T2N (effective only for synchronous transmission mode).

- T2/T2E/T2N ladder program operation

  The ladder program writes data, to be outputted to slave devices in the bit strobe mode, into the "bit strobe output data area" before writing "1" into this register, and then instructs the DN211 to start output.

  Write the value "1" only in this semaphore register.

- DN211 side operation

  The DN211 monitors this register in the "scan interval wait time" cycle specified from the T2/T2E/T2N. When detecting "1" is set to this register, the DN211 outputs output data in the "bit strobe output data area" to slave devices. When the output is completed, "0" is set to the register. The "scan interval wait time" is explained in "4.6.3 Parameter Setting Request (local node)."

(4) The Bit Strobe Output Data Area (0100H – 0103H: 4 words)

Stores data that the DN211 outputs to slave devices in the bit strobe mode.

The ladder program for the T2/T2E/T2N writes output data in this area. The transmitting data in the bit strobe mode is fixed at 8 bytes (64 bits).

The corresponding relation of the bits in this area and the node addresses of the slave devices is indicated below.

Table 4.1 Bit Strobe Output Data Area Configuration

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0100H	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0101H	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0102H	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
0103H	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

(5) The Polling Output Data Area (0080H – 00FFH: 128 words)

Stores data that the DN211 will output to slave devices in the polling mode.

The ladder program for the T2/T2E/T2N writes output data in this area. The area has 128 words (2048 bits) in size; unless the data size that the DN211 sends to salve devices doesn't exceed this limit, up to 63 slave devices are connectable with one DN211.

How to allocate output data to slave devices from this area is explained in "4.4 Allocating Slave Data to the Input/Output Data Area"

(6) The Polling/Bit Strobe Input Data Area (0000H – 007FH: 128 words)

Stores data collected by the DN211 from the slave devices in the polling mode and bit strobe mode. The ladder program for the T2/T2E/T2N read data from this area. The area has 128 words (2048 bits) in size; unless the data size that slave devices send to the DN211 doesn't exceed this limit, up to 63 slave devices are connectable with one DN211.

How to allocate input data from slave devices to this area is explained in "4.4 Allocating Slave Data to Input/Output Data Area"

Figure 4.3. shows an overview of the output data area/input data area.

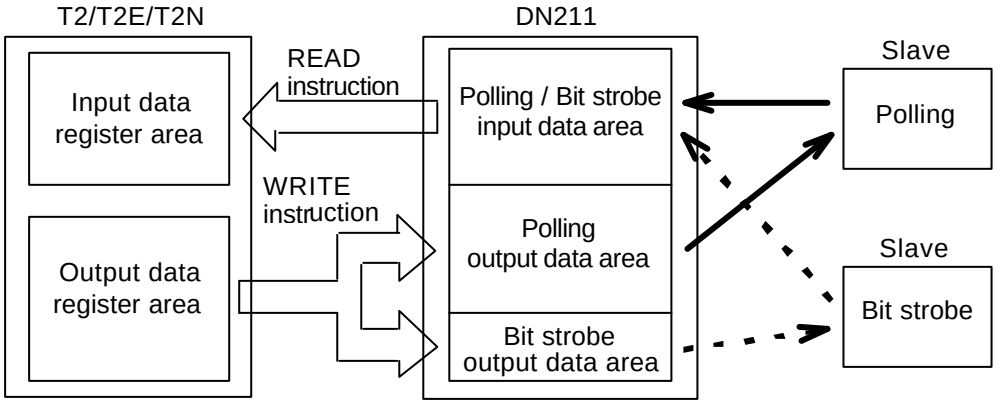


Figure 4.3 Overview of Input/Output Data Area

(7) The usage of Output/Input Data Semaphore (for synchronous transmission mode alone)

Figure 4.4 indicates the relation between output data semaphore (polling / bit strobe) and input data semaphore. Oblique lines parts indicate each of the semaphore values is set to the "1".

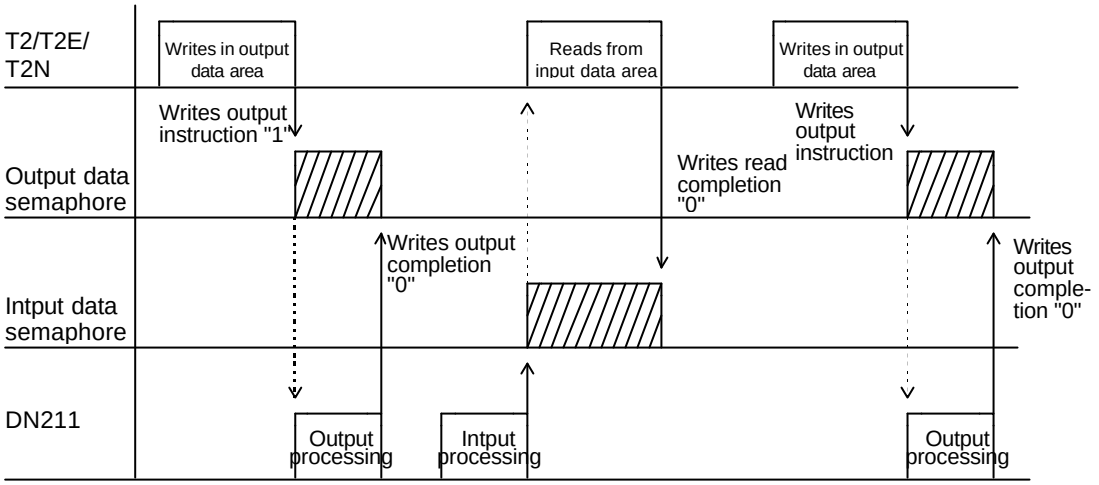


Figure 4.4 Use of Semaphores in Synchronous Mode

(8) Cautions in Using the Input/Output Data Area

- **The input data semaphore register is used both for the polling mode and the bit strobe mode. Therefore, when some slave devices use the polling mode while other slave devices use the bit strobe mode, set data input/output processing in the alternative way like :**

  polling mode processing completion ® bit strobe mode processing completion ® polling mode processing completion ® bit strobe mode ® ¼

- **Don't allow the WRITE instruction to execute in the input data area/input data semaphore register. Otherwise, input data could be destroyed.**
- **When you write data in the polling output data area/bit strobe output data area with the WRITE instruction, be careful of the top address of the area and the data size to be written. Otherwise, data could destroy those in another area, causing the DN211 and/or slave devices to get malfunctioned.**

4.3 The RAS Information Area

This area indicates the DN211's module status and the communication status of the network and slave devices. Don't write data into this area. Otherwise, the correct data may not be read. The addresses in Figure 4.5 indicate the word addresses seen from the T2/T2E/T2N.

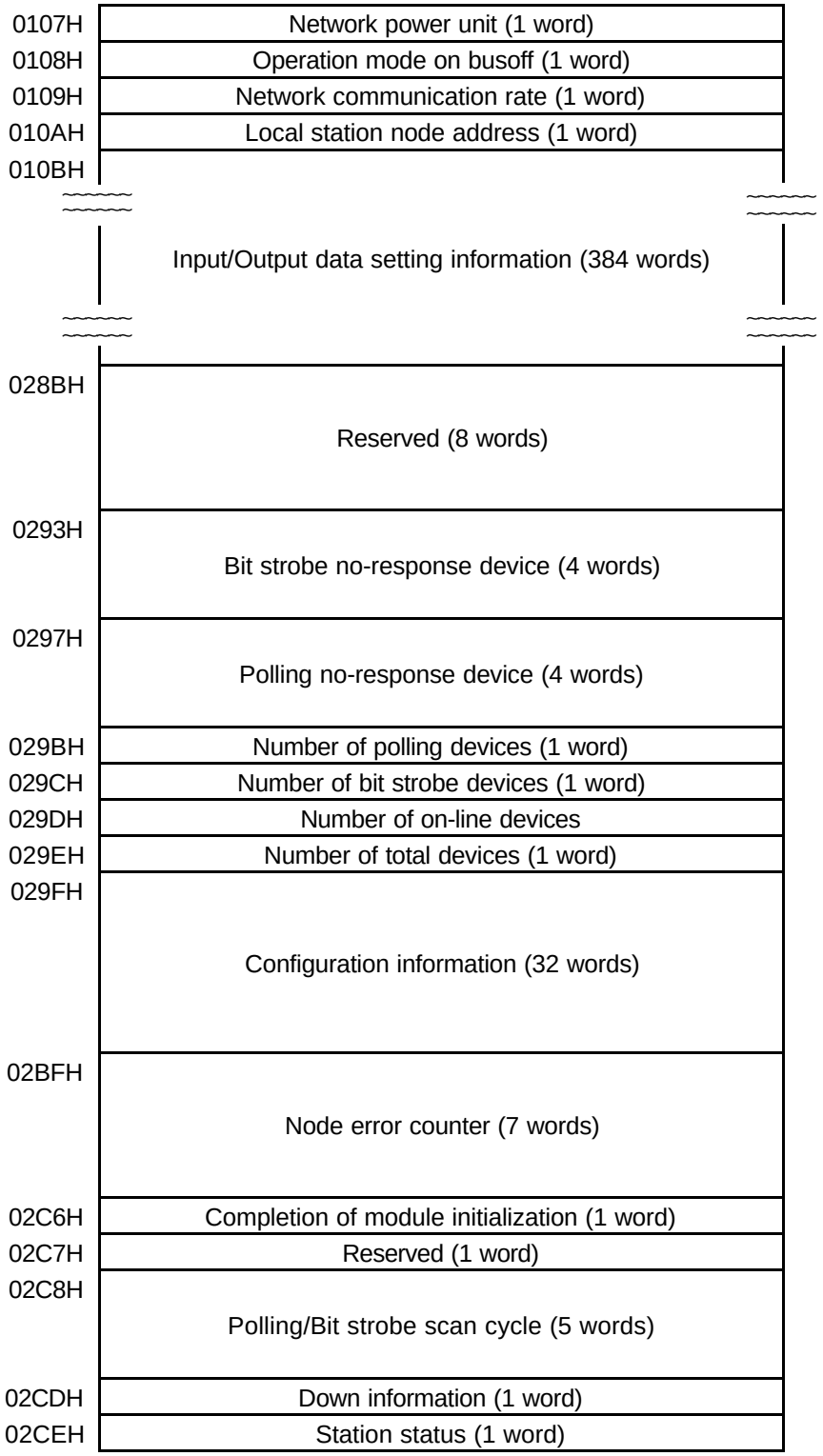


Figure 4.5 RAS Information Area Configuration

Indicated below is detailed information that can be checked in the RAS information area.

(1) Station Status (02CEH: 1 word)

This register indicates the DN211's status with bit flags. Each bit has meaning when "1" is set.

Format

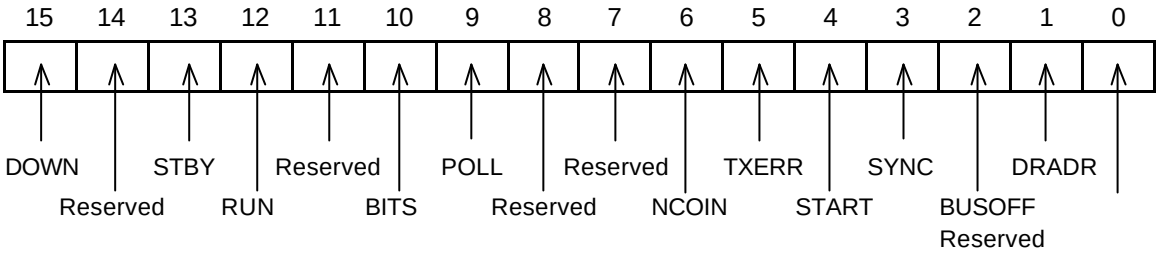


Figure 4.6 Configuration of Station Status Bits

Table 4.2 Meaning of Individual Bits of Station Status

Bit	Name	Meaning
15	DOWN	DN211 is set to the down mode.
14		Reserved
13	STBY	DN211 is set to standby mode.
12	RUN	DN211 is set to run mode.
11		Reserved
10	BITS	Bit strobe mode transmission is operating.
9	POLL	Poling mode transmission is operating.
8		Reserved
7		Reserved
6	NCOIN	No slave device is registered in the DN211.
5	TXERR	Some of the salve devices registered do not respond.
4	START	DN211 is executing transmission.
3	SYNC	DN211 is operating in synchronous mode.
2	BUSOFF	DN211 is set to busoff status.
1	DPADR	DN211 detected an duplicated node address when starting transmission.
0		Reserved

Table 4.3 on the next page indicates the configuration of the station status bits of the DN211 in different modes.

Table 4.3 DN21's Modes and Station statuses

	DN211's mode	Bit "1"	Station status
a	Down mode	DOWN	8000H
b	After switching ON the power or after issuing a reset request from the T2/T2E/T2N	STBY	2000H
c	No slave device is registered (or deleted) in the DN211 in mode b).	STBY NCOIN	2040H
d	When a slave device is registered in mode c) by a parameter setting request	STBY	2000H
e	When "standby" is requested by a module control request from the T2/T2E/T2N	STBY	2000H
f	When "transmission enabled, polling mode transmission, asynchronous mode" is requested by a module control request from the T2/T2E/T2N and transmitted normally	RUN START POLL	1210H
g	When "transmission enabled, bit strobe mode transmission, asynchronous mode" is requested by a module control request from the T2/T2E/T2N and transmitted normally	RUN START BITS	1410H
h	When "transmission enabled, polling mode and bit strobe mode transmissions, asynchronous mode" is requested by a module control request from the T2/T2E/T2N and transmitted normally	RUN START POLL BITS	1610H
I	When asynchronous mode is requested in a mode within f) to h)	Bits from f) to h), followed by SYNC	1218H 1418H 1618H
j	While transmitting with a slave device in a mode within f) to i), the slave device stopped responses.	The bits from f) to i), followed by TXERR	1230H 1430H 1630H 1238H 1438H 1638H
k	When busoff occurs, the DIP switch of the DN211 (BUSOFF) remains OFF (when the DN211 has control of restarting transmission)	Station status bits before busoff occurring, followed by :BUSOFF	
l	When busoff occurs, the DIP switch of the DN211 (BUSOFF) remains ON (changing to standby mode when busoff occurring)	STBY BUSOFF	2004H
m	An overlapped node address is detected when starting transmission	STBY DPADR	2002H

(2) Down Information (02CDH: 1 word)

This register stores the cause of becoming the down mode when the DN211 turns down mode. When this happens, some of the following down codes are displayed in the 7–segment LED on the front panel.

Table 4.4 Down Information

Down information (hex.)	Cause of down mode occurred
F0H	Watchdog timeout occurred
F1H	Memory bus abnormal occurred
F2H	TRAP occurred
F3H	ROM's BCC check error occurred (on DN211 startup)
F4H	RAM's read/write error occurred (on DN211 startup)
F5H	Read/Write error occurred for the DN211 communication memory (on DN211 startup)
F6H	DN211 node address setting abnormal
F7H	DN211 network communication rate setting abnormal
F8H	Configuration data EEPROM read error occurred

(3) Polling / Bit Strobe Scan Cycle (02C8H - 02CCH: 5 words)

This area stores the DN211's scan time in milliseconds for the polling mode or bit strobe mode transmission.

When in asynchronous mode: The "scan cycle" means the time that the DN211 starts carrying out data input/output with all slave devices until starting the next input/output.

- Only for the slave devices with the polling mode, the "scan cycle" means the time from starting polling input/output until starting the next polling input/output.
- Only for the slave device with the bit strobe mode, the "scan cycle" means the time from starting bit strobe input/output until starting the next bit strobe input/output.
- For the salve devices where the polling mode and bit strobe mode are intermingled, the "scan cycle" means the time from starting bit strobe input/output, followed by performing polling input/output, until starting the next bit strobe input/output.

When in synchronous mode: The "scan completion time" means the time from the T2/T2E/T2N's writing "1" in the "bit strobe output data semaphore/polling output data semaphore" until the DN211's writing "1" in the "input data semaphore."

Table 4.5 Scan Cycle Configuration

02C8H	Scan cycle/Scan completion time
02C9H	Asynchronous mode: Min. scan cycle value
02CAH	Asynchronous mode: Max. scan cycle value
02CBH	Synchronous mode: Min. scan cycle time value
02CCH	Synchronous mode: Max. scan cycle time value

(4) Completion of module initialization (02C6H:1 word)

This register indicates the completion of initialization processing by switching ON the power or by requesting resetting.

"1": Completion of initialization

"Value other than 1": Under initialization

(5) The Node Error Counter (02BFH to 02C5H: 7 words)

The CAN controller used in the DN211 has a function of notifying error state changes of the local station error state (error active ⇔ error passive ⇔ busoff) based on the number of transmission errors occurring.

The CAN controller also has a function of notifying the DN211 of "overrun error" if the DN211 fails to take the data sent from slave devices.

The DN211 maintains the current error state and a history of error state changes since communication was activated. This register indicates a history of error state changes since communication was activated and the total number of transmission times and reception times.

Table 4.6 Node Error Counter Configuration

02BFH	Current error state (hexadecimal scale)
02C0H	Number of transmission times since communication was activated
02C1H	Number of reception times since communication was activated
02C2H	Number of error active occurrence times
02C3H	Number of error passive occurrence times
02C4H	Number of busoff occurrence times
02C5H	Number of overrun error occurrence times

Current error state	Error code (hexadecimal scale)
Initial mode	00H
Error active state	01H
Error passive state	02H
Busoff state	03H
Overrun error occurrence	04H
Reserved	Other

(6) Slave Device Configuration Information (029FH – 02BEH: 32 words)

This area indicates scan type information for slave devices, which is set in the DN211(stored in the non-volatile memory).

Table 4.7 Slave Device Configuration Information

Address	F 8	7 0
029FH	Node address : 1	Node address : 0
02A0H	Node address : 3	Node address : 2
02A1H	Node address : 5	Node address : 4
02A2H	Node address : 7	Node address : 6
02A3H	Node address : 9	Node address : 8
02A4H	Node address : 11	Node address : 10
02A5H	Node address : 13	Node address : 12
02A6H	Node address : 15	Node address : 14
02A7H	Node address : 17	Node address : 16
02A8H	Node address : 19	Node address : 18
02A9H	Node address : 21	Node address : 20
02AAH	Node address : 23	Node address : 22
02ABH	Node address : 25	Node address : 24
02ACH	Node address : 27	Node address : 26
02ADH	Node address : 29	Node address : 28
02AEH	Node address : 31	Node address : 30
02AFH	Node address : 33	Node address : 32
02B0H	Node address : 35	Node address : 34
02B1H	Node address : 37	Node address : 36
02B2H	Node address : 39	Node address : 38
02B3H	Node address : 41	Node address : 40
02B4H	Node address : 43	Node address : 42
02B5H	Node address : 45	Node address : 44
02B6H	Node address : 47	Node address : 46
02B7H	Node address : 49	Node address : 48
02B8H	Node address : 51	Node address : 50
02B9H	Node address : 53	Node address : 52
02BAH	Node address : 55	Node address : 54
02BBH	Node address : 57	Node address : 56
02BCH	Node address : 59	Node address : 58
02BDH	Node address : 61	Node address : 60
02BEH	Node address : 63	Node address : 62

Scan type	Code (hexadecimal)
Unassigned	00H
Bit strobe mode	01H
Polling mode	02H
Polling & strobe	03H
Reserved	Other

(7) The Number of Total Devices (029EH: 1 word)

Indicates the number of the slave devices, operable on the network, specified by a parameter setting request from the T2/T2E/T2N (setting information)

(8) The Number of Online Devices (029DH: 1 word)

Indicates the number of the slave devices which are performing data input/output with the DN211 (execution information).

(9) The Number of Bit Strobe Devices (029CH: 1 word)

Indicates the number of the bit strobe mode slave devices, operable on the network, specified by a parameter setting request from the T2/T2E/T2N (setting information).

(10) The Number of Polling Devices (029BH: 1 word)

Indicates the number of the polling mode slave devices, operable on the network, specified by a parameter setting request from the T2/T2E/T2N (setting information).

Note: For the slave devices which support both the polling mode and bit strobe mode, both of the bit strobe devices and polling devices are counted.

(11) The Polling No-Response Device Map (0297H – 029AH: 4 words)

Indicates, per bit, the individual polling–mode devices not responding to the transmission from the DN211.The value in each frame in Table 4.8 indicates the node address of a slave device.
When a slave device becomes not responding, the corresponding bit turns ON. The bit for the normal slave device is set to OFF. The corresponding bit for the slave device not selected is also set to OFF.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0297H	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0298H	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0299H	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
029AH	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

Table 4.8 Polling No-Response Slave Devices

(12) The Bit Strobe No-Response Device Map (0293H – 0296H: 4 words)

Indicates, per bit, the individual bit-strobe mode salve devices not responding to the transmission from the DN211. The value in each frame in Table 4.9 indicates the node address of a slave device. When a slave device becomes not responding, the corresponding bit turns ON. The bit for the normal slave device is set to OFF. The corresponding bit for the slave device not selected is also set to OFF.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0293H	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0294H	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0295H	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
0296H	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

Table 4.9 Bit Strobe No-Response Slave Devices

(13) Input/Output Data Setting Information (010BH - 028AH: 384 words)

Indicates , per slave device (node address: NA), the allocations of input/output data for slave devices in the input/output data area. The input/output data setting information has 6 words per 1 slave device.

Figure 4.7 indicates the top addresses of areas where individual node information is stored. Table 4.10 lists the meanings per slave device.

After the slave device parameters are set, data will be input in these areas when the DN211 is set to run mode (transmission enabled status) by an operation mode control request.

"0" is set to the areas where no slave device is found.

010BH	NA = 0	018FH	NA = 22	0213H	NA = 44
0111H	NA = 1	0195H	NA = 23	0219H	NA = 45
0117H	NA = 2	019BH	NA = 24	021FH	NA = 46
011DH	NA = 3	01A1H	NA = 25	0225H	NA = 47
0123H	NA = 4	01A7H	NA = 26	022BH	NA = 48
0129H	NA = 5	01ADH	NA = 27	0231H	NA = 49
012FH	NA = 6	01B3H	NA = 28	0237H	NA = 50
0135H	NA = 7	01B9H	NA = 29	023DH	NA = 51
013BH	NA = 8	01BFH	NA = 30	0243H	NA = 52
0141H	NA = 9	01C5H	NA = 31	0249H	NA = 53
0147H	NA = 10	01CBH	NA = 32	024FH	NA = 54
014DH	NA = 11	01D1H	NA = 33	0255H	NA = 55
0153H	NA = 12	01D7H	NA = 34	025BH	NA = 56
0159H	NA = 13	01DDH	NA = 35	0261H	NA = 57
015FH	NA = 14	01E3H	NA = 36	0267H	NA = 58
0165H	NA = 15	01E9H	NA = 37	026DH	NA = 59
016BH	NA = 16	01EFH	NA = 38	0273H	NA = 60
0171H	NA = 17	01F5H	NA = 39	0279H	NA = 61
0177H	NA = 18	01FBH	NA = 40	027FH	NA = 62
017DH	NA = 19	0201H	NA = 41	0285H	NA = 63
0183H	NA = 20	0207H	NA = 42		
0189H	NA = 21	020DH	NA = 43		

Figure 4.7 Input/Output Data Setting Information Addresses

Example) Input/output data setting information for node address = 1

- Input data offset indicates the offset address (in bytes) from the top (0000H) of input data area.
- Output data offset indicates the offset address (in bytes) from the top (0080H) of output data area.
- There are no items for the offset of bit strobe output data and for the number of bytes because of the bit strobe output data area.

Table 4.10 Input/Output Data Setting Information for Node Address = 1

0111H	Bit strobe input data offset
0112H	Number of bit strobe input data bytes
0113H	Polling input data offset
0114H	Number of polling input data bytes
0115H	Polling output data offset
0116H	Number of polling output data bytes

(14) The Local Station Node Address (010AH:1 word)

The hexadecimal node address of the local station, specified with the rotary switch on the side face of the module, is stored (00H - 3FH).

(15) The Network Communication Rate (0109H:1 word)

The network communication rate, set with the DIP switch on the front panel, is stored.

00H: Unassigned (setting disabled)

01H: 500kbps

02H: 250kbps

03H: 125kbps

(16) The Operation Mode on Busoff Occurring (0108H:1 word)

The DN211's operation mode setting is stored when the DN211 detects busoff state of the local station.

00H: When busoff is detected, the module will be set to standby mode, followed by the initialization of the CAN controller.
The procedure for resuming transmission is the same for starting ordinary transmission. Chapter 5 describes the transmission start procedure.

01H: When busoff is detected, the operation mode of the module is left intact, and the CAN controller is initialized, followed by resuming communication, if possible.

(17) Yes/No of Supplying the Network Power (0107H:1 word)

The supply mode of the network power is stored.

00H: Network power normal

01H: Network power abnormal

4.4 Allocating Slave Device Data to the Input/Output Data Area

Reception/transmission data of slave devices will be allocated to the input/output data area in the order from smaller to larger node addresses. For example, in Table 4.11, Slave Device Configuration, the input data area/output data area is allocated to the top and the subsequent addresses without skipping, as shown in Figure 4.8. Allocation will be executed when run mode (transmission state enabled) is set by an operation mode control request after setting slave device parameters.

Table 4.11 Slave Device Configuration (sample)

Node address	Transmission size	Reception size
10	2 bytes	4 bytes
11	4 bytes	2 bytes
12	6 bytes	6 bytes
20	3 bytes	4 bytes
30	4 bytes	1 byte
40	4 bytes	6 bytes

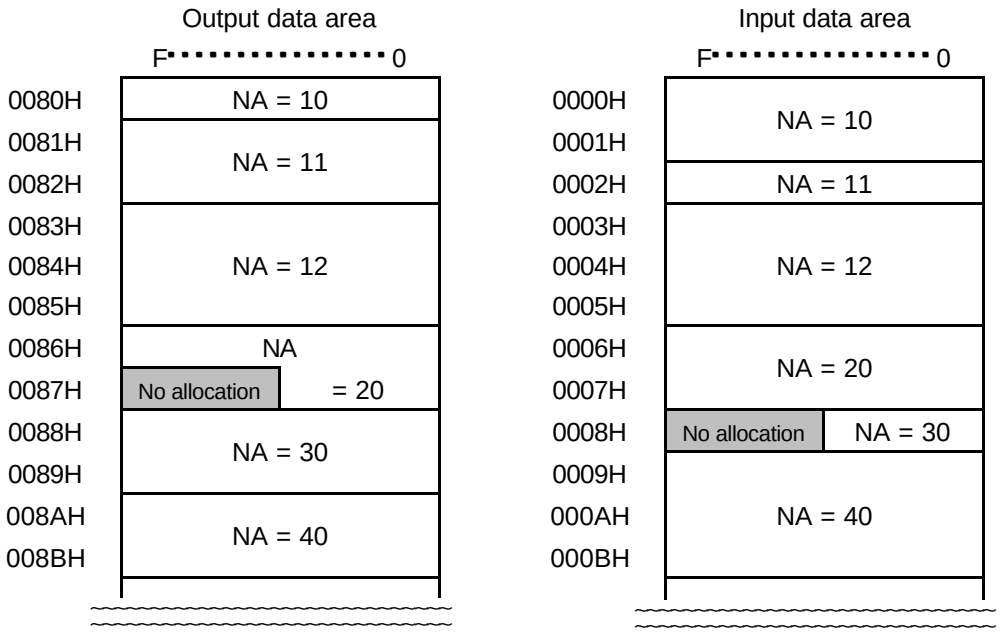


Figure 4.8 Input/Output Data Area in Slave Device Configuration (sample)

⚠ CAUTION

1. When a slave device has odd transmission/reception bytes in size, **the actual size plus 1 byte are allocated in the DN211 input/output area**.
2. When you add a new slave device, enter a new value larger than the node addresses of the present slave devices. For Figure 4.8, enter a value larger than "41"for the node address of a new slave. If the node address of a new slave device is set to "18", allocating data area of node addresses 20/30/40 will be shifted.
3. Don't change the input/output data size for slave devices (FLEX-I/O, etc.) which are flexible in data allocation size. If changed, the slave devices with a node address larger than that of the slave device changed data size will be shifted in their data allocation.

4.5 The Semaphore Area

This area is used for issuing a request from the T2/T2E/T2N for operating the DN211, or for reading the DN211's response to a request. The addresses in Figure 4.9 indicate the word addresses seen from the T2/T2E/T2N.

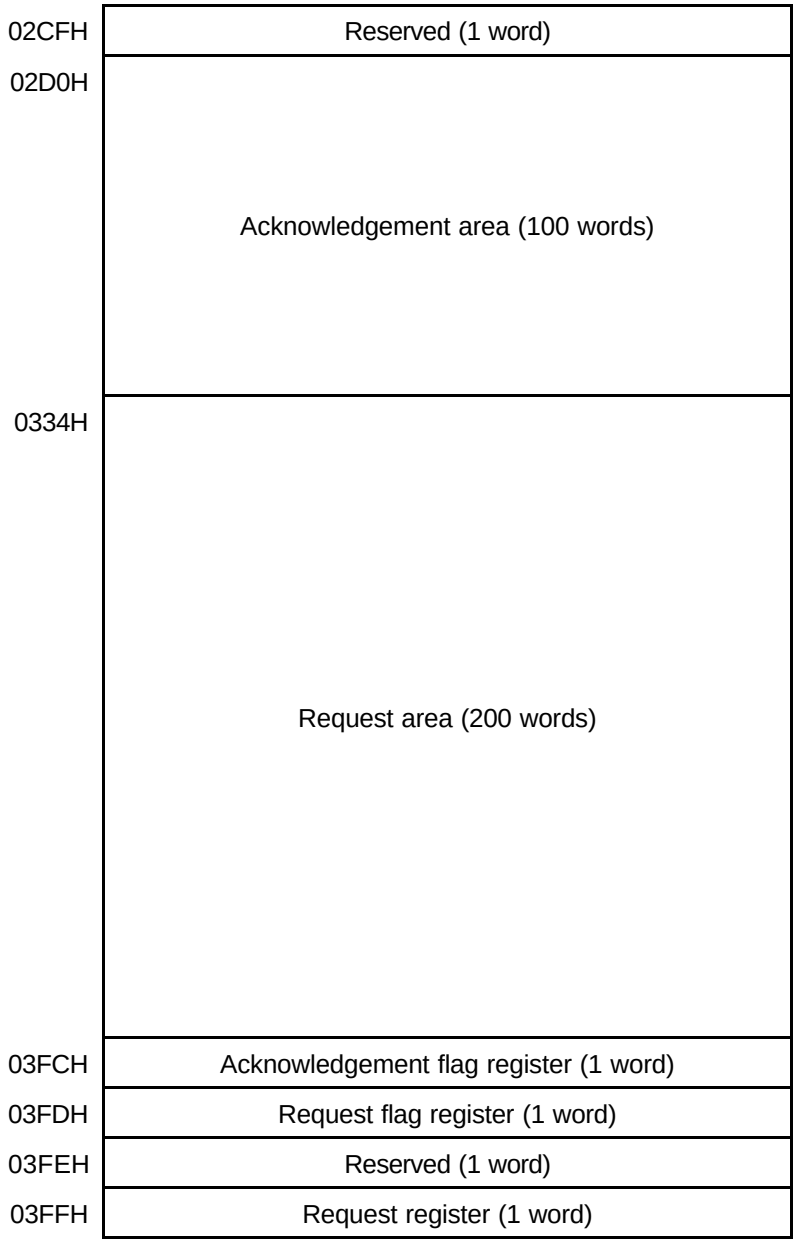


Figure 4.9 The Semaphore Area Configuration

(1) The Request Register (03FFH: 1 word): T2/T2E/T2N ® DN211

This register is used for notifying the DN211 of a request when the T2/T2E/T2N issues the request to the DN211. After writing "1" in the "request flag register," the ladder program of the T2/T2E/T2N writes "256 (0100H)" in this register.

"0": No notice.

"256": Noticed

After reading a request from the "request area," the DN211 sets this register to "0."

(2) The Request Flag Register (03FDH: 1 word): T2/T2E/T2N ® DN211

This register is used when the T2/T2E/T2N issues a request to the DN211. After writing request data in the "request area," the ladder program of the T2/T2E/T2N writes "1" in this register.

"0": No request.

"1": A request is issued from the T2/T2E/T2N to the DN211

"Value other than 0 and 1": Reserved

The DN211 sets this register to "0" after reading a request in the "request area."

(3) The Acknowledgement Flag Register (03FCH: 1 word): DN211 ® T2/T2E/T2N

This register is used for notifying the T2/T2E/T2N of the DN211's response after the T2/T2E/T2N issues a request to the DN211. The ladder program of the T2/T2E/T2N checks this register for "1" to be set after a request is issued to the DN211. When "1" is set to this register, the ladder program reads response data of the DN211 from the "acknowledgement area" before writing "0" in this register.

"0": No response.

"1": Responded to the T2/T2E/T2N from the DN211

"Value other than 0 and 1": Reserved

(4) The Request Area (0334H - 03FBH: 200 words): T2/T2E/T2N ® DN211

Request data is written when the T2/T2E/T2N issues a request to the DN21.

The data is written in the area beginning "0334 H" as the top address.

The T2/T2E/T2N has the following six types of requests to the DN211.

- Reset request
- Parameter setting request (local node)
- Parameter setting request (slave device)
- DN211 operation mode control request
- RAS information read request
- Time setting request

Each of the six requests has a different composition of request data, which is described in "4.6 Requests to the DN211."

(5) The Acknowledgement Area (02D0H - 0333H: 100 words): DN211 ® T2/T2E/T2N

When the T2/T2E/T2N issues a request to the DN211, the DN211 sets response data to the T2/T2E/T2N to this acknowledgment area. The response data is set at the addresses beginning "02 D0H." The request data composition is described in "4.6 Requests to the DN211."

(6) How to Use the Semaphore Area

Figure 4.10 illustrates the usage of the areas and registers discussed at (1) to (5).

The squares in oblique lines in the figure indicate that "1" has been set to the flag registers and that "256" has been set to the request register.

a) Use a READ instruction to the acknowledgement flag register to check for "0." If a value other than "0" is found, write "0" in this area (first time only)

b) Use a WRITE instruction to write request data to the DN211 in the request area (top address: 0334H).

c) Use a WRITE instruction to write "1" in the request flag register.

d) Use a WRITE instruction to write "256" in the request register.

e) Use a READ instruction to read the acknowledgement flag register and waits until "1" is set to the register.

f) Use a READ instruction to read response data of the DN211 from the acknowledgement area when "1" is found in the acknowledgement flag register. (top address: 02DOH).

g) Use a WRITE instruction to write "0" in the acknowledgement flag register. → Returns to b).

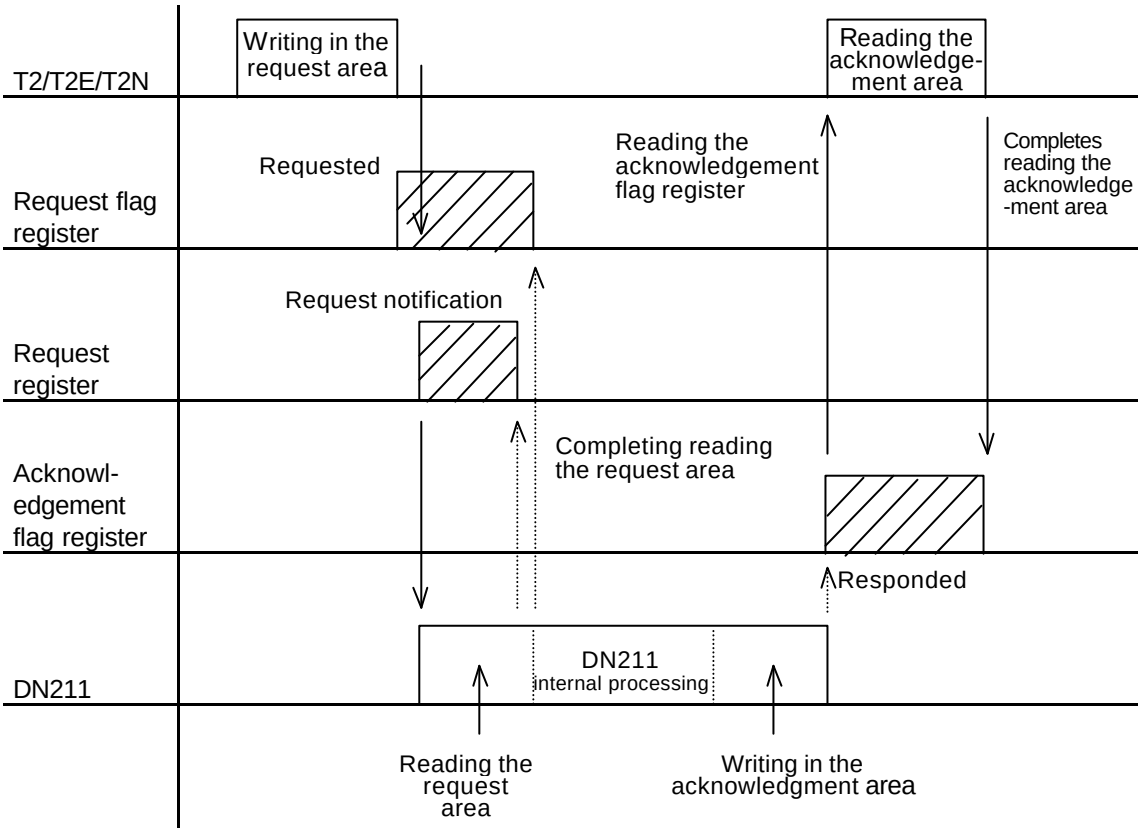


Figure 4.10 How to Use the Semaphore Area on Requests

(7) Cautions When Using the Semaphore Area

a) Since only a pair of request area and acknowledgment area is furnished, issue the next request after the DN211 returns the acknowledgement to a request from the T2/T2E/T2N.

b) Don't write data (no WRITE instruction) in the acknowledgement area / acknowledgement flag register. Otherwise, data could be destroyed.

c) When a WRITE instruction writes data in the request area, be careful of the top address and the data size to be written. Failing to do so could lead to the destruction of other data, causing the DN211 to get malfunctioned.

4.6 Requests to the DN211

This section describes different types of requests that the T2/T2E/T2N issues to the DN211. There are six such types of requests that the T2/T2E/T2N issues to the DN211.

The six types of requests are classified into those executable and those not executable, depending on the DN211's operation mode, which is explained in "4.6.1 The DN211 Operation Modes." Table 4.12 lists the relation between different types of requests and the operation modes.

The six types of requests are detailed in "4.6.2 Reset Request."

Table 4.12 List of Requests

Operatin mode / Request name [request code]	Down mode (DOWN)	Initialization mode (INIT)	Standby mode (STBY)		Run mode (RUN)
			Local node Parameters unassigned	Local node Parameters assigned	
Reset [0011H]	△	×	○	○	○
Paremeter setting (local node)[0012H]	×	×	○	○	×
Parameter setting (slave device)[0012H]	×	×	○	○	×
Operation mode control [0013H]	×	×	×	○	○
RAS information reading [0015H]	○	×	○	○	○
Time setting [0018H]	×	×	○	○	○

○ : Request enabled

△ : Though the request is enabled, an error could be responded depending on the down cause. See "Table 4.4 Down Information" for the possible down cause.

× : Request disabled ... When requested, an error is responded. The error codes are explained in "4.7 Completion Status."

4.6.1 The DN211 Operation Modes

The DN211 has the following operation modes:

1) Initialize Mode
   - The DN211 is in the process of resetting when the power is turned ON or reset is requested.
   - The reset processing turns "standby mode" when the reset processing is completed successfully.
   - The reset processing turns "down mode" when the reset processing fails to complete successfully (e.g, when an error occurs in self-testing).
   - Don't issue an instruction from the user program of the T2/T2E/T2N side during "initialize mode."
2) Standby Mode
   - The DN211 turns this mode when the reset processing is completed successfully after you turn ON the power or request resetting.
   - An operation mode control request can changes run mode to standby mode.
   - Only this mode allows you to set the parameters of the local node/slave devices to the DN211.
   - Unless the parameters of the local node is set, "run mode" cannot be set from this mode.
3) Run Mode
   - After the parameters of the local node are set, an operation mode control request allows you to change to run mode.
   - This mode allows the DN211 to transmit to salve devices.
   - This mode allows you to select a transmission mode (polling mode/bit strobe mode) with slave devices.
   - This mode allows you to select a transfer mode (synchronous/asynchronous mode) between the T2/T2E/T2N ⇔ DN211.
4) Down mode
   - Indicates that the DN211 has turned unrecoverable abnormal state.
   - A reset request can change to "standby mode." If such a reset request gets an error response, turn OFF and ON the power for recovery.
   - See "Table 4.4 Down Information" for the possible cause of the down mode.

Figure 4.11 illustrates transitions of the DN211 operation modes. Inside square frames indicates the operation mode of the DN211. The operation mode in thick squared frame is the one that the user program can control. The thick arrowheads indicate the request that the user program can specify.

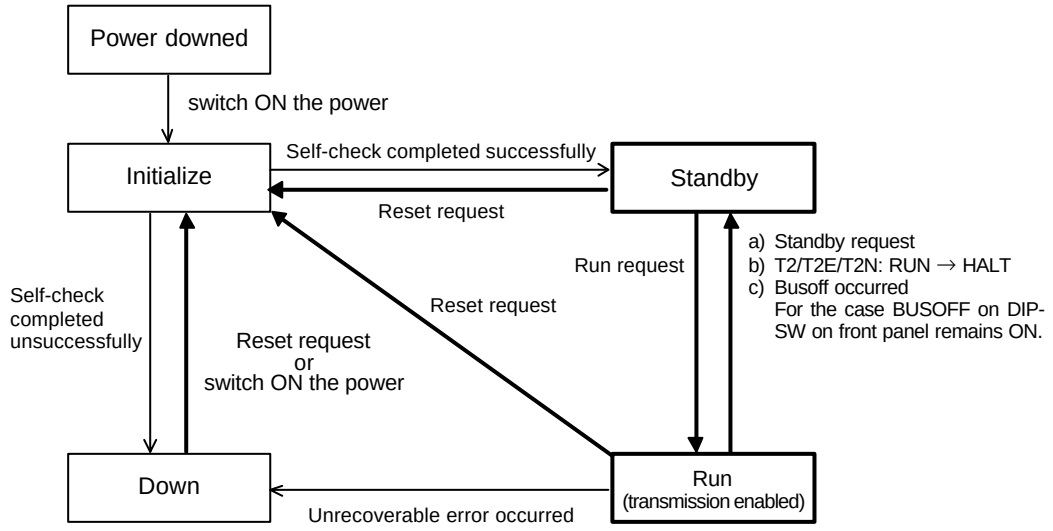


Figure 4.11 The DN211 Operation Modes

⚠ CAUTION
1. If the T2/T2E/T2N turns into HALT/ERROR mode, the DN211 in run mode becomes standby mode.

4.6.2 Reset Request

(1) The Function

This request is used for resetting the DN211 from theT2/T2E/T2N. When receiving a reset request, the DN211 executes initialization of the module. This request also can delete the scan list (parameters of the slave devices being linked to the network) saved in the internal non-volatile storage of the DN211.

During normal operation:
When a reset request is executed, the DN211 turns waiting for a parameter setting request (standby mode). No response will be made to the T2/T2E/T2N when a reset request is completed successfully. To confirm successful completion of the reset request, check the station status (05D5H) for transiting from "initialize mode" to "standby mode."

When in abnormal state:
An error response (completion status) will be returned to the T2/T2E/T2N when the request is not accepted.

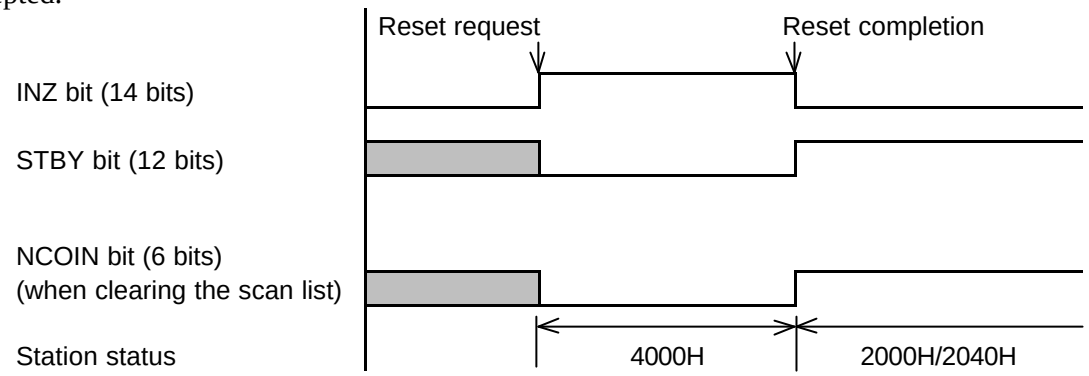


Figure 4.12 Station Status Operation on Reset Request

(2) The Data Part Format

a) Request

	Request area	
0334H	Request code (0011H)	
0335H	Scan list clear	0: Don't clear it / 1: Clear it

b) Acknowledgement (only for abnormal state)

	Acknowledgement area
02D0H	Request code (0011H)
02D1H	Completion status

See "4.7 Completion Status" for the above completion status.

(3) Execution Time: Since the T2/T2E/T2N writes "1" in the request register until the station status changes to "2000H/2040H" from "4000H"

- When the scan list is found in the non-volatile storage: Scan list is not cleared... Approx. 1 second
  Scan list is cleared ... Approx. 9 seconds
- When **no** scan list is found in the non-volatile storage: No scan list cleared ... Approx. 9 seconds
  Scan list is cleared ... Approx. 9 seconds

(4) Others

- The 7-segment LED goes out during initialization processing after a reset request is accepted.
- Startup time takes approx. 9 seconds after switching ON the power when no scan list is found in the non-volatile storage.

⚠ CAUTION

1. Neither issue a request from the T2/T2E/T2N to DN211 while the DN211 is being reset nor execute data input/output. Otherwise, the instruction requested will be completed abnormal (error of station mode abnormal), or the module self-check will fail turning into down mode.

4.6.3 Parameter Setting Request (local node)

(1) The Function

This request is used for setting the "local node parameters" of the DN211. This request can be issued only when the DN211 is in standby mode.

After setting the "local node parameters" and "slave device parameters," set the DN211 to "run mode (transmission-enabled)" by following "4.6.5 Operation Mode Control Request." If the slave device parameters have already been set into the non-volatile storage of the DN211, set the DN211 to run mode by following "4.6.5 Operation Mode Control Request" after setting "local node parameters."

(2) Data Part Format

a) Request

	Request area	
0334H	Request code (0012H)	
0335H	Request type = 0	
0336H	Port No. = 0	
0337H	Local station node address	Setting value : 0 to 63
0338H	Polling transmission mode	Setting value: 0, 1
0339H	Scan interval wait time	Setting value: 2 to 10,000 ms
033AH	Background poll ratio	Setting value: 1 to 65535
033BH	Retransmission counter	Setting value: fixed at 1
033CH	Transmission timing	Setting value: in ms

b) Acknowledgement

	Acknowledgement area
02D0H	Request code (0012H)
02D1H	Completion status

See "4.7 Completion Status" for the above completion status.

c) Local Station Parameters

Table 4.13 Local Station Parameters (1/2)

Parameter	Description
Polling transmitting mode	0: Makes a polling request to all slave devices and waits for the polling response in batch. 1: Waits for polling response after requesting polling by the slave device.
Scan interval wait time	Specifies the wait time until starting the next access after completing access to all slave devices. Minimum value: 2 ms Maximum value: 10,000 ms
Background poll ratio	Accesses the devices to which background polling was specified (setting with slave parameters) at scan interval set to the poll ratio. Example) When 5 is specified, access is made by 5 scans. This parameter is effective both for polling mode devices 1 bit strobe mode devices.
Retransmission counter	Fixed at "1"

Table 4.14 Local Station Parameters (2/2)

Parameter	Description
Transmission timing	Is the value for slave devices to detect transmission timeout when the DN211 doesn't access for a certain interval or more. Set a value larger than the scan cycle to slave devices(usually, 100 ms or more). • When a slave device with background polling is installed, set a value of time longer than (scan cycle x poll ratio). • For **synchronous mode communication**, an **interval time value longer than the transmission interval of the user program** must be specified.

d) Supplement to the Polling Transmission Mode

The DN211 resolution varies when a slave device in polling mode results in no response after selecting the polling transmission mode.

◎ When the polling transmission mode = 0

- The master device performs polling requests asynchronously with the responses of slave devices in polling mode; the master device waits for the polling response from a slave device for 20 ms after executing a request. When the 20 ms exceeds, the next scan starts.
- As long as a no-responding slave device is found, the master device performs 20 ms of response wait time per scan.
- The real scan cycle, when a no-responding slave device is found, is expressed in the following formula:

  Real scan cycle = Real scan cycle in normal operation + 20 ms

◎ When the polling transmission mode = 1

- The master device checks for the response from a slave device in polling mode and sequentially executes polling requests to individual slave devices. When polling results in no response from a slave device, the master device waits for 20 ms before executing a polling request to the next slave device.
- When three consecutive timeouts occur for a no-responding slave device, the slave device is delisted from the scan list in the DN211. This will allow the DN211 to transmit with the remaining slave devices in normal operation, and no wait time for response takes place.
- Only the slave devices which have three consecutive timeouts of no response will be delisted from the scan list. When a slave device has two consecutive timeouts of no response but responds to the third polling, the number of timeouts of no response is cleared.
- The DN211 periodically checks for the response from the slave devices delisted from the scan list; if a delisted slave device responds, the device is re-registered in the scan list.
- When n units of slave devices results in no response at the same time, the real scan cycle for three consecutive timeouts is expressed in the following formula.

  Real scan cycle = Real scan cycle in normal operation + n units x 20 ms

e) When a slave device in bit-strobe mode results in no response
The master device executes bit-strobe requests disregarding the polling transmission mode selected; it waits for the bit-strobe response from a slave device for 20 ms after executing a request. After the 20 ms of response wait time passes, the next scan starts.

- As long as a no-responding slave device is found, the master device executes 20 ms of response wait time per scan.
- When a no-responding slave device is found, the real scan cycle is expressed in the following formula.

Real scan cycle = Real scan cycle in normal operation + 20 ms

Usage Recommendation
1. Set the node address of your DN211 to a value smaller than the node addresses of slave devices(because of the feature of CAN currently used in the DeviceNet).

4.6.4 Parameter Setting Request (slave device)

(1) The Function

This request is used for setting "slave devices parameters" in the DN211. The request can be issued only when the DN211 is in standby mode.
Up to 10 salve devices can be set per parameter setting request.
As "slave devices parameters" setting is stored in the non-volatile memory of the DN211, no additional setting is required when switching ON the power as long as the current slave devices configuration is unchanged. When the slave devices parameters in the non-volatile memory are identical with the slave devices parameters newly requested, no writing is executed into the non-volatile memory.
When the slave devices configuration is changed, delete the slave devices parameters before registering new slave devices parameters.
Up to 300 times of slave devices parameters setting are available in the non-volatile memory of the DN211.

(2) Data Part Format

a) Request

	Request area	
0334H	Request code (0012H)	
0335H	Request type = 1	
0336H	Number of request devices	Number of slave devices set by this request
0337H	Port Number	Fixed at 0
0338H	Slave node address	Setting value: 0 to 63
0339H	Vendor ID	* 1
033AH	Product type	* 1
033BH	Product code	* 1
033CH	Scan type	Setting value: 0, 1, 2
033DH	Poll background	Setting value: 0, 1
033EH	Bit strobe reception size	* 1
033FH	Polling reception size	* 1
0340H	Reserved	Fixed at 0
0341H	Polling transmission size	* 1
0342H	Reserved	Fixed at 0
0343H	Major revision	* 1
0344H	Minor revision	* 1
0345H	Reserved	Fixed at 0
0346H	Reserved	Fixed at 0
0347H	Port number	
0348H	Slave node address	
0349H	Vendor ID	
:		

First slave device setting information

Second slave device setting information

* 1: Refer to the description of the slave device.

Specify the polling transmission size/bit strobe reception size in bytes.

b) Acknowledgement

	Acknowledgement area
02D0H	Request code (0012H)
02D1H	Completion status

See "4.7 Completion Status" for the above completion status.

c) Slave Device Parameters
For slave device parameters, refer to the description of the relevant slave devices except for the parameters listed in the following Table 4.15.

Note the DN211 has the following restrictions in transmitting "0 byte" to a slave device.

Restrictions
When a slave device fails to communicate with the DN211 due to some reason (power of the slave device side turned OFF, connector removed, etc.), the DN211 cannot identify the slave device being malfunctioned.
Even after the cause of the failure is solved, no communication between the slave device Û DN211 can be resumed.
Note: **Though the present DN211 has the above-mentioned restrictions, an upgraded version of the internal software will solve those restrictions.**

Table 4.15 Slave Device Parameters

Parameter	Description
San type	Specifies the transmission system of a slave device. 0: Bit strobe 1: Polling 2: 2: Bit strobe and polling } No value other than 0, 1, or 2 can be specified (reserved).
Poll background polling	Specifies an access interval that the DN211 can have to a device. 00: Scan polling (accessing for every scan) 01: Background polling (accessing by the number of scan times specified by the poll ratio)

(3) Other

- **It takes about 4 seconds** to set the parameters of a slave device to the non-volatile storage of the DN211.
- While slave device parameters are being set, the local node address is **blinking** on the 7-segment LED.

⚠ CAUTION

1. The parameter setting request (slave device) sets the parameters of slave devices on to the non-volatile memory in the DN211. As long as the slave devices configuration is unchanged, you don't need to execute this request every time when the power is switched ON. In addition, when the parameters of the slave device requested and the parameters of the slave device in the non-volatile memory are same, this setting request is not executed.
2. When the slave devices configuration needs to be changed, delete the salve devices parameters using a reset request before setting new slave devices parameters.
3. The number of times available for setting slave devices parameters in the non-volatile memory of the DN211 is 300 times.
4. The DN211 has the following restriction for transmitting "0 byte" to a slave device from the DN211.
   - When a slave device comes into no communication state with the DN211 due to some reason (for example, the power of the slave device is OFF; the connector is disconnected, etc.), the DN211 cannot recognize the slave device is abnormal.
     Even after the cause of the failed communications is solved, the DN211 and the slave device cannot communicate with each other.

   Note: The above restriction of the present DN211 will be solved by a version-up of the internal software.

4.6.5 Operation Mode Control Request

(1) The Function

Specifies the operation mode of the DN211 module. When the DN211 is neither in down mode nor initialize mode, a request is enabled. Run mode (transmission enabled) is available only when the DN211 is in standby mode and the local node parameters are set. When the DN211 is set to run mode, slave device data will be allocated to the input/output data area.

(2) Data Part Format

a) Request

	Request area
0334H	Request code (0013H)
0335H	Specified information

Specified information: "1" has some meaning.

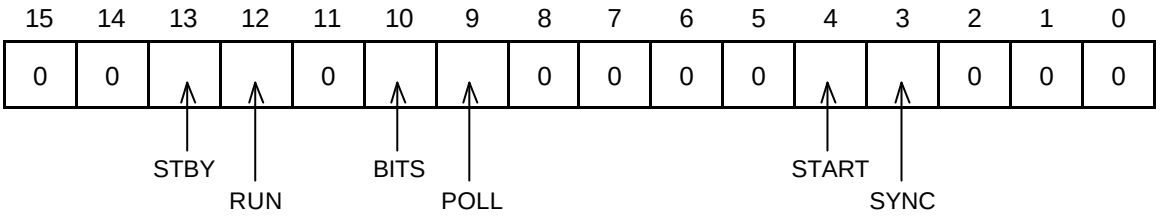


Figure 4.13 Composition of Specified Information Bits

Table 4.16 Meaning of Specified Information Bits

BIT	Name	Description
13	STBY	Standby request: changes from run mode to standby mode.
12	RUN	Run request: changes standby mode to run mode.
10	BITS	Bit strobe mode transmission enabled
9	POLL	Polling mode transmission enabled
4	START	1: Polling and bit strobe transmission start 0: Stop transmission
3	SYNC	T2/T2E/T2N ⇔ DN211 transfer mode …1: Synchronous 0: Asynchronous

b) Acknowledgement

	Acknowledgement area
02D0H	Request code (0013H)
02D1H	Completion status

See "4.7 Completion Status" for above completion status.

(3) Others

- The following combinations of requests are forbidden..
  - ① standby request and run request are requested simultaneously.
  - ② The already running mode (standby/run) is requested
- See the station status for the actual mode change confirmation.
- When you are changing BIT 10, 9, 4, or 3, first change to standby mode before requesting a run request and a new setting.
- When BITs 10, 9, 4, and 3 are set to "1", no standby request is allowed.

4.6.6 RAS Information Read Request

(1) The Function

Reads the RAS information on the DN211 from the T2/T2E/T2N. This RAS information includes RAS history counter, event history, and execution node information (execution information of the slave devices that DN211 has); these three types of information are different from those in the RAS information area.

Unless the DN211 is in initialize mode, these types of information can be read anytime.

The content of the RAS data read is explained in "6.3 RAS Information Reading Data."

(2) Data Part Format

a) Request

Request area

0334H	Request code (0015H)
0335H	Request information type
0336H	Start position
0337H	Number of events to read

The dotted line is valid only for event history.

A history of up to 10 events can be read.

Request type: 1…RAS history, 2…Event history, 3…Execution node information,
4…RAS information clear

Start position: Specifies from where to read event history.
0 specified: Newest event

b) Acknowledgement

Acknowledgement area

02D0H	Request code (0015H)
02D1H	Completion status
02D2H	Number of RAS information words
02D3H	RAS information
:	
:	

Number of RAS data words read

See "4.7 Completion Status" for the above completion status.

4.6.7 Time Setting Request

(1) The Function

Performs the time setting in the DN211. This time is used for event history data, which is read by "RAS information read request." When the DN211 is in down mode or initialize mode, this function cannot be used.

(2) Data Part Format

a) Request

Request area

0334H	Request code (0018H)	
0335H	Month	Year
0336H	Hour	Day
0337H	Second	Minute

b) Acknowledgement

Acknowledgement area

02D0H	Request code (0018H)
02D1H	Completion status

See "4.7 Completion Status" for the above completion status.

(3) Other

- Use to the BCD codes to enter a year, month, day, hour, minute, and second.
- Enter the last two digits of the Western calendar in the year item. For the year 2000, enter 00. Example: 12:20:00, September 30, 1997

0334H	0118H
0335H	0997H
0336H	1230H
0337H	0020H

- Since the time set above will be updated by the timer in the DN211, it can be different from the time of the T2/T2E/T2N. Daily adjustment of time is recommend .

4.7 Completion Status

Indicated below are the completion statuses that DN211 returns to the T2/T2E/T2N.

Except for normal completion, an error code and the local node address are indicated alternatively on the 7-segment LED on the front panel of the DN211. The error code indication stops when the following request is completed successfully.

Table 4.17 List of Completion Statuses

Completin status	Code	Description
Normal completion	0001H	Indicates a request is completed successfully.
Local station failure	00A0H	When a request for inhibited processing is requested in down mode
Serial number unregistered	00A1H	When a serial number registered in the DN211 disappeared → Ask for repair because the DN211 needs resetting.
Local station parameters unassigned	00A2H	A request for inhibited processing is issued when no local station parameters are set
Length abnormal	00A3H	When the data size of a bit strobe output data write request is 8 bytes or more
Station mode abnormal	00A4H	When a request for inhibited processing is issued during run mode time When a request for inhibited processing is issued during standby mode time
	00A5H	Reserved
Transmission inhibition status	00A6H	When a request relating to transmission processing is issued in transmission inhibition state by the T2/T2E/T2N
Format abnormal	00B0H	When the requested processing code is not supported
	00B1H	When requesting a status inhibited at request status for operation mode control request
	00B2H	When the requested year is invalid at time setting
	00B3H	When the requested month is invalid at time setting
	00B4H	When the request day is invalid at time setting
	00B5H	When the request hour is invalid at time setting
	00B6H	When the request minute is invalid at time setting
	00B7H	When the request second is invalid at time setting
	00B8H	When the node address is invalid at parameter setting request and explicit message request (value other than 0 to 63)
Composition data abnormal	00C0H	When invalid data is found in the composition data for parameter setting request (see trace information (Event history) for detail)
	00C1H	Input/output data of a slave device cannot be allocated to the input/output data area (when operation mode control request "RUN" is issued).
Memory pool acquisition abnormal	00C2H	When the OS in the DN211 fails to allocate memory, **turn OFF and ON the power to reset the module.**
Number of request devices abnormal	00C3H	When the number of read devices is incorrect at input data request and output data write request

5. Example of DN211 Applications

This chapter describes an example of operating the DN211 from the T2/T2E/T2N and a sample ladder program.

⚠ CAUTION
1. This chapter describes an example of operating the DN211's functions from the T2/T2E/T2N and a sample ladder program. It also explains subjects necessary to use the DN211. Thus, try to understand the DN211 well before writing programs. Because the sample program is basic, ample discussion is needed before applying to real systems.
2. When the T2/T2E/T2N changes to the HALT/ERROR mode from the RUN mode, the DN211 in run mode will change to standby mode.

5.1 The DN211 Operation Order

Figure 5.1 illustrates steps from switching ON the DN211 power, setting the module, writing output data, and to reading input data.

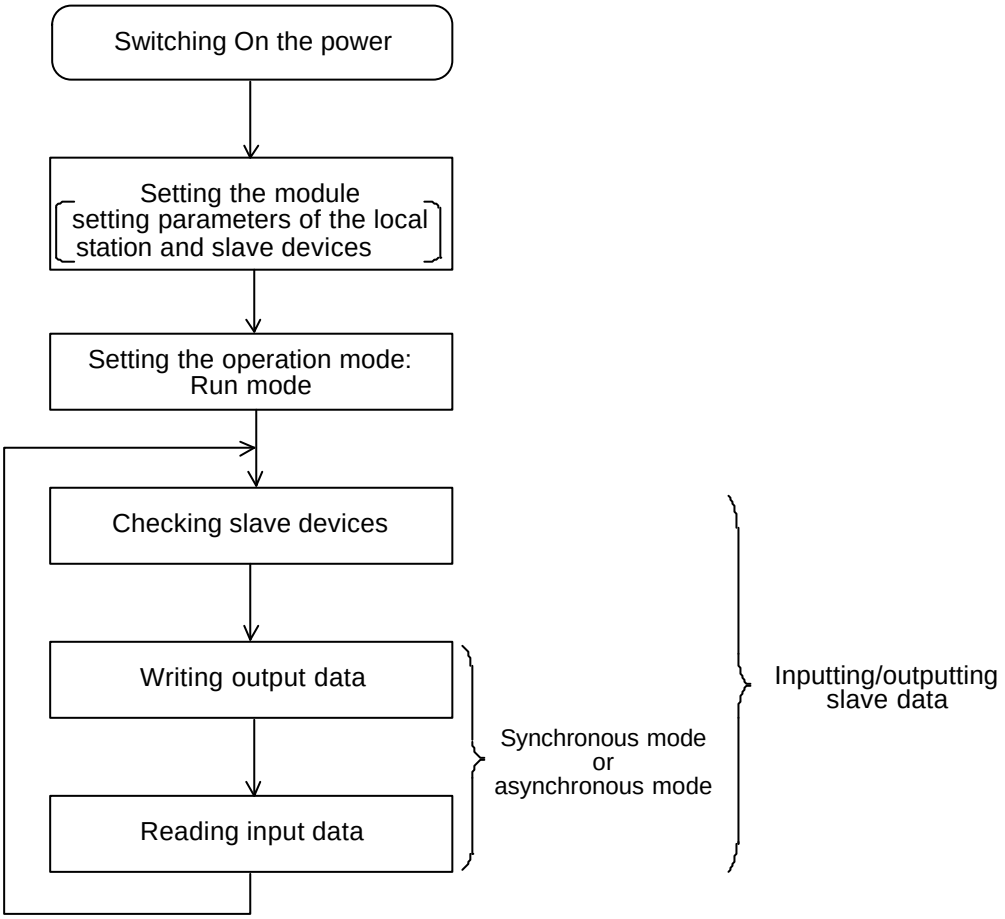


Figure 5.1 The DN211 Operation Flow

5.2 Module Setting Procedure

This section describes, based on the flowchart of Figure 5.2, the procedures for setting and starting up the DN211 module.

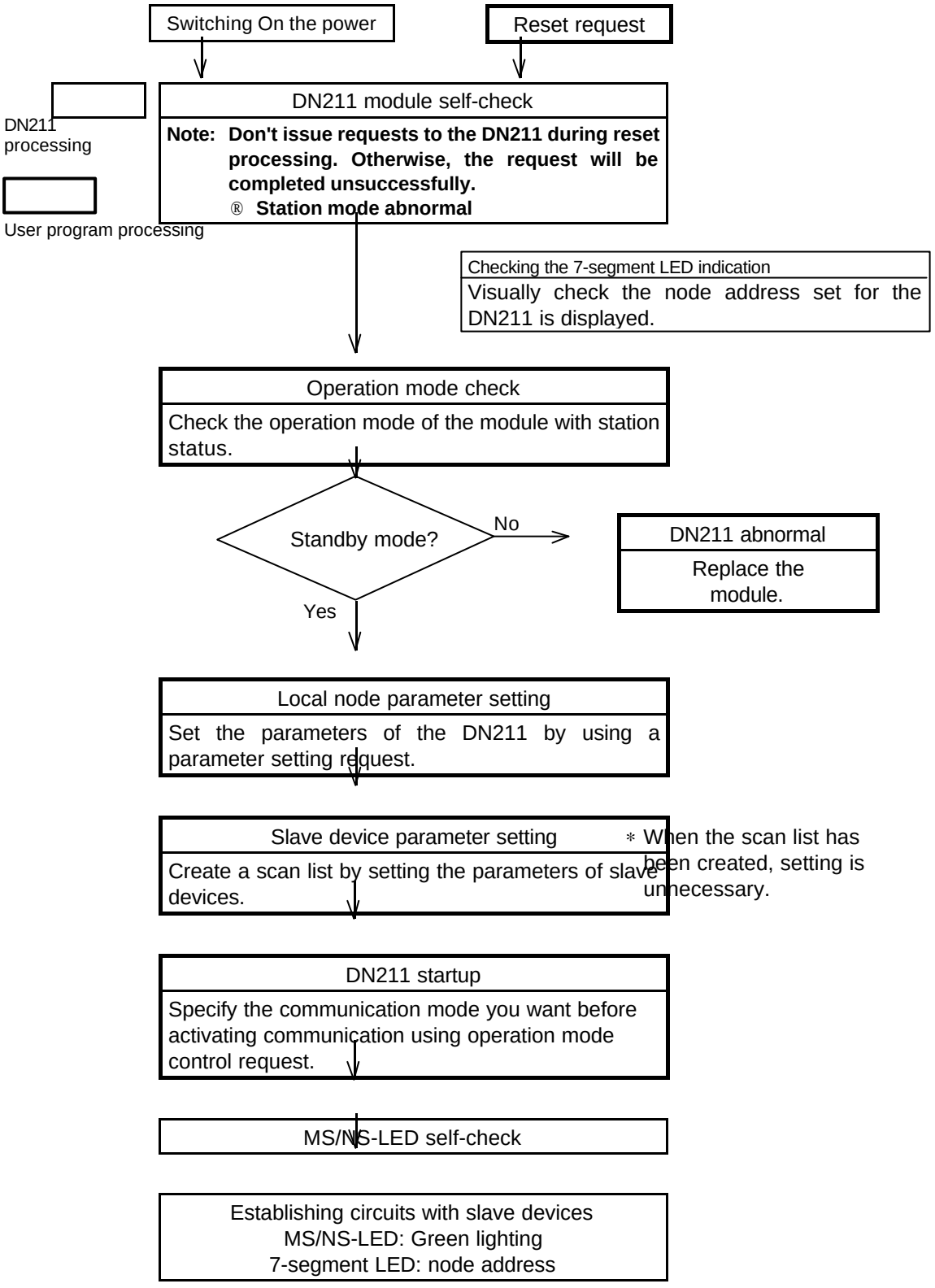


Figure 5.2 Module Setting Procedure

5.2.1 Accessing the DN211 in Module Setting

This section describes how to access the DN211 in module setting. The semaphore area of the DN211 is used for this accessing. It is the area used for issuing requests from the T2/T2E/T2N for operating the DN211 or reading the response to a request from the DN211. See "4 .5 The Semaphore Area" for details of individual areas and registers in the semaphore area.

(1) How to Use the Semaphore Area

Figure 5.3 illustrates the usage of the areas and registers in the semaphore area.

The squares in oblique lines in the figure indicate that "1" has been set to the flag registers and that "256" has been set to the request register.

a) Use a READ instruction to read the acknowledgement flag register to check it is "0." If a value other than "0" is found, write "0" in the area (first time only)

b) Use a WRITE instruction to write request data to the DN211 in the request area (top address: 0334H).

c) Use a WRITE instruction to write "1" in the request flag register.

d) Use a WRITE instruction to write "256" in the request register.

e) Use a READ instruction to read the acknowledgement flag register and wait until "1" is set to the register.

f) Use a READ instruction to read the response data of the DN211 from the acknowledgement area when "1" is found in the acknowledgement flag register (top address: 02D0H).

g) Use a WRITE instruction to write "0" in the acknowledgement flag register.
→ Returns to b).

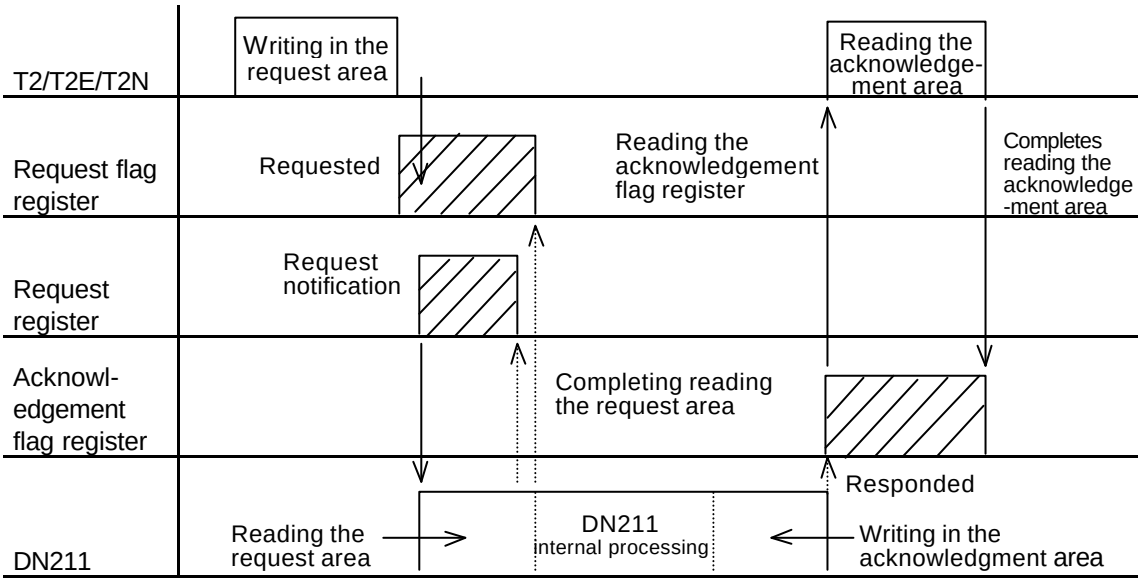


Figure 5.3 How to Use the Semaphore Area on Requests

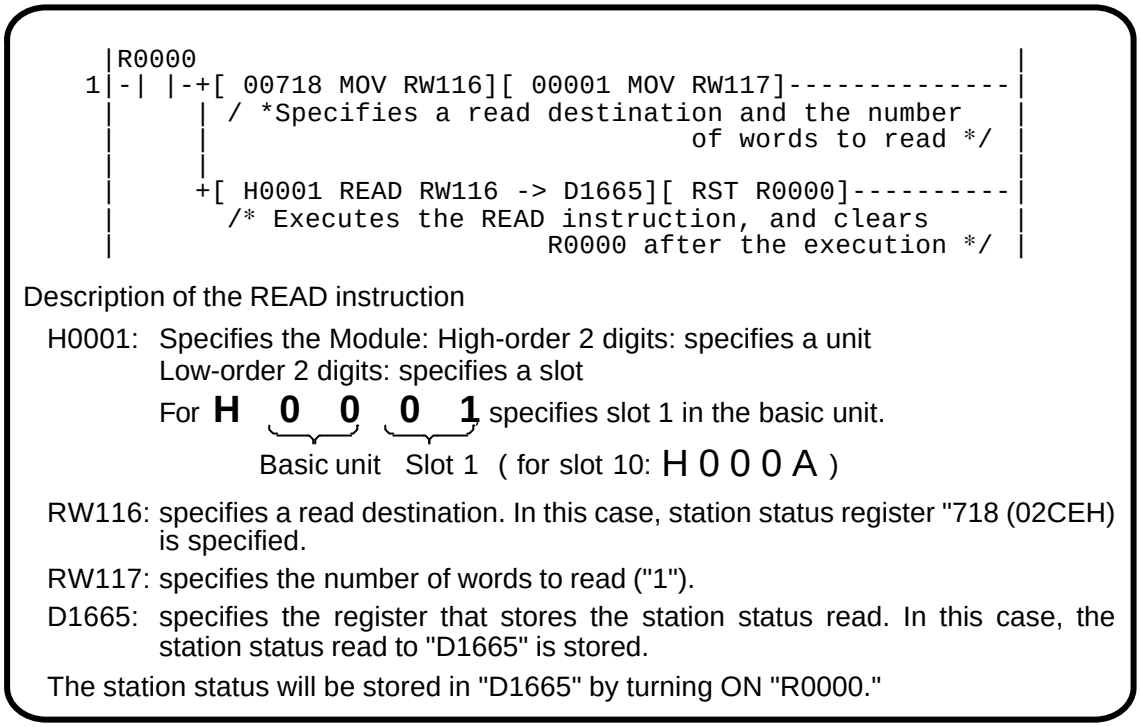
(2) Cautions When Using the Semaphore Area

a) Since only a pair of request area and acknowledgment area is furnished, issue the next request after the DN211 returns the acknowledgement to a request from the T2/T2E/T2N.

b) Don't write data (no WRITE instruction) in the acknowledgement area/acknowledge-ment flag register. Otherwise, response data could be destroyed.

c) When using a WRITE instruction to write data in the request area, be careful of the top address and the data size to be written. Failing to do so could lead to the destruction of other data, causing the DN211 to get malfunctioned.

3) Example of Using the READ Instruction



Description of the READ instruction

H0001: Specifies the Module: High-order 2 digits: specifies a unit
Low-order 2 digits: specifies a slot

For **H 0 0 0 1**, specifies slot 1 in the basic unit.

Basic unit Slot 1 (for slot 10: H 0 0 0 A)

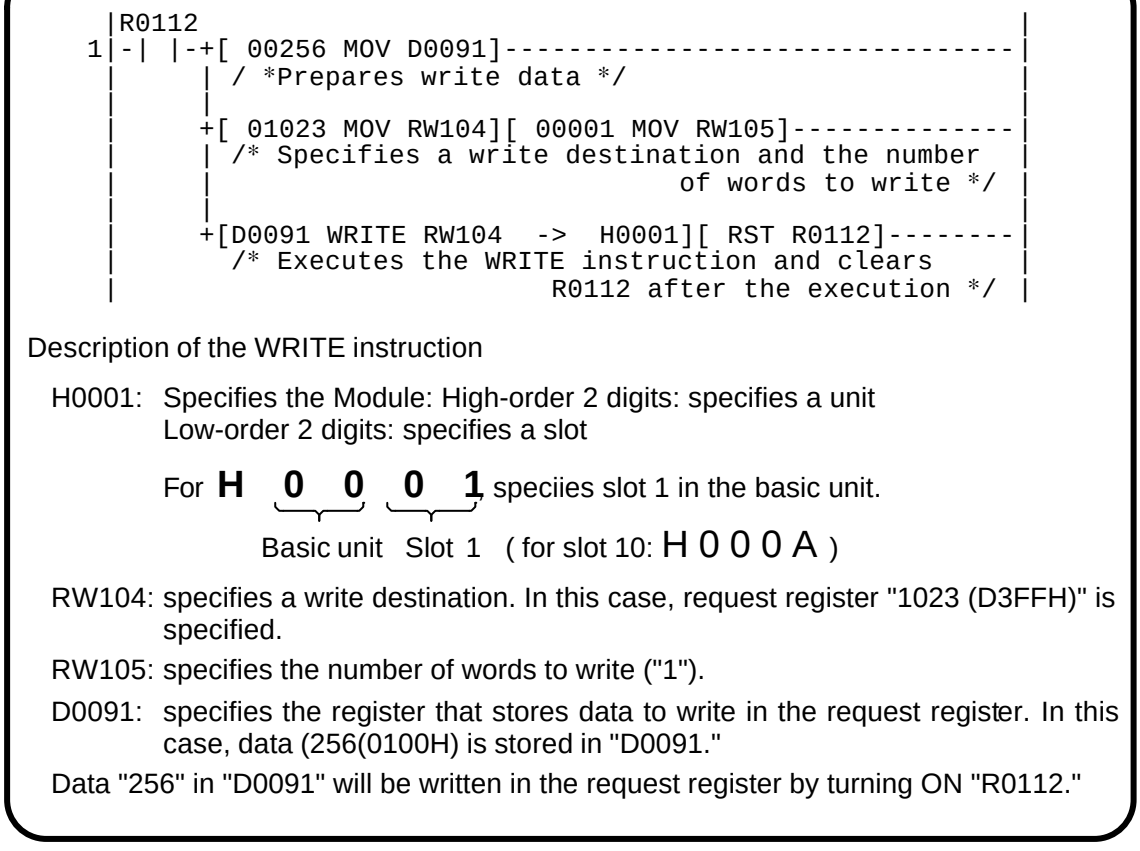
RW116: specifies a read destination. In this case, station status register "718 (02CEH) is specified.

RW117: specifies the number of words to read ("1").

D1665: specifies the register that stores the station status read. In this case, the station status read to "D1665" is stored.

The station status will be stored in "D1665" by turning ON "R0000."

4) How to Use the WRITE Instruction



Description of the WRITE instruction

H0001: Specifies the Module: High-order 2 digits: specifies a unit
Low-order 2 digits: specifies a slot

For **H 0 0 0 1**, speciies slot 1 in the basic unit.

Basic unit Slot 1 (for slot 10: H 0 0 0 A)

RW104: specifies a write destination. In this case, request register "1023 (D3FFH)" is specified.

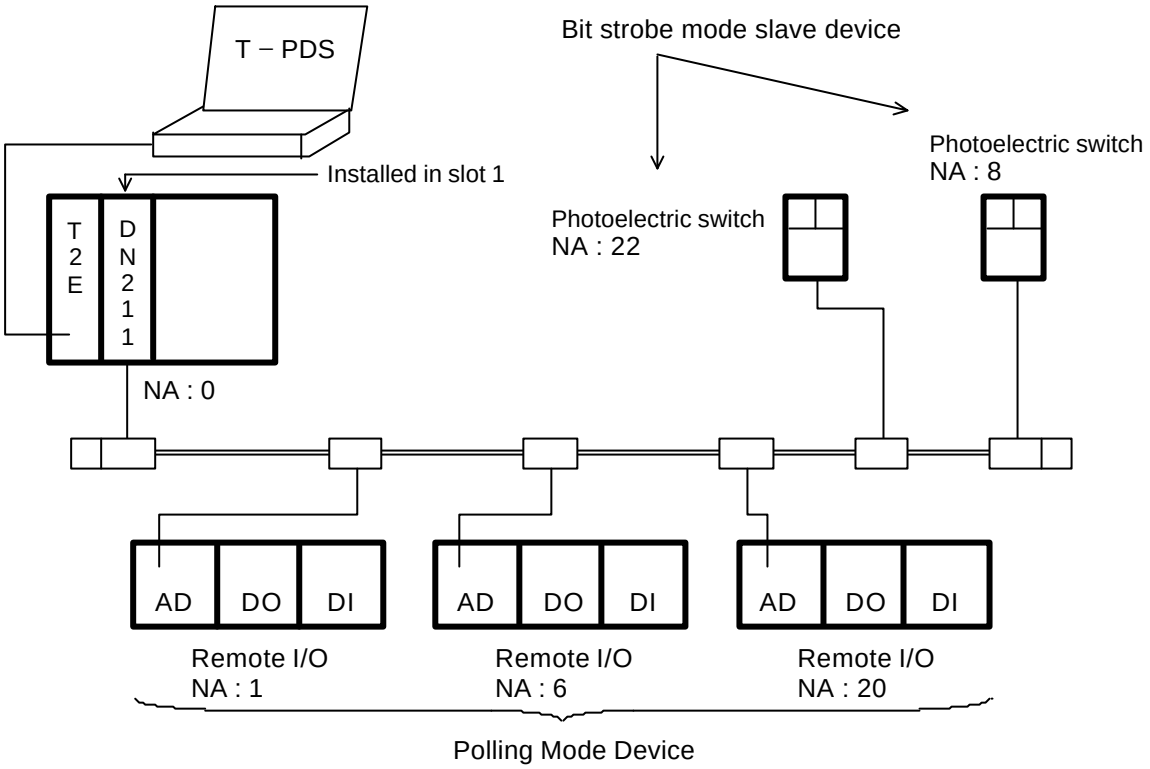
RW105: specifies the number of words to write ("1").

D0091: specifies the register that stores data to write in the request register. In this case, data (256(0100H) is stored in "D0091."

Data "256" in "D0091" will be written in the request register by turning ON "R0112."

5.2.2 Configuration of a Module Setting Sample Program

The figure below is the configuration of a module setting sample program.



Photoelectric switch: Series 9000 photoelectric sensor (Rockwell Automation)
Bit strobe mode slave device
Reception data size: 1 byte

Remote I/O: FLEX I/O (Rockwell Automation)
Polling mode slave device
AD: 1794-ADN...FLEX - I/O adapter module
DO: 1794-OB16...24 Vdc, 16-point DO module
DI: 1794-IB16...24 Vdc, 16-point DI module
Transmitting data size: 4 bytes (2 words)
Reception data size: 6 bytes (3 words)

Transmission data

A	Output data to DO
A + 1	Output data to DI

Reception data

B	Input data from AD
B + 1	Input data from DO
B + 2	Input data from DI

* Refer to the instruction manual made by Rockwell Automation for details about Series 9000 photoelectric sensors and FLEX I/O.

5.2.3 Reset Request

See"4.6.2 Reset Request" for details.

Request area	F–0		Register allocation
0334H	0011H	Reset request code	D0100
0335H	0001H	Scan request clear	D0101

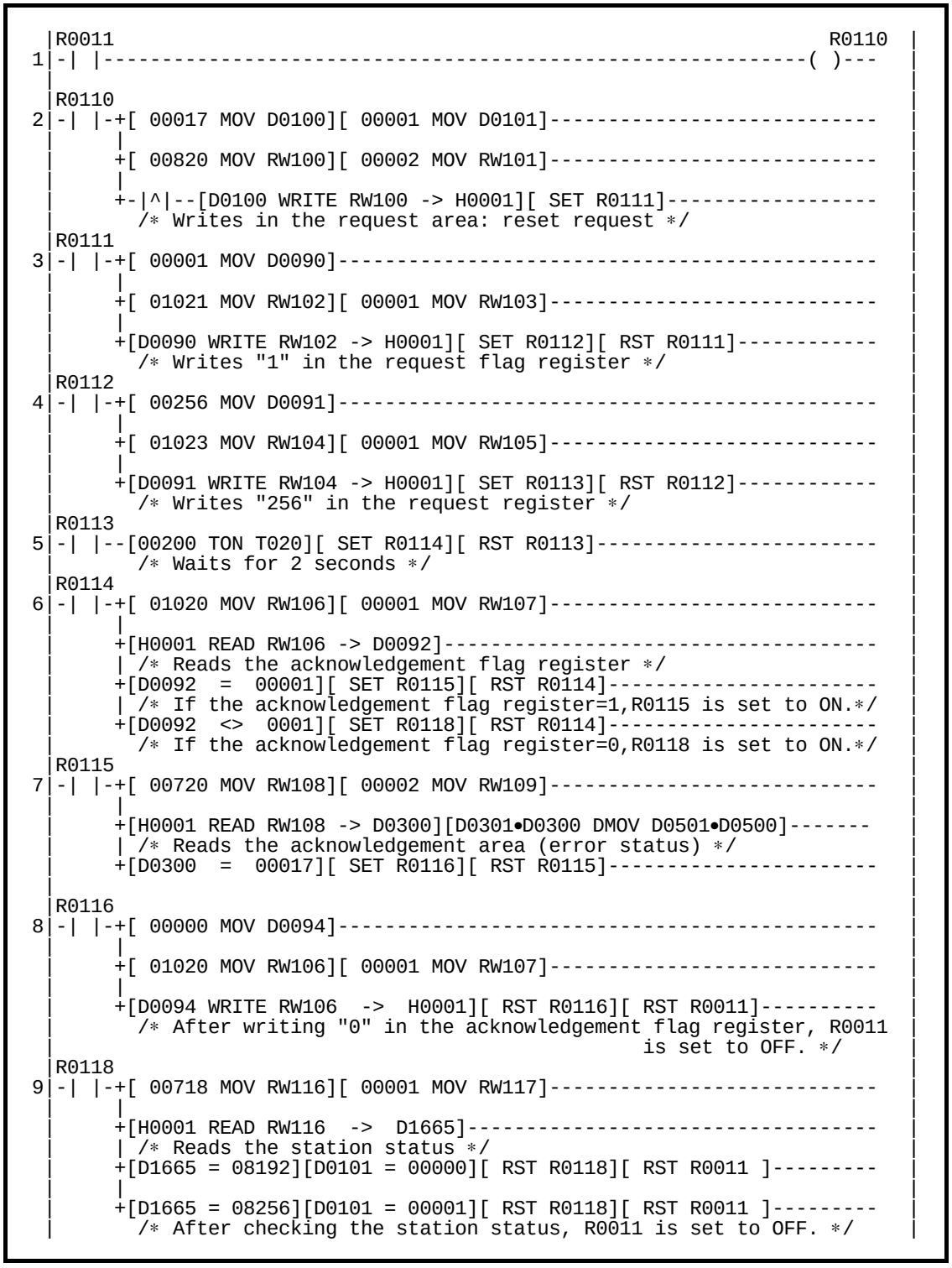
Acknowledgement area			Register allocation
02D0H	0011H	Reset request code	D0300
02D1H		Completion status (an abnormal response)	D0301
			D0500
			D0501

Semaphore register			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0092
03FCH		Acknowledgement flag register (write)	D0094

RAS information			Register allocation
02CEH		Station status	D1665

Work register		Register allocation
Request area address store	0334H	RW100
Request data length store	0002H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgement data length store	0002H	RW109
RAS information read address store	02CEH	RW116
RAS information read data length store	0001H	RW117

R0011 in the sample program on the following page indicates a reset request startup relay.


R0011
R0110
1
R0110
2
[00017 MOV D0100][00001 MOV D0101]
[00820 MOV RW100][00002 MOV RW101]
[D0100 WRITE RW100 -> H0001][SET R0111]
/* Writes in the request area: reset request */
R0111
3
[00001 MOV D0090]
[01021 MOV RW102][00001 MOV RW103]
[D0090 WRITE RW102 -> H0001][SET R0112][RST R0111]
/* Writes "1" in the request flag register */
R0112
4
[00256 MOV D0091]
[01023 MOV RW104][00001 MOV RW105]
[D0091 WRITE RW104 -> H0001][SET R0113][RST R0112]
/* Writes "256" in the request register */
R0113
5
[00200 TON T020][SET R0114][RST R0113]
/* Waits for 2 seconds */
R0114
6
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0092]
/* Reads the acknowledgement flag register */
[D0092 = 00001][SET R0115][RST R0114]
/* If the acknowledgement flag register=1,R0115 is set to ON.*/
[D0092 <> 0001][SET R0118][RST R0114]
/* If the acknowledgement flag register=0,R0118 is set to ON.*/
R0115
7
[00720 MOV RW108][00002 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0501•D0500]
/* Reads the acknowledgement area (error status) */
[D0300 = 00017][SET R0116][RST R0115]
R0116
8
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R0116][RST R0011]
/* After writing "0" in the acknowledgement flag register, R0011
is set to OFF. */
R0118
9
[00718 MOV RW116][00001 MOV RW117]
[H0001 READ RW116 -> D1665]
/* Reads the station status */
[D1665 = 08192][D0101 = 00000][RST R0118][RST R0011]
[D1665 = 08256][D0101 = 00001][RST R0118][RST R0011]
/* After checking the station status, R0011 is set to OFF. */

5.2.4 Parameter Setting Request (local node)

See "4.6.3 Parameter Setting Request (local node)" for details.

Request area	F 0		Register allocation
0334H	0012H	Parameter setting request code	D0100
0335H	0000H	Local node parameter setting	D0101
0336H	0000H	Fixed at "0"	D0102
0337H	0000H	Node address (0)	D0103
0338H	0000H	Polling transmission mode specify	D0104
0339H	000AH	Scan interval wait time (10 ms)	D0105
033AH	0001H	Background poll ratio	D0106
033BH	0001H	Fixed at "1"	D0107
033CH	0064H	Transmission timing (100 ms)	D0108

Acknowledgement area			Register allocation
02D0H	0012H	Parameter setting request code	D0300
02D1H		Completion status	D0301
			D0505
			D0506

Semaphore register			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0092
03FCH		Acknowledgement flag register (write)	D0094

Work register		Register allocation
Request area address store	0334H	RW100
Request data length store	0009H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgement data length store	0002H	RW109
RAS information read address store	02CEH	RW116
RAS information read data length store	0001H	RW117

5.2.5 Parameter Setting Request (slave device)

See"4.6.4 Parameter Setting Request "(slave device) for details.

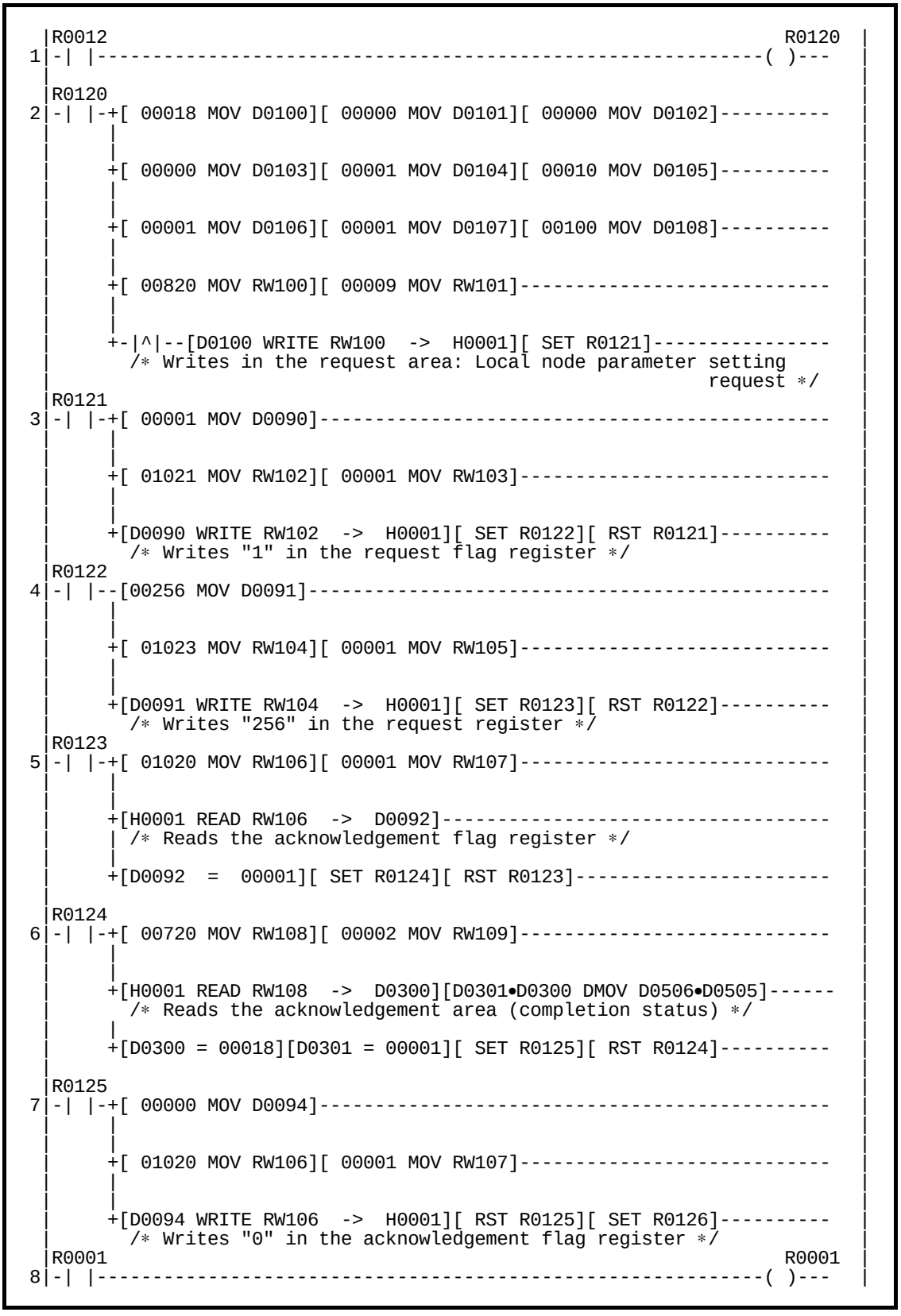
Request area	F 0		Register allocation	
0334H	0012H	Parameter setting request code	D0100	
0335H	0001H	Slave parameter setting	D0101	
0336H	0005H	Number of slave devices (5)	D0102	
0337H	0000H	Fixed at "0"	D0103	
0338H	0001H	Node address (1)	D0104	
0339H	0001H	Vendor ID (1)	D0105	
033AH	000CH	Product type (12)	D0106	
033BH	0001H	Product code (1)	D0107	
033CH	0001H	Scan type: polling	D0108	
033DH	0000H	Polling by the scan	D0109	
033EH	0000H	BS reception size (byte)	D0110	1st unit
033FH	0006H	PL reception size (byte)	D0111	
0340H	0000H	Fixed at "0"	D0112	
0341H	0004H	PL transmitting size (byte)	D0113	
0342H	0000H	Fixed at "0"	D0114	
0343H	0001H	Major revision (1)	D0115	
0344H	0004H	Minor revision (4)	D0116	
0345H	0000H	Fixed at "0"	D0117	
0346H	0000H	Fixed at "0"	D0118	
0347H	0000H	Fixed at "0"	D0119	
0348H	0006H	Node address (6)	D0120	
0349H	0001H	Vendor ID (1)	D0121	
034AH	000CH	Product type (12)	D0122	2nd unit
034BH	0001H	Product code(1)	D0123	
034CH	0001H	Scan type: polling	D0124	
034DH	0000H	Polling by the Scan	D0125	

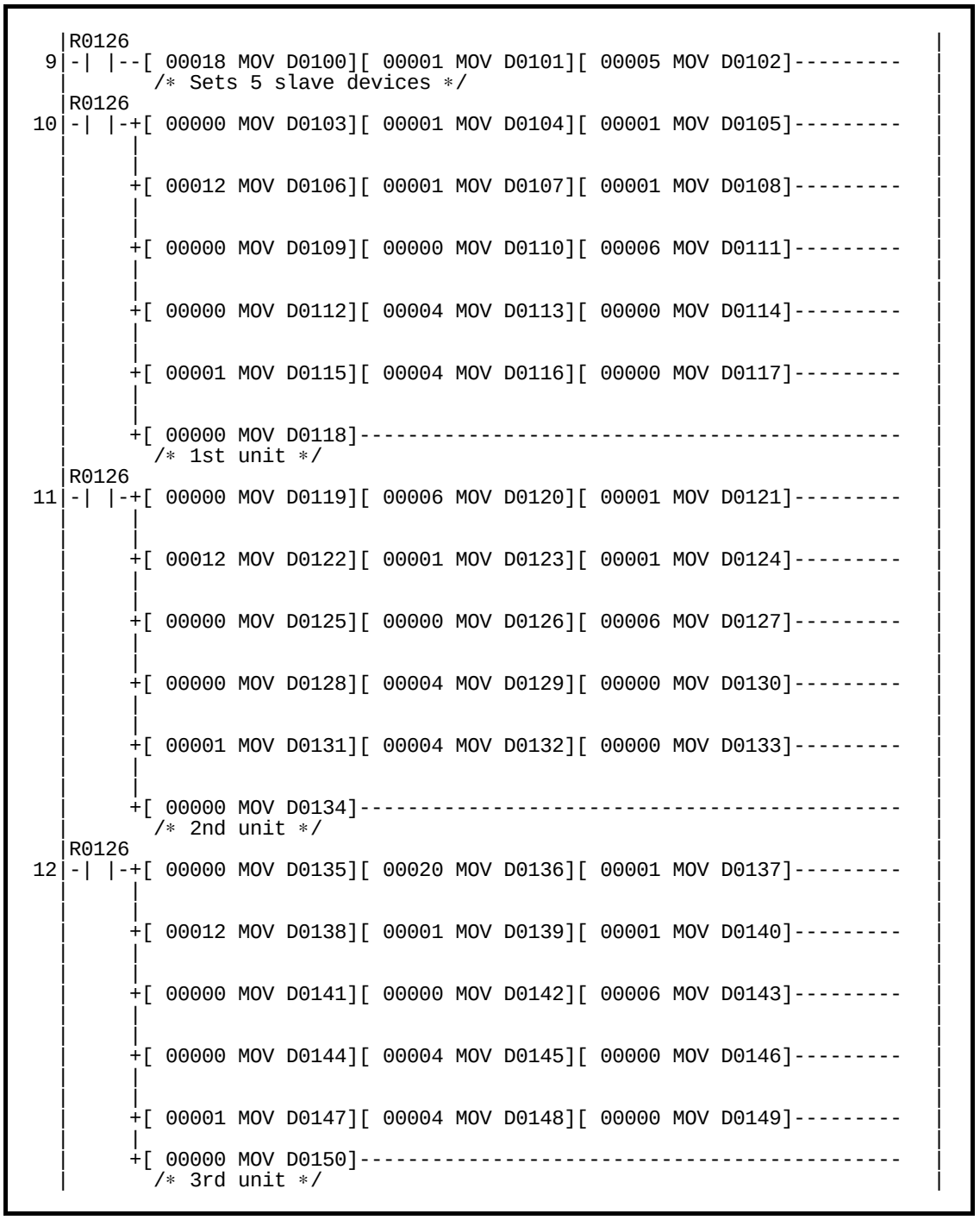
Acknowledgement area			Register allocation
02D0H	0012H	Parameter setting request code	D0300
02D1H		Completion statue	D0301
			D0510
			D0511

Semaphore register			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0093
03FCH		Acknowledgement flag register (write)	D0094

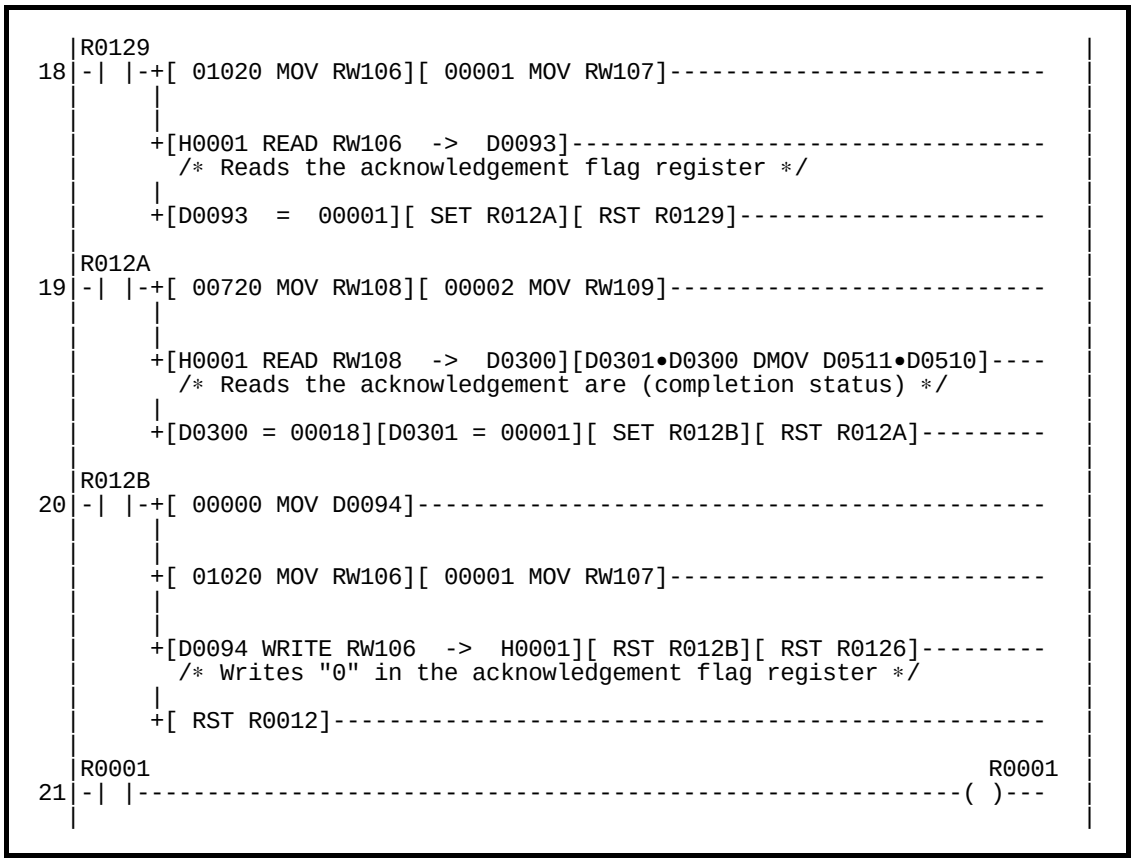
Work register		Register allocation
Request area address store	0334H	RW100
Request data length store	0053H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgement data length store	0002H	RW109
RAS information read address store	02CEH	RW116
RAS information read data length store	0001H	RW117

R0012 in the sample program on the following page indicates the startup relay for the local node and slave device parameter setting request.


R0012
R0120
1
R0120
2
[00018 MOV D0100][00000 MOV D0101][00000 MOV D0102]
[00000 MOV D0103][00001 MOV D0104][00010 MOV D0105]
[00001 MOV D0106][00001 MOV D0107][00100 MOV D0108]
[00820 MOV RW100][00009 MOV RW101]
[D0100 WRITE RW100 -> H0001][SET R0121]
/* Writes in the request area: Local node parameter setting request */
R0121
3
[00001 MOV D0090]
[01021 MOV RW102][00001 MOV RW103]
[D0090 WRITE RW102 -> H0001][SET R0122][RST R0121]
/* Writes "1" in the request flag register */
R0122
4
[00256 MOV D0091]
[01023 MOV RW104][00001 MOV RW105]
[D0091 WRITE RW104 -> H0001][SET R0123][RST R0122]
/* Writes "256" in the request register */
R0123
5
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0092]
/* Reads the acknowledgement flag register */
[D0092 = 00001][SET R0124][RST R0123]
R0124
6
[00720 MOV RW108][00002 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0506•D0505]
/* Reads the acknowledgement area (completion status) */
[D0300 = 00018][D0301 = 00001][SET R0125][RST R0124]
R0125
7
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R0125][SET R0126]
/* Writes "0" in the acknowledgement flag register */
R0001
R0001
8


R0126
9|-| |--[00018 MOV D0100][00001 MOV D0101][00005 MOV D0102]---------
/* Sets 5 slave devices */
R0126
10|-| |-+[00000 MOV D0103][00001 MOV D0104][00001 MOV D0105]---------
+[00012 MOV D0106][00001 MOV D0107][00001 MOV D0108]---------
+[00000 MOV D0109][00000 MOV D0110][00006 MOV D0111]---------
+[00000 MOV D0112][00004 MOV D0113][00000 MOV D0114]---------
+[00001 MOV D0115][00004 MOV D0116][00000 MOV D0117]---------
+[00000 MOV D0118]---
/* 1st unit */
R0126
11|-| |-+[00000 MOV D0119][00006 MOV D0120][00001 MOV D0121]---------
+[00012 MOV D0122][00001 MOV D0123][00001 MOV D0124]---------
+[00000 MOV D0125][00000 MOV D0126][00006 MOV D0127]---------
+[00000 MOV D0128][00004 MOV D0129][00000 MOV D0130]---------
+[00001 MOV D0131][00004 MOV D0132][00000 MOV D0133]---------
+[00000 MOV D0134]---
/* 2nd unit */
R0126
12|-| |-+[00000 MOV D0135][00020 MOV D0136][00001 MOV D0137]---------
+[00012 MOV D0138][00001 MOV D0139][00001 MOV D0140]---------
+[00000 MOV D0141][00000 MOV D0142][00006 MOV D0143]---------
+[00000 MOV D0144][00004 MOV D0145][00000 MOV D0146]---------
+[00001 MOV D0147][00004 MOV D0148][00000 MOV D0149]---------
+[00000 MOV D0150]---
/* 3rd unit */

```
   |R0126                                                                  |
 13|-| |-+[ 00000 MOV D0151][ 00008 MOV D0152][ 00001 MOV D0153]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00006 MOV D0154][ 00006 MOV D0155][ 00000 MOV D0156]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0157][ 00001 MOV D0158][ 00000 MOV D0159]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0160][ 00000 MOV D0161][ 00000 MOV D0162]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00001 MOV D0163][ 00003 MOV D0164][ 00000 MOV D0165]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0166]-------------------------------------------     |
   |       /* 4th unit */                                                   |
   |R0126                                                                   |
 14|-| |-+[ 00000 MOV D0167][ 00022 MOV D0168][ 00001 MOV D0169]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00006 MOV D0170][ 00006 MOV D0171][ 00000 MOV D0172]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0173][ 00001 MOV D0174][ 00000 MOV D0175]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0176][ 00000 MOV D0177][ 00000 MOV D0178]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00001 MOV D0179][ 00003 MOV D0180][ 00000 MOV D0181]---------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00000 MOV D0182]-------------------------------------------     |
   |       /* 5th unit */                                                   |
   |R0126                                                                   |
 15|-| |-+[ D0102 * 00016 -> D0266•D0265][D0265 + 00003 -> D0266]--------   |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 00820 MOV RW100][D0266 MOV RW101]---------------------------    |
   |     |                                                                  |
   |     |                                                                  |
   |     +-|^|--[D0100 WRITE RW100  ->  H0001][ SET R0127]---------------   |
   |       /* Writes in the request area: Slave device parameter setting    |
   |                                                          request */    |
   |R0127                                                                   |
 16|-| |-+[ 00001 MOV D00900]-----------------------------------------      |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 01021 MOV RW102][ 00001 MOV RW103]--------------------------    |
   |     |                                                                  |
   |     |                                                                  |
   |     +[D0090 WRITE RW102  ->  H0001][ SET R0128][ RST R0127 ]--------   |
   |       /* Writes "1" in the request flag register */                    |
   |R0128                                                                   |
 17|-| |-+[ 00256 MOV D0091]-----------------------------------------      |
   |     |                                                                  |
   |     |                                                                  |
   |     +[ 01023 MOV RW104][ 00001 MOV RW105]--------------------------    |
   |     |                                                                  |
   |     |                                                                  |
   |     +[D0091 WRITE RW104  ->  H0001][ SET R0129][ RST R0128]---------   |
   |       /* Writes "256" in the request register */                       |
```


R0129
18
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0093]
/* Reads the acknowledgement flag register */
[D0093 = 00001][SET R012A][RST R0129]
R012A
19
[00720 MOV RW108][00002 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0511•D0510]
/* Reads the acknowledgement are (completion status) */
[D0300 = 00018][D0301 = 00001][SET R012B][RST R012A]
R012B
20
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R012B][RST R0126]
/* Writes "0" in the acknowledgement flag register */
[RST R0012]
R0001
21
R0001

5.2.6 Operation Mode Control Request

See"4.6.5 Operation Mode Control Request" for details.

Request area	F	0		Register allocation
0334H	0013H		Operation mode control request code	D0100
0335H	1210H		Specified information	D0101

Acknowledgement area			Register allocation
02D0H	0013H	Operation mode control request code	D0300
02D1H		Completion status	D0301
			D0515
			D0516

Semaphore register			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0092
03FCH		Acknowledgement flag register(write)	D0094

RAS information			Register allocation
010BH		Input/output data setting information	D1000
:			:
028AH			D01383
02CEH		Station status	D1665

Work register		Register allocation
Request area address store	0334H	RW100
Request data length store	0002H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgment data length store	0002H	RW109
RAS information reading address store	02CEH	RW116
RAS information reading data length store	0001H	RW117
Input/output data setting information address store		RW118
Input/output data setting information data length store		RW119

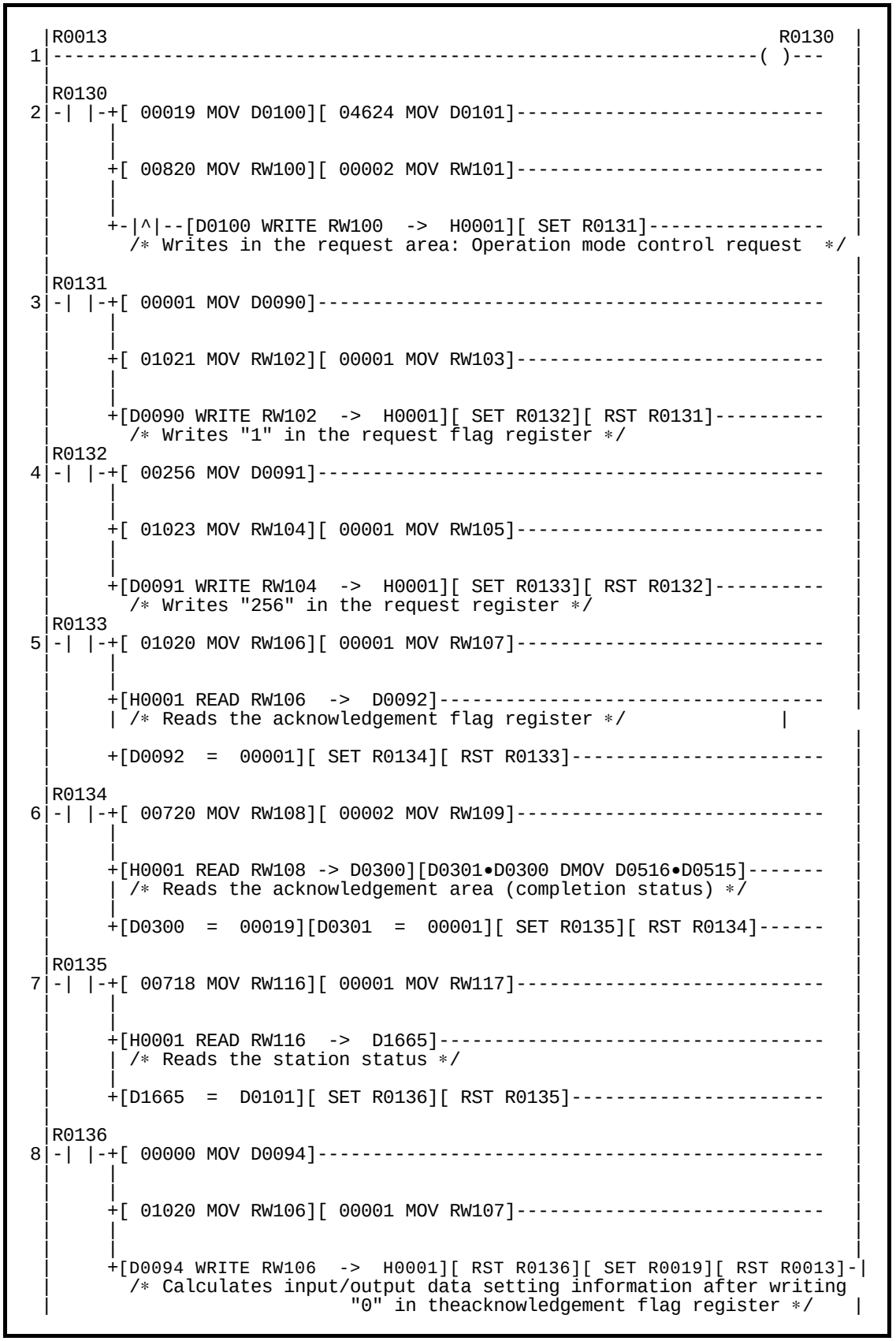
Allocations of the slave device data in the input/output data area (input/output data setting information) are read onto D1000 - D1383. Based on this information, Obtain parameters for reading and writing input/output data area using the READ/WRITE instructions.

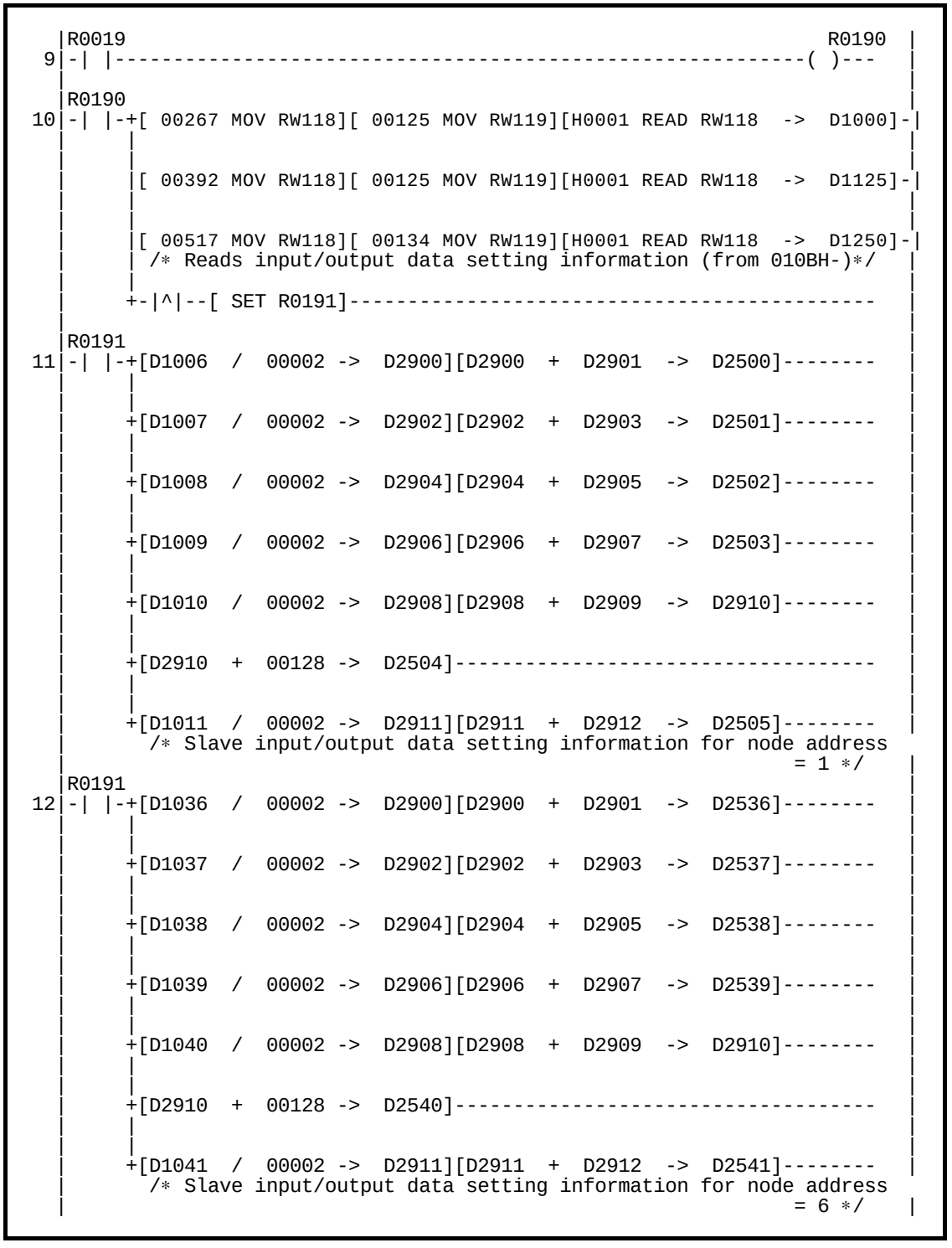
Table 5.1 READ/WRITE Instruction Parameters

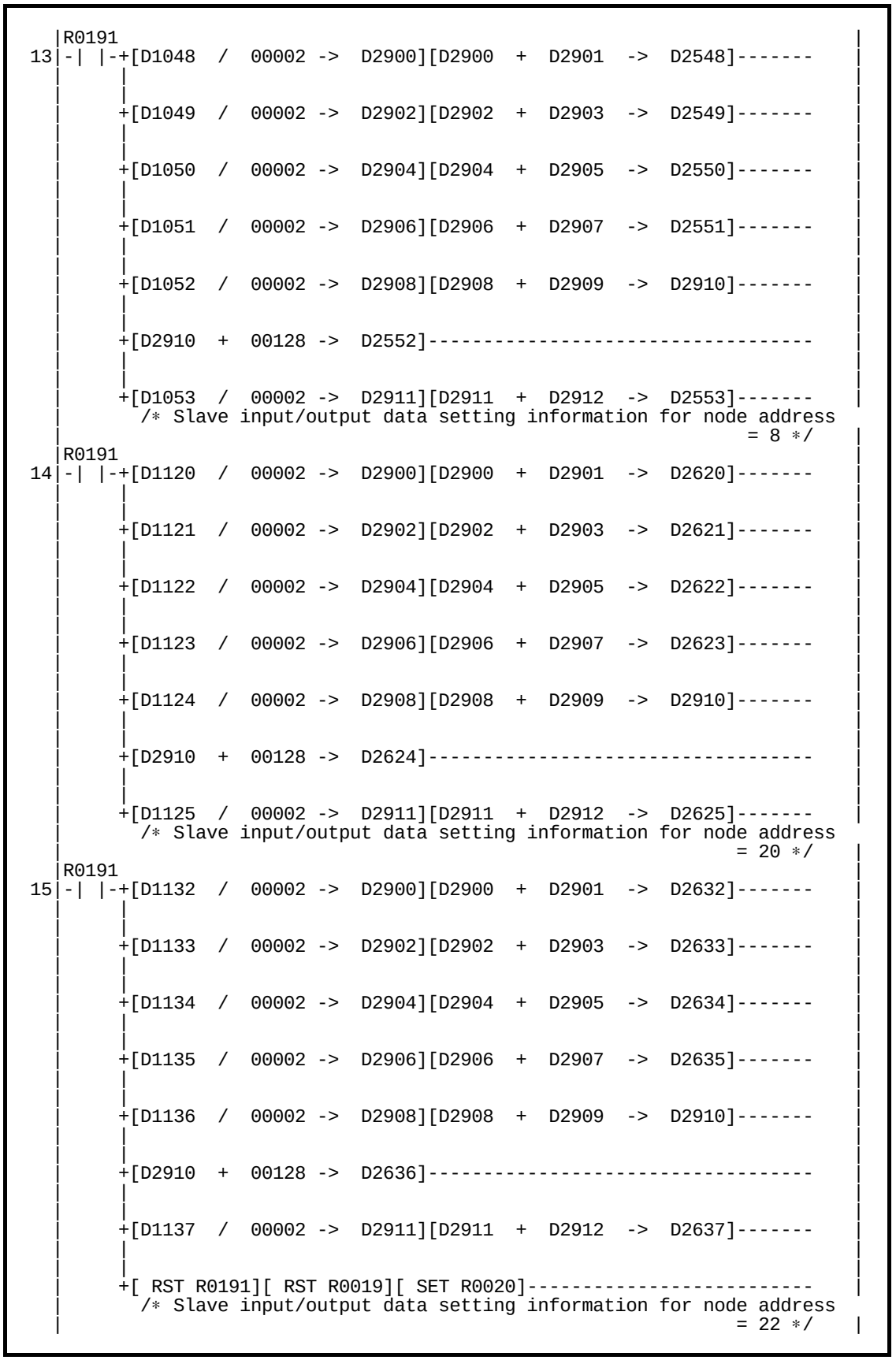
Node Address	Description	Register
1	BS input data top address	D2500
	Number of BS input data words	D2501
	Polling input data top address	D2502
	Number of polling input data words	D2503
	Polling output data top address	D2504
	Number of polling output data words	D2505
6	BS input data top address	D2536
	Number of BS input data words	D2537
	Polling input data top address	D2538
	Number of polling input data words	D2539
	Polling output data top address	D2540
	Number of polling output data words	D2541
8	BS input data top address	D2548
	Number of BS input data words	D2549
	Polling input data top address	D2550
	Number of polling input data words	D2551
	Polling output data top address	D2552
	Number of polling output data words	D2553
20	BS input data top address	D2620
	Number of BS input data words	D2621
	Polling input data top address	D2622
	Number of polling input data words	D2623
	Polling output data top address	D2624
	Number of polling output data words	D2625
22	BS input data top address	D2632
	Number of BS input data words	D2633
	Polling input data top address	D2634
	Number of polling input data words	D2635
	Polling output data top address	D2636
	Number of polling output data words	D2637

BS : Bit Strobe

R0013 in the sample program on the following page indicates the startup relay for mode control request operation.


R0013
R0130
1
( )
R0130
2
[00019 MOV D0100][04624 MOV D0101]
[00820 MOV RW100][00002 MOV RW101]
[D0100 WRITE RW100 -> H0001][SET R0131]
/* Writes in the request area: Operation mode control request */
R0131
3
[00001 MOV D0090]
[01021 MOV RW102][00001 MOV RW103]
[D0090 WRITE RW102 -> H0001][SET R0132][RST R0131]
/* Writes "1" in the request flag register */
R0132
4
[00256 MOV D0091]
[01023 MOV RW104][00001 MOV RW105]
[D0091 WRITE RW104 -> H0001][SET R0133][RST R0132]
/* Writes "256" in the request register */
R0133
5
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0092]
/* Reads the acknowledgement flag register */
[D0092 = 00001][SET R0134][RST R0133]
R0134
6
[00720 MOV RW108][00002 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0516•D0515]
/* Reads the acknowledgement area (completion status) */
[D0300 = 00019][D0301 = 00001][SET R0135][RST R0134]
R0135
7
[00718 MOV RW116][00001 MOV RW117]
[H0001 READ RW116 -> D1665]
/* Reads the station status */
[D1665 = D0101][SET R0136][RST R0135]
R0136
8
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R0136][SET R0019][RST R0013]
/* Calculates input/output data setting information after writing
"0" in theacknowledgement flag register */


R0019
R0190
9
R0190
10
[00267 MOV RW118][00125 MOV RW119][H0001 READ RW118 -> D1000]
[00392 MOV RW118][00125 MOV RW119][H0001 READ RW118 -> D1125]
[00517 MOV RW118][00134 MOV RW119][H0001 READ RW118 -> D1250]
/* Reads input/output data setting information (from 010BH-)*/
SET R0191
R0191
11
[D1006 / 00002 -> D2900][D2900 + D2901 -> D2500]
[D1007 / 00002 -> D2902][D2902 + D2903 -> D2501]
[D1008 / 00002 -> D2904][D2904 + D2905 -> D2502]
[D1009 / 00002 -> D2906][D2906 + D2907 -> D2503]
[D1010 / 00002 -> D2908][D2908 + D2909 -> D2910]
[D2910 + 00128 -> D2504]
[D1011 / 00002 -> D2911][D2911 + D2912 -> D2505]
/* Slave input/output data setting information for node address = 1 */
R0191
12
[D1036 / 00002 -> D2900][D2900 + D2901 -> D2536]
[D1037 / 00002 -> D2902][D2902 + D2903 -> D2537]
[D1038 / 00002 -> D2904][D2904 + D2905 -> D2538]
[D1039 / 00002 -> D2906][D2906 + D2907 -> D2539]
[D1040 / 00002 -> D2908][D2908 + D2909 -> D2910]
[D2910 + 00128 -> D2540]
[D1041 / 00002 -> D2911][D2911 + D2912 -> D2541]
/* Slave input/output data setting information for node address = 6 */


R0191
13 -| |-+[D1048 / 00002 -> D2900][D2900 + D2901 -> D2548]-------
+[D1049 / 00002 -> D2902][D2902 + D2903 -> D2549]-------
+[D1050 / 00002 -> D2904][D2904 + D2905 -> D2550]-------
+[D1051 / 00002 -> D2906][D2906 + D2907 -> D2551]-------
+[D1052 / 00002 -> D2908][D2908 + D2909 -> D2910]-------
+[D2910 + 00128 -> D2552]-----------------------------------
+[D1053 / 00002 -> D2911][D2911 + D2912 -> D2553]-------
/* Slave input/output data setting information for node address = 8 */
R0191
14 -| |-+[D1120 / 00002 -> D2900][D2900 + D2901 -> D2620]-------
+[D1121 / 00002 -> D2902][D2902 + D2903 -> D2621]-------
+[D1122 / 00002 -> D2904][D2904 + D2905 -> D2622]-------
+[D1123 / 00002 -> D2906][D2906 + D2907 -> D2623]-------
+[D1124 / 00002 -> D2908][D2908 + D2909 -> D2910]-------
+[D2910 + 00128 -> D2624]-----------------------------------
+[D1125 / 00002 -> D2911][D2911 + D2912 -> D2625]-------
/* Slave input/output data setting information for node address = 20 */
R0191
15 -| |-+[D1132 / 00002 -> D2900][D2900 + D2901 -> D2632]-------
+[D1133 / 00002 -> D2902][D2902 + D2903 -> D2633]-------
+[D1134 / 00002 -> D2904][D2904 + D2905 -> D2634]-------
+[D1135 / 00002 -> D2906][D2906 + D2907 -> D2635]-------
+[D1136 / 00002 -> D2908][D2908 + D2909 -> D2910]-------
+[D2910 + 00128 -> D2636]-----------------------------------
+[D1137 / 00002 -> D2911][D2911 + D2912 -> D2637]-------
+[RST R0191][RST R0019][SET R0020]-------------------------
/* Slave input/output data setting information for node address = 22 */

5.2.7 RAS Information Read

See "4.6.6 RAS Information Read Request" for details.

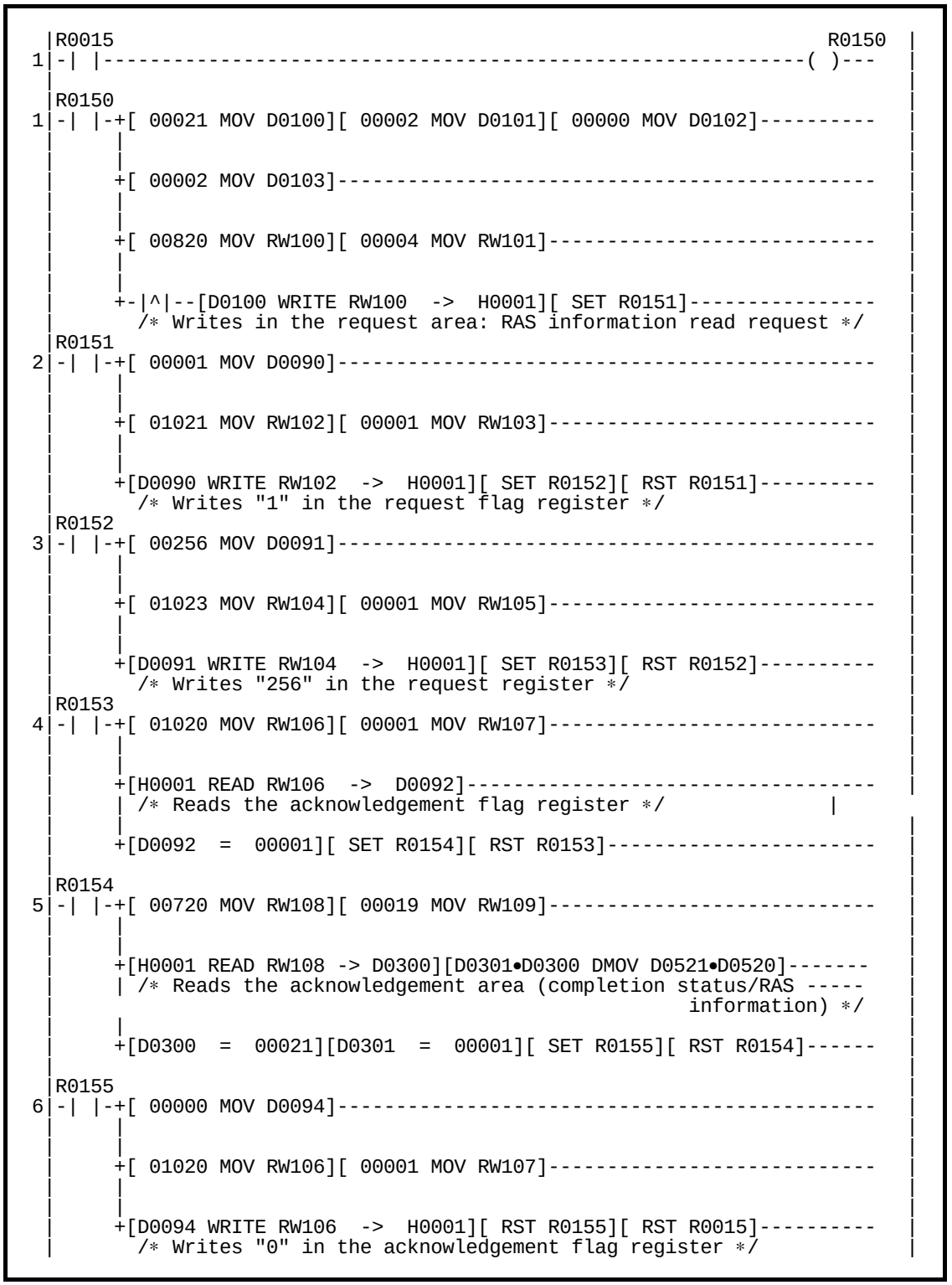
Request area	F	0		Register allocation
0334H	0015H		RAS information read request code	D0100
0335H	0002H		Request information type (event history)	D0101
0336H	0000H		Starting position (from newest -)	D0102
0337H	0002H		Number of events to read (2)	D0103

Acknowledgement area				Register allocation
02D0H	0015H		RAS information read request code	D0300
02D1H			Completion status	D0301
02D2H	0010H		Number of RAS information words (16)	D0302
02D3H	Event code			D0303
02D4H	Detailed information1			D0304
02D5H	Detailed information2			D0305
02D6H	Detailed information3			D0306
02D7H	Detailed information4			D0307
02D8H	Month	Year		D0308
02D9H	Hour	Day		D0309
02DAH	Second	Minute		D0310
02DBH	Event code			D0311
02DCH	Detailed information1			D0312
02DDH	Detailed information2			D0313
02DEH	Detailed information3			D0314
02DFH	Detailed information4			D0315
02E0H	Month	Year		D0316
02E1H	Hour	Day		D0317
02E2H	Second	Minute		D0318
				D0520
				D0521

Semaphore register			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0092
03FCH		Acknowledgement flag register (write)	D0094

Work register		Register allocation
Request area address store	0334H	RW100
Request data length store	0004H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgement data length store	0013H	RW109
RAS information read address store	02CEH	RW116
RAS information read data length store	0001H	RW117

R0015 in the sample program on the following page indicates the startup relay for RAS information read request.


R0015
R0150
1
R0150
[00021 MOV D0100][00002 MOV D0101][00000 MOV D0102]
[00002 MOV D0103]
[00820 MOV RW100][00004 MOV RW101]
[D0100 WRITE RW100 -> H0001][SET R0151]
/* Writes in the request area: RAS information read request */
R0151
2
[00001 MOV D0090]
[01021 MOV RW102][00001 MOV RW103]
[D0090 WRITE RW102 -> H0001][SET R0152][RST R0151]
/* Writes "1" in the request flag register */
R0152
3
[00256 MOV D0091]
[01023 MOV RW104][00001 MOV RW105]
[D0091 WRITE RW104 -> H0001][SET R0153][RST R0152]
/* Writes "256" in the request register */
R0153
4
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0092]
/* Reads the acknowledgement flag register */
[D0092 = 00001][SET R0154][RST R0153]
R0154
5
[00720 MOV RW108][00019 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0521•D0520]
/* Reads the acknowledgement area (completion status/RAS information) */
[D0300 = 00021][D0301 = 00001][SET R0155][RST R0154]
R0155
6
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R0155][RST R0015]
/* Writes "0" in the acknowledgement flag register */

5.2.8 Time Setting Request

See "4.6.7 Time Setting Request" for details.

Request area F 0

				Register allocation
0334H	0018H		Time setting request	D0100
0335H	Month	Year	0597H	D0101
0336H	Hour	Day	1512H	D0102
0337H	Second	Minute	0030H	D0103

Acknowledgement area

			Register allocation
02D0H	0018H	Time setting request	D0300
02D1H		Completion status	D0301
			D0530
			D0531

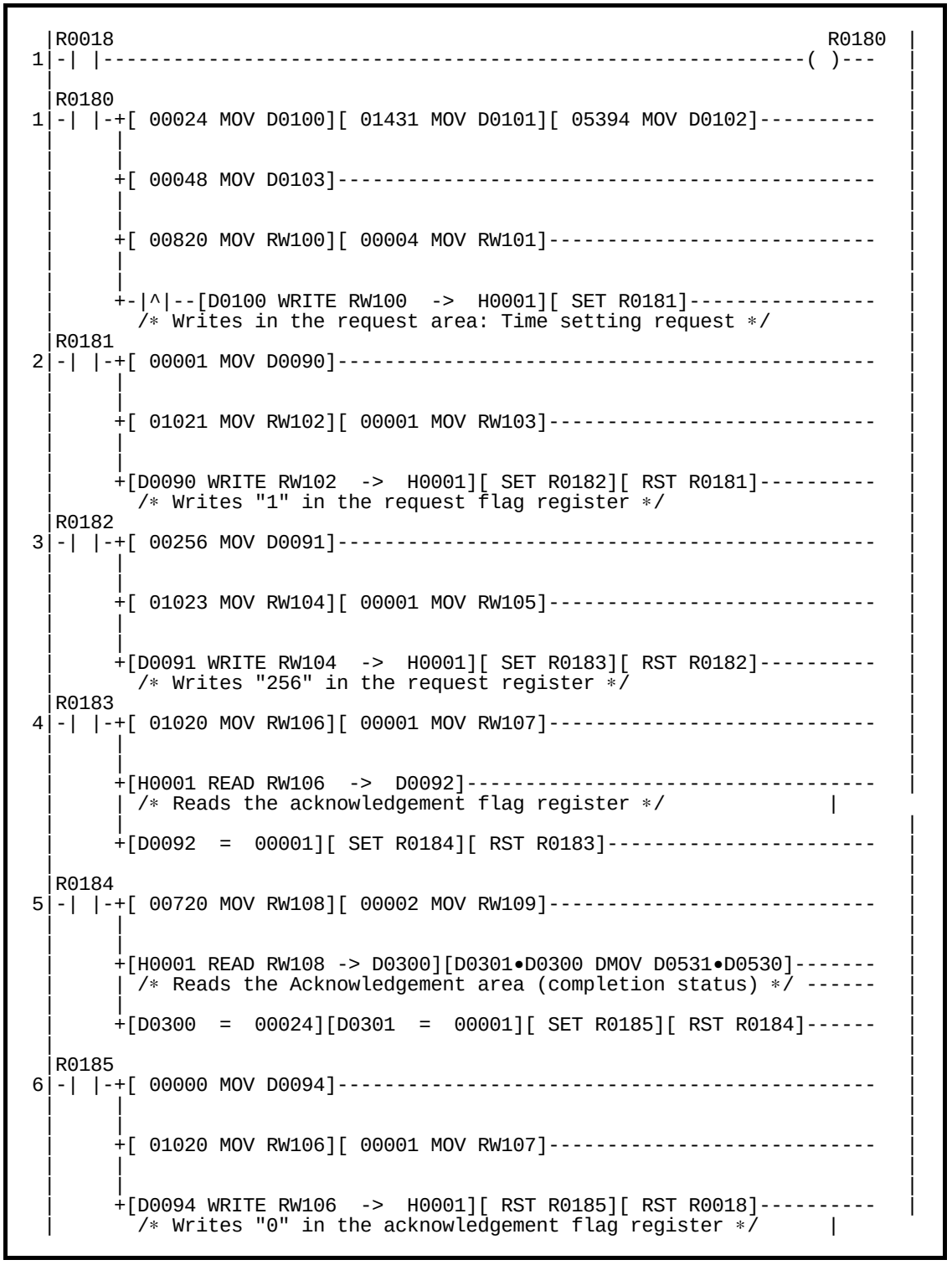
Semaphore register

			Register allocation
03FDH		Request flag register	D0090
03FFH		Request register	D0091
03FCH		Acknowledgement flag register (read)	D0092
03FCH		Acknowledgement flag register (write)	D0094

Work register

		Register allocation
Request area address store	0334H	RW100
Request data length store	0004H	RW101
Request flag register address store	03FDH	RW102
Request flag register length store	0001H	RW103
Request register address store	03FFH	RW104
Request register length store	0001H	RW105
Acknowledgement flag register address store	03FCH	RW106
Acknowledgement flag register length store	0001H	RW107
Acknowledgement area address store	02D0H	RW108
Acknowledgement data length store	0002H	RW109
RAS information read address store	02CEH	RW116
RAS information read data length store	0001H	RW117

R0018 in the sample program on the following page indicates the startup relay for time setting request.


R0018
R0180
1
R0180
1
[00024 MOV D0100][01431 MOV D0101][05394 MOV D0102]
[00048 MOV D0103]
[00820 MOV RW100][00004 MOV RW101]
[D0100 WRITE RW100 -> H0001][SET R0181]
/* Writes in the request area: Time setting request */
R0181
2
[00001 MOV D0090]
[01021 MOV RW102][00001 MOV RW103]
[D0090 WRITE RW102 -> H0001][SET R0182][RST R0181]
/* Writes "1" in the request flag register */
R0182
3
[00256 MOV D0091]
[01023 MOV RW104][00001 MOV RW105]
[D0091 WRITE RW104 -> H0001][SET R0183][RST R0182]
/* Writes "256" in the request register */
R0183
4
[01020 MOV RW106][00001 MOV RW107]
[H0001 READ RW106 -> D0092]
/* Reads the acknowledgement flag register */
[D0092 = 00001][SET R0184][RST R0183]
R0184
5
[00720 MOV RW108][00002 MOV RW109]
[H0001 READ RW108 -> D0300][D0301•D0300 DMOV D0531•D0530]
/* Reads the Acknowledgement area (completion status) */
[D0300 = 00024][D0301 = 00001][SET R0185][RST R0184]
R0185
6
[00000 MOV D0094]
[01020 MOV RW106][00001 MOV RW107]
[D0094 WRITE RW106 -> H0001][RST R0185][RST R0018]
/* Writes "0" in the acknowledgement flag register */

5.3 Slave Data Input/Output

After the DN211 is set to "run mode" by operation mode control request, the ladder program for the T2/T2E/T2N writes data to output slave devices and also reads data inputted from slave devices as well. As described in "1.4 The Basic Functions," the communication between the DN211 and slave devices can be performed with the polling instruction/response mode and bit strobe instruction/response mode. In addition, synchronous mode or asynchronous mode can be used to exchange data between the T2/T2E/T2N and the DN211.
This section describes data input/output between the T2/T2E/T2N and the DN211 in synchronous mode or asynchronous mode.

5.3.1 Slave Device Check

It is recommended to check the communication circuits with the slave devices before reading/writing slave input/output data. This can be done when you check for MS/NS's green lighting on the front panel and for the local node address indication on the 7-segment LED. **This checking also can be done through the program when you find the number of the total devices (029EH) and the number of the online devices (029DH) in the RAS information are equal.** Moreover, when a difference is found in the numbers of the total devices and of the online devices, no-responded slave devices can be identified using the polling no-responded device map and the bit strobe no-responded device map.
The sample program in this chapter checks communication circuits by comparing the number of the total devices with the number of the online devices; and when these numbers differ, the program will stop data updates.

- The number of total devices(029EH):
  Indicates the number of the slave devices specified by a parameter setting request (setting information).
- The number of online devices(029DH):
  Indicates the number of the slave devices which are performing data input/output with the DN211 (execution information).
- Polling no-responded device map
  Indicates, per bit per device, the number of the slave devices not responded to the DN211 (No response for ON). The figure in frames in Table 5.2 represent the node address of a slave device.

Table 5.2 Polling No-response Slave Devices

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0297H	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0298H	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0299H	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
029AH	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

- Bit strobe no-responded device map
  Indicates, per bit per device, the number of the slave devices not responded to the DN211 (No response for ON). The figure in frames in Table 5.3 represents the node address of a slave device.

Table 5.3 Bit Strobe No-response Slave Devices

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0293H	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0294H	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0295H	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32

0296H	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

5.3.2 Asynchronous Mode Data Input/Output

When outputting: Output data to slave devices will be written in the output data area of the DN211 from the T2/T2E/T2N. The DN211 transmits output data written in its scan cycle to slave devices (unrelated to the output data write timing by the T2/T2E/T2N).Unless output data is updated, the DN211 continues to transmit the same data.

When inputting: The DN211 receives data from slave devices in polling response/bit strobe response. The DN211 updates data in the input data area when completing data reception from all slave devices. The DN211 doesn't inform the T2/T2E/T2N of the completion of receiving data. The T2/T2E/T2N reads input data regardless of the timing of input data updates by the DN211.

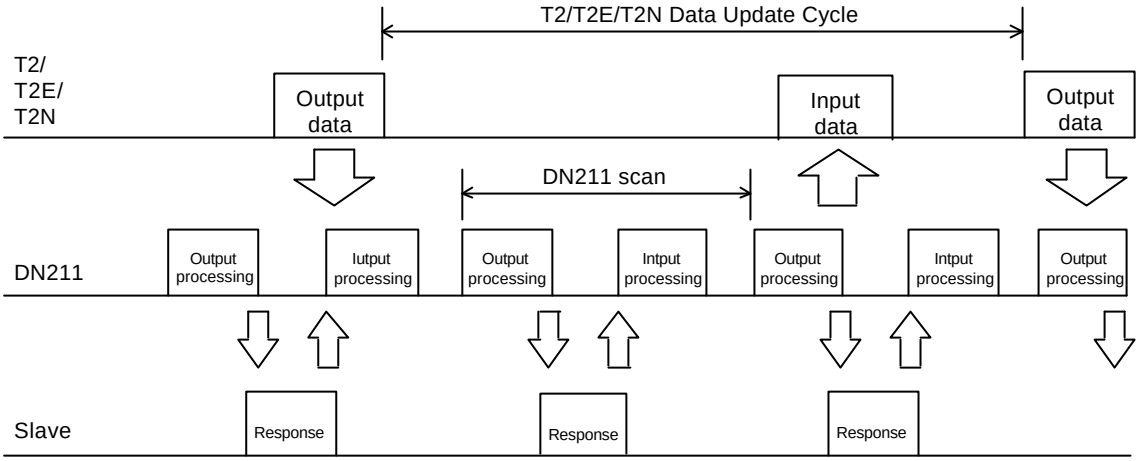


Figure 5.4 Asynchronous Mode Data Input/Output

Input data area

		Register allocation
0000H	Node address = 1	D02100
0001H		D02101
0002H		D02102
0003H	Node address = 6	D02103
0004H		D02104
0005H		D02105
0006H	Node address = 8	D02106
0007H	Node address = 20	D02107
0008H		D02108
0009H		D02109
000AH	Node address = 22	D02110

Output data area

		Register allocation
0080H	Node address = 1	D1710
0081H		D1711
0082H	Node address = 6	D1712
0083H		D1713
0084H	Node address = 20	D1714
0085H		D1715

Bit strobe output data area

	Register allocation
0100H	D1700
0101H	D1701
0102H	D1702
0103H	D1703

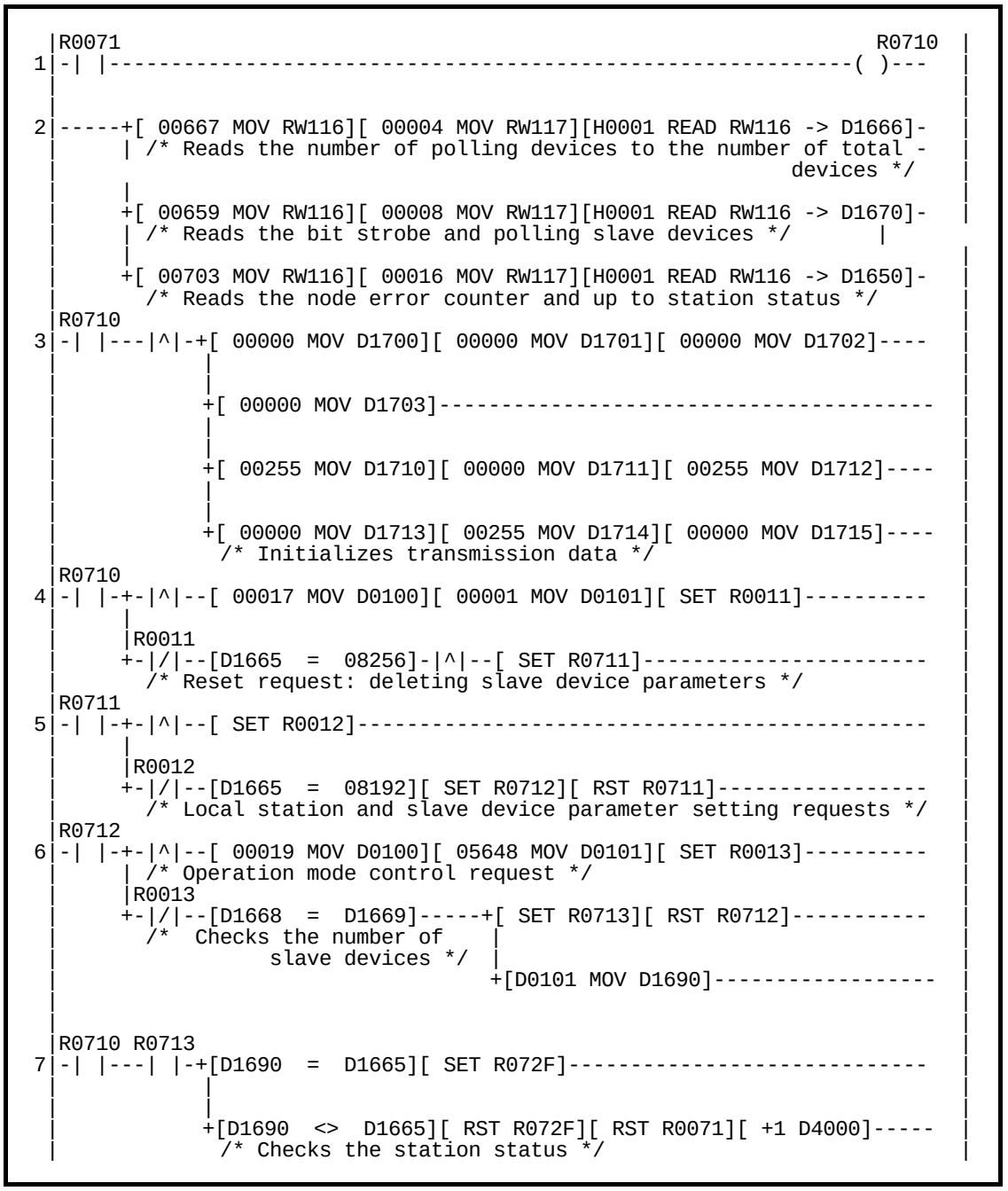
RAS information			Register allocation
029BH		Number of polling devices	D1666
029CH		Number of bit strobe devices	D1667
029DH		Number of online devices	D1668
029EH		Number of total devices	D1669
0293H			D1670
0294H		Bit strobe	D1671
0295H		No-response device	D1672
0296H			D1673
0297H			D1674
0298H		Polling	D1675
0299H		No-response device	D1676
029AH			D1677
02CEH		Station status	D1665

Work register	Register allocation
RAS information read address store	RW116
RAS information read data length store	RW117
Request mode store of operation mode control request	D1690

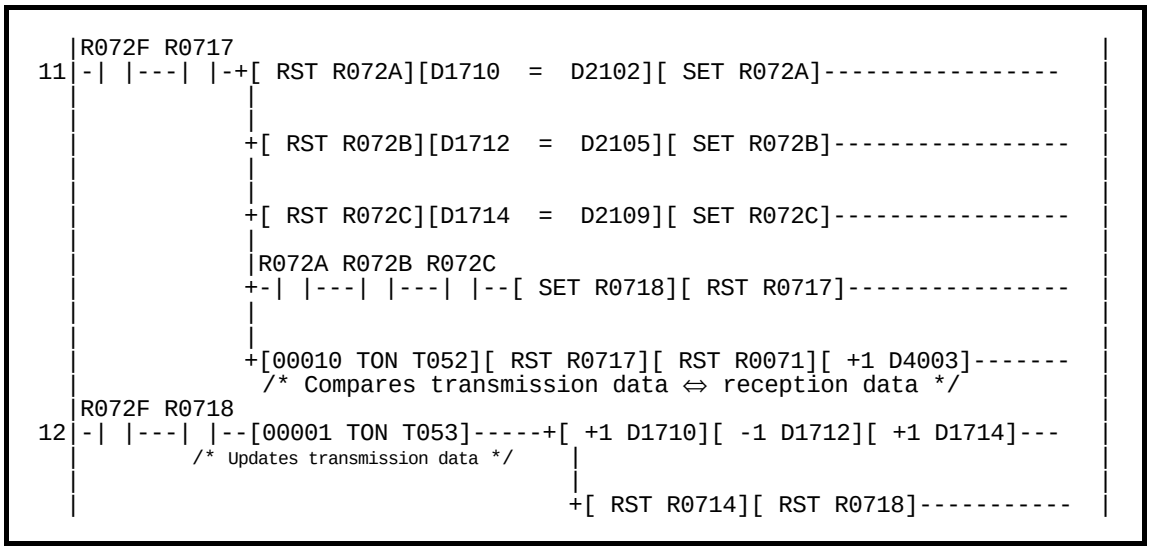
		Register allocation
Node address = 1	Polling input data top address	D2502
	Number of polling input data words	D2503
	Polling output data top address	D2504
	Number of polling output data words	D2505
Node address = 6	Polling input data top address	D2538
	Number of polling input data words	D2539
	Polling output data top address	D2540
	Number of polling output data words	D2541
Node address = 8	BS input data top address	D2548
	Number of BS input data words	D2549
Node address = 20	Polling input data top address	D2622
	Number of polling input data words	D2623
	Polling output data top address	D2624
	Number of polling output data words	D2625
Node address = 22	BS input data top address	D2632
	Number of BS input data words	D2633

Remarks:

- This sample program performs loopback check of data transmitted to FLEX I/O.
- R0071 in the sample program on the next page indicates the startup relay for asynchronous data input/output.
- This sample program requires the programs stated in **"5.2.3 Reset Request"**, **"5.2.4/5.2.5 Parameter Setting Request"**, and **"5.2.6 Operation Mode Control Request."**
- This program allows the WRITE / READ instructions to write/read output and input data for individual slave devices. Besides these performances, input/output data can be read/written in batch processing (maximum 128 words). This method allows to reduce the number of READ/WRITE executions, resulting in a shorter execution time for the ladder program.


R0071
R0710
1
( )
2
[00667 MOV RW116][00004 MOV RW117][H0001 READ RW116 -> D1666]
/* Reads the number of polling devices to the number of total devices */
[00659 MOV RW116][00008 MOV RW117][H0001 READ RW116 -> D1670]
/* Reads the bit strobe and polling slave devices */
[00703 MOV RW116][00016 MOV RW117][H0001 READ RW116 -> D1650]
/* Reads the node error counter and up to station status */
R0710
3
[00000 MOV D1700][00000 MOV D1701][00000 MOV D1702]
[00000 MOV D1703]
[00255 MOV D1710][00000 MOV D1711][00255 MOV D1712]
[00000 MOV D1713][00255 MOV D1714][00000 MOV D1715]
/* Initializes transmission data */
R0710
4
[00017 MOV D0100][00001 MOV D0101][SET R0011]
R0011
[D1665 = 08256]
[SET R0711]
/* Reset request: deleting slave device parameters */
R0711
5
[SET R0012]
R0012
[D1665 = 08192][SET R0712][RST R0711]
/* Local station and slave device parameter setting requests */
R0712
6
[00019 MOV D0100][05648 MOV D0101][SET R0013]
/* Operation mode control request */
R0013
[D1668 = D1669]
[SET R0713][RST R0712]
/* Checks the number of slave devices */
[D0101 MOV D1690]
R0710 R0713
7
[D1690 = D1665][SET R072F]
[D1690 <> D1665][RST R072F][RST R0071][+1 D4000]
/* Checks the station status */

```
   |R072F R0714                                                          |
 8 |-| |---|/|-+[ 00256 MOV RW120][ 00004 MOV RW121]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[D1700 WRITE RW120  ->  H0001]--------------------------  |
   |             | /* Writes bit strobe transmission data */              |
   |             |                                                       |
   |             +[D2504  MOV RW122][D2505  MOV RW123]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[D1710 WRITE RW122  ->  H0001]--------------------------  |
   |             | /* Writes polling transmission data of node address =1 */  |
   |             |                                                       |
   |             +[D2540  MOV RW122][D2541  MOV RW123]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[D1712 WRITE RW122  ->  H0001]--------------------------  |
   |             | /* Writes polling transmission data of node address = 6 *   /
   |             |                                                       |
   |             +[D2624  MOV RW122][D2625  MOV RW123]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[D1714 WRITE RW122 -> H0001][ SET R0715][ SET R0714]------  |
   |               /* Writes polling transmission data of node address=20 */  |
   |R072F R0715                                                          |
 9 |-| |---| |--[00005 TON T051][ SET R0716][ RST R0715]-----------------  |
   |               /* Waits for loopback time */                         |
   |R072F R0716                                                          |
10 |-| |---| |-+[D2502 MOV RW124][ D2503 MOV RW125]----------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[H0001 READ RW124  ->  D2100]--------------------------  |
   |             | /* Reads polling reception data of node address = 1 */  |
   |             |                                                       |
   |             +[D2538  MOV RW124][D2539  MOV RW125]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[H0001 READ RW124  ->  D2103]--------------------------  |
   |             | /* Reads polling reception data of node address = 6 */  |
   |             |                                                       |
   |             +[D2622  MOV RW124][D2623  MOV RW125]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[H0001 READ RW124  ->  D2107]--------------------------  |
   |             | / *Reads polling reception data of node address=20 */  |
   |             |                                                       |
   |             +[D2548  MOV RW124][D2549  MOV RW125]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[H0001 READ RW124  ->  D2106]--------------------------  |
   |             | /* Reads bit strobe reception data of node address=8 */  |
   |             |                                                       |
   |             +[D2632  MOV RW124][D2633  MOV RW125]--------------------  |
   |             |                                                       |
   |             |                                                       |
   |             +[H0001 READ RW124 -> D2110][ SET R0717][ RST R0716]-----  |
   |               /* Reads bit strobe reception data of node address=22 */  |
```


R072F R0717
11
-| |---| |-+[RST R072A][D1710 = D2102][SET R072A]
+[RST R072B][D1712 = D2105][SET R072B]
+[RST R072C][D1714 = D2109][SET R072C]
R072A R072B R072C
+-| |---| |---| |--[SET R0718][RST R0717]
+[00010 TON T052][RST R0717][RST R0071][+1 D4003]
/* Compares transmission data ⇔ reception data */
R072F R0718
12
-| |---| |--[00001 TON T053]-----+[+1 D1710][-1 D1712][+1 D1714]
/* Updates transmission data */
+[RST R0714][RST R0718]

5.3.3 Synchronous Mode Data Input/Output

When outputting: Output data to slave devices from the T2/T2E/T2N is written into the output data area of the DN211. Then, an output data semaphore or bit strobe output data semaphore is used for commanding a polling instruction or bit strobe instruction. When receiving the polling instruction / bit strobe instruction, the DN211 will transmit the written output data to slave devices.

When inputting: The DN211 receives data from slave devices in polling response / bit strobe response. When Completing receiving data from all slave devices, the DN211 will update data in the input data area. Then, an input data semaphore is used for notifyingthe T2/T2E/T2N of the input completion.
When reading input data, the T2/T2E/T2N read data after checking for input completion by the DN211.

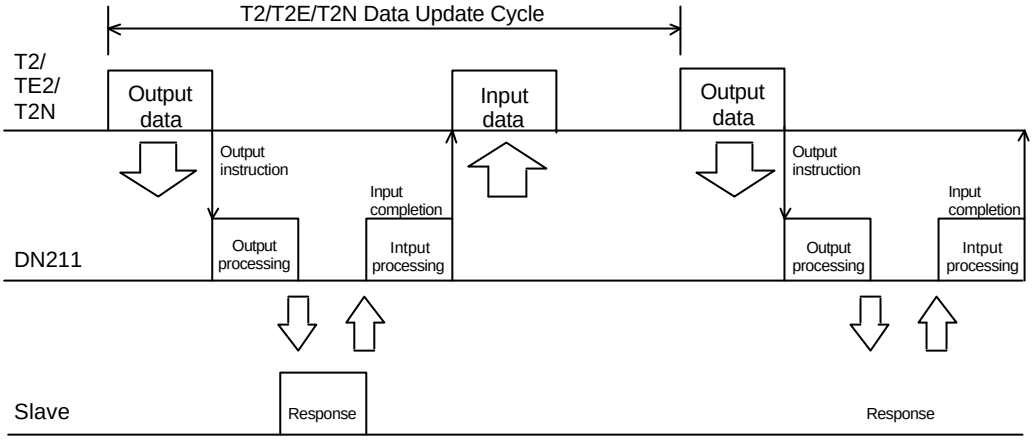


Figure 5.5 Synchronous Mode Data Input/Output

How to Use an Output/Input Data Semaphore (for synchronous mode only):

Figure 5.6 illustrates the relation between the output data semaphore (polling/bit strobe) and the input data semaphore. The squares in oblique lines indicate the value of individual semaphores are set to "1."

When devices with the polling system and bit strobe system are intermingled, use of the input data semaphore register is shared by the polling mode and bit strobe mode. Therefore, input/output data must be **processed alternatively after the other mode completes the processing, as shown below:**

Polling mode ® Bit strobe mode ® Polling mode ® Bit strobe mode ® ¼

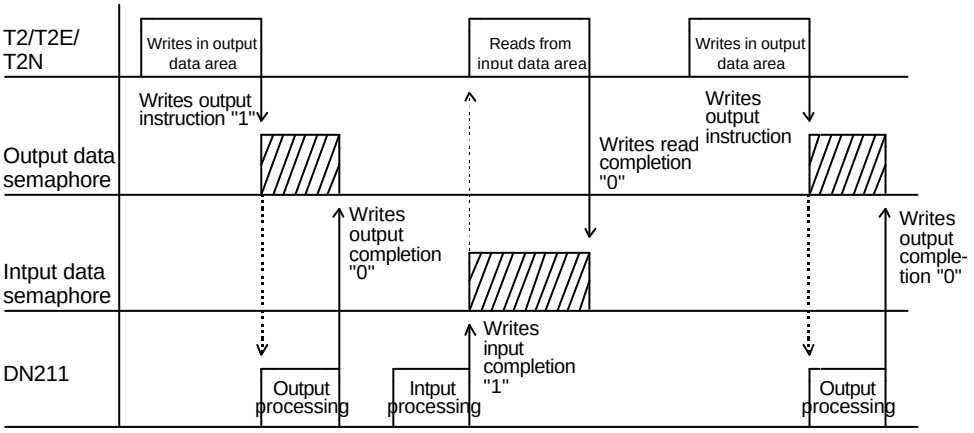
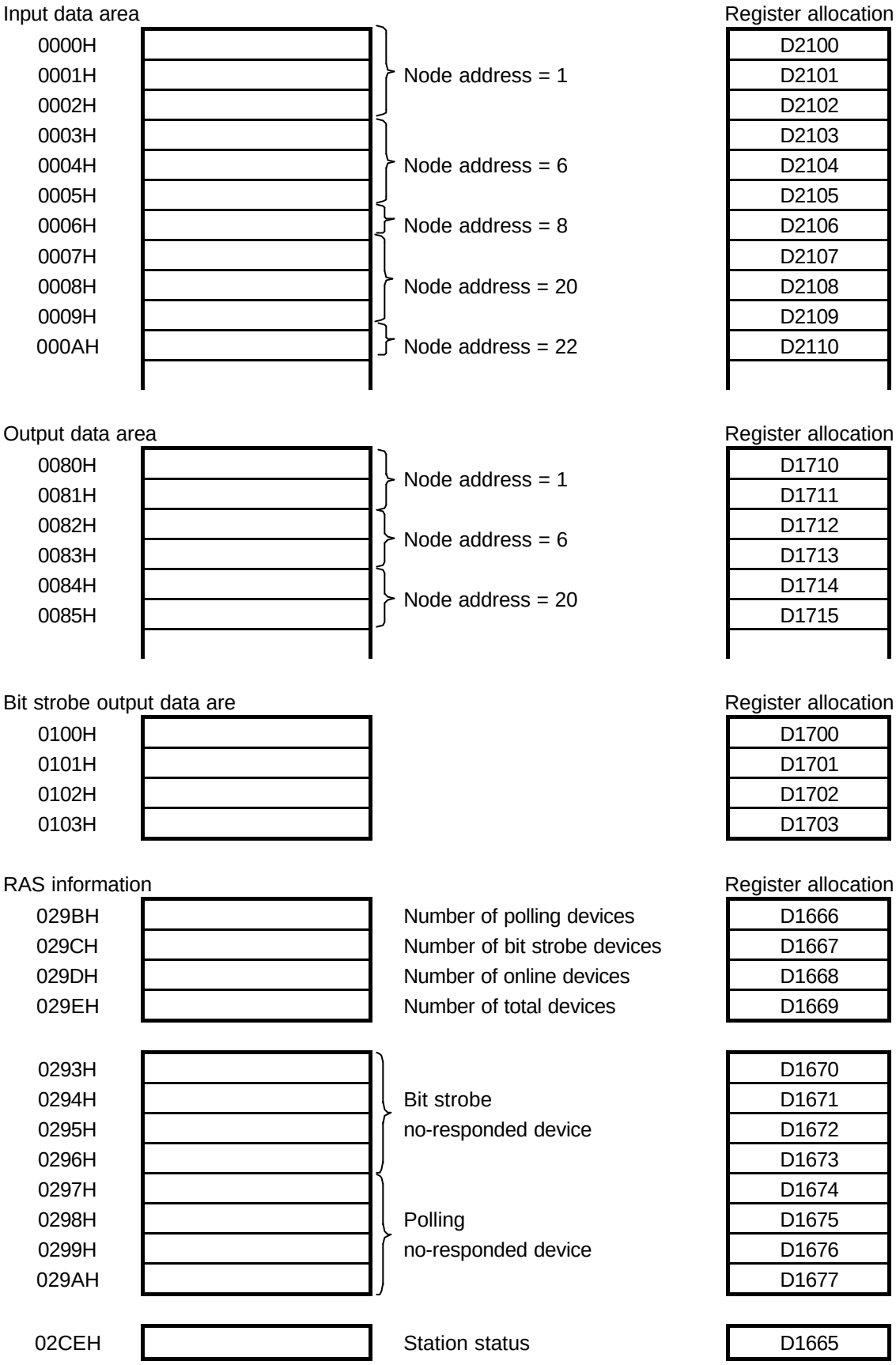


Figure 5.6 How to Use Semaphores in Synchronous Mode


Input data area
Register allocation
0000H
0001H
0002H
0003H
0004H
0005H
0006H
0007H
0008H
0009H
000AH
Node address = 1
Node address = 6
Node address = 8
Node address = 20
Node address = 22
D2100
D2101
D2102
D2103
D2104
D2105
D2106
D2107
D2108
D2109
D2110
Output data area
Register allocation
0080H
0081H
0082H
0083H
0084H
0085H
Node address = 1
Node address = 6
Node address = 20
D1710
D1711
D1712
D1713
D1714
D1715
Bit strobe output data are
Register allocation
0100H
0101H
0102H
0103H
D1700
D1701
D1702
D1703
RAS information
Register allocation
029BH
029CH
029DH
029EH
Number of polling devices
Number of bit strobe devices
Number of online devices
Number of total devices
D1666
D1667
D1668
D1669
0293H
0294H
0295H
0296H
0297H
0298H
0299H
029AH
Bit strobe
no-responded device
Polling
no-responded device
D1670
D1671
D1672
D1673
D1674
D1675
D1676
D1677
02CEH
Station status
D1665

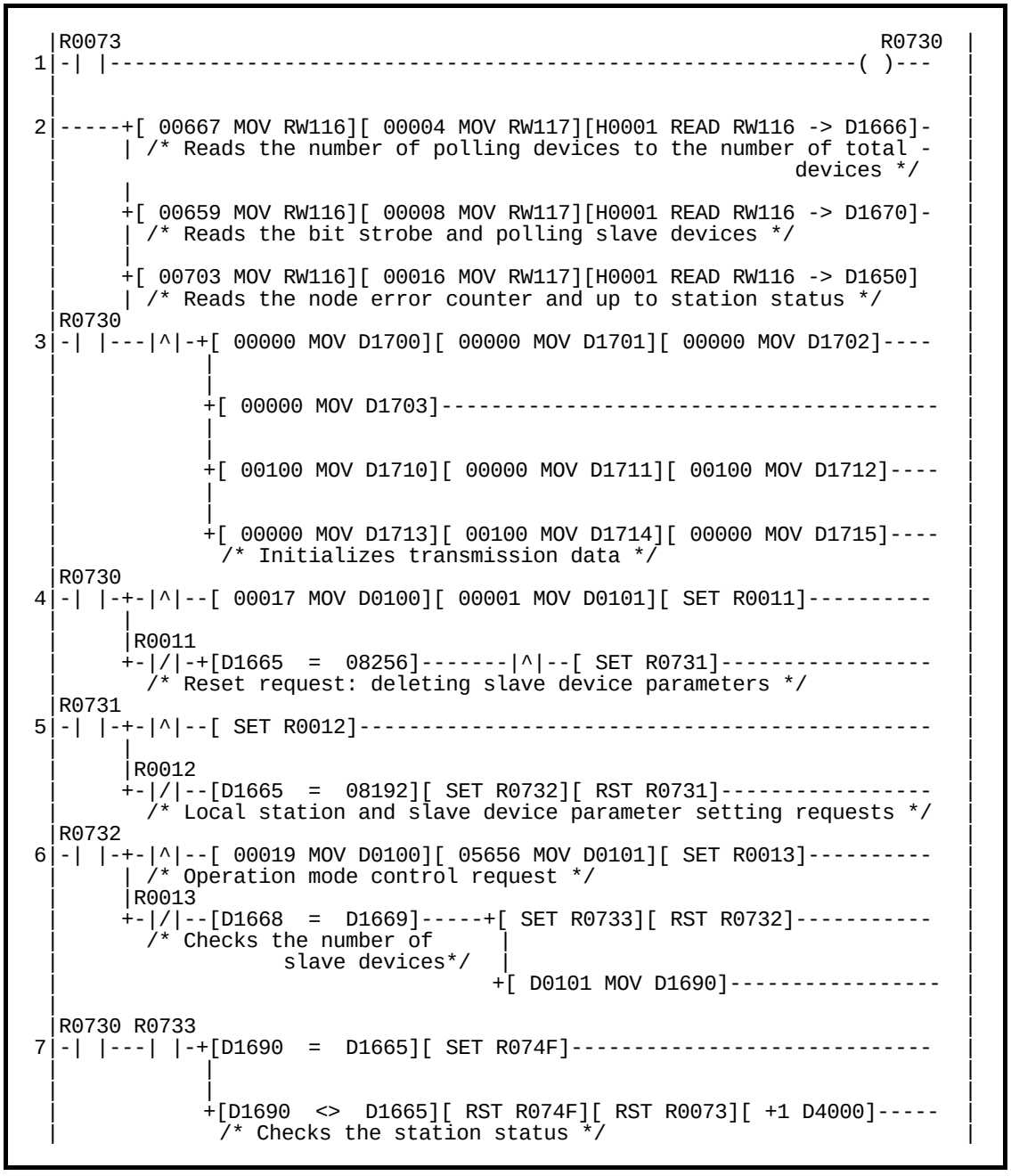
Semaphore register			Register allocation
0104H		BS output data semaphore	D0095
0105H		Output data semaphore	D0096
0106H		Input data semaphore (read)	D0097
0106H		Input data semaphore (write)	D0098

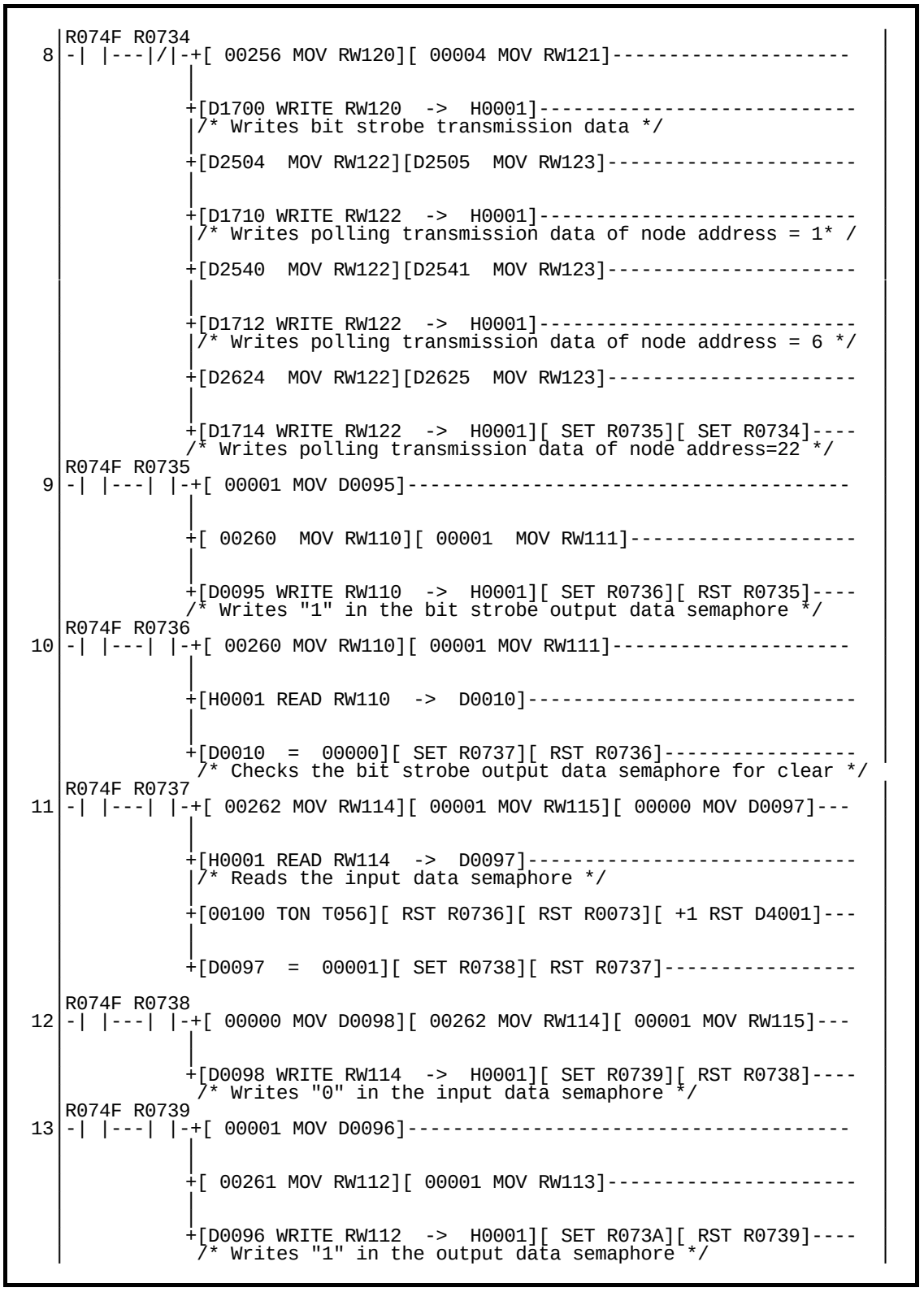
Work register	
Bit strobe output data semaphore address store	RW110
Bit strobe output data semaphore data length store	RW111
Output data semaphore address store	RW112
Output data semaphore data length store	RW113
Input data semaphore address store	RW114
Input data semaphore data length store	RW115
RAS information read address store	RW116
RAS information read data length store	RW117
Storing request mode for operation mode control request	D1690

Node address = 1	Polling input data top address	D2502
	Number of polling input data words	D2503
	Polling output data top address	D2504
	Number of polling output data words	D2505
Node address = 6	Polling input data top address	D2538
	Number of polling input data words	D2539
	Polling output data top address	D2540
	Number of polling output data words	D2541
Node address = 8	BS input data top address	D2548
	Number of BS input data words	D2549
Node address = 20	Polling input data top address	D2622
	Number of polling input data words	D2623
	Polling output data top address	D2624
	Number of polling output data words	D2625
Node address = 22	BS input data top address	D2632
	Number of BS input data words	D2633

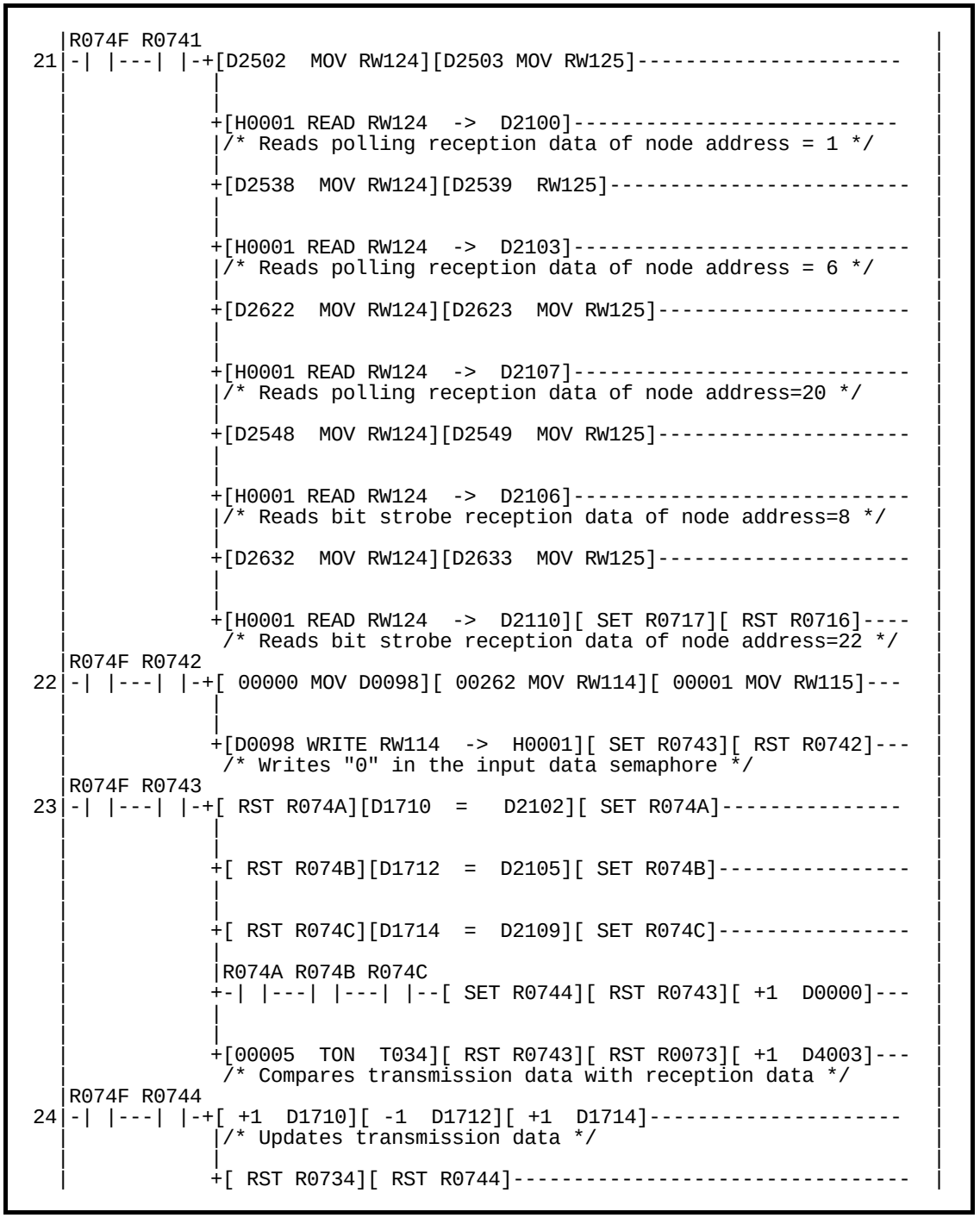
Remarks

- This sample program performs loopback check of data transmitted to FLEX I/O.
- R0073 in the sample program on the next page indicates the startup relay for asynchronous data input/output.
- This sample program requires the programs stated in **"5.2.3 Reset Request"**, **"5.2.4/5.2.5 Parameter Setting Request"**, and **"5.2.6 Operation Mode Control Request."**
- This program allows the WRITE/READ instructions to write/read output and input data for individual slave devices. Besides these performances, input/output data can be read/written in batch processing (maximum 128 words). This method allows to reduce the number of READ/WRITE executions, resulting in a shorter execution time for the ladder program.


R0073
R0730
1
2
3
4
5
6
7
[00667 MOV RW116][00004 MOV RW117][H0001 READ RW116 -> D1666]-
/* Reads the number of polling devices to the number of total -
devices */
[00659 MOV RW116][00008 MOV RW117][H0001 READ RW116 -> D1670]-
/* Reads the bit strobe and polling slave devices */
[00703 MOV RW116][00016 MOV RW117][H0001 READ RW116 -> D1650]
/* Reads the node error counter and up to station status */
R0730
[00000 MOV D1700][00000 MOV D1701][00000 MOV D1702]----
[00000 MOV D1703]----------
[00100 MOV D1710][00000 MOV D1711][00100 MOV D1712]----
[00000 MOV D1713][00100 MOV D1714][00000 MOV D1715]----
/* Initializes transmission data */
R0730
[00017 MOV D0100][00001 MOV D0101][SET R0011]----------
R0011
[D1665 = 08256]-------|^|--[SET R0731]----------
/* Reset request: deleting slave device parameters */
R0731
[SET R0012]----------
R0012
[D1665 = 08192][SET R0732][RST R0731]----------
/* Local station and slave device parameter setting requests */
R0732
[00019 MOV D0100][05656 MOV D0101][SET R0013]----------
/* Operation mode control request */
R0013
[D1668 = D1669]-----+[SET R0733][RST R0732]----------
/* Checks the number of
slave devices*/
+[D0101 MOV D1690]----------
R0730 R0733
[D1690 = D1665][SET R074F]----------
[D1690 <> D1665][RST R074F][RST R0073][+1 D4000]-----
/* Checks the station status */


R074F R0734
8
-| |---|/|-+[00256 MOV RW120][00004 MOV RW121]----------
+[D1700 WRITE RW120 -> H0001]----------
/* Writes bit strobe transmission data */
+[D2504 MOV RW122][D2505 MOV RW123]----------
+[D1710 WRITE RW122 -> H0001]----------
/* Writes polling transmission data of node address = 1* /
+[D2540 MOV RW122][D2541 MOV RW123]----------
+[D1712 WRITE RW122 -> H0001]----------
/* Writes polling transmission data of node address = 6 */
+[D2624 MOV RW122][D2625 MOV RW123]----------
+[D1714 WRITE RW122 -> H0001][SET R0735][SET R0734]----
/* Writes polling transmission data of node address=22 */
R074F R0735
9
-| |---| |-+[00001 MOV D0095]----------
+[00260 MOV RW110][00001 MOV RW111]----------
+[D0095 WRITE RW110 -> H0001][SET R0736][RST R0735]----
/* Writes "1" in the bit strobe output data semaphore */
R074F R0736
10
-| |---| |-+[00260 MOV RW110][00001 MOV RW111]----------
+[H0001 READ RW110 -> D0010]----------
+[D0010 = 00000][SET R0737][RST R0736]----------
/* Checks the bit strobe output data semaphore for clear */
R074F R0737
11
-| |---| |-+[00262 MOV RW114][00001 MOV RW115][00000 MOV D0097]---
+[H0001 READ RW114 -> D0097]----------
/* Reads the input data semaphore */
+[00100 TON T056][RST R0736][RST R0073][+1 RST D4001]---
+[D0097 = 00001][SET R0738][RST R0737]----------
R074F R0738
12
-| |---| |-+[00000 MOV D0098][00262 MOV RW114][00001 MOV RW115]---
+[D0098 WRITE RW114 -> H0001][SET R0739][RST R0738]----
/* Writes "0" in the input data semaphore */
R074F R0739
13
-| |---| |-+[00001 MOV D0096]----------
+[00261 MOV RW112][00001 MOV RW113]----------
+[D0096 WRITE RW112 -> H0001][SET R073A][RST R0739]----
/* Writes "1" in the output data semaphore */

```
   |R074F R073A                                                          |
14 |-| |---| |-+[ 00261 MOV RW112][ 00001 MOV RW113]--------------------  |
   |           |                                                         |
   |           |                                                         |
   |           +[H0001 READ RW112  ->  D0010]----------------------------|
   |           |                                                         |
   |           |                                                         |
   |           +[D0010  =  00000][ SET R073B][ RST R073A]-----------------|
   |            /* Checks the output data semaphore for clear */         |
   |R074F R073B                                                          |
15 |-| |---| |-+[ 00262 MOV RW114][ 00001 MOV RW115][ 00000 MOV D0097]---  |
   |           |                                                         |
   |           |                                                         |
   |           +[H0001 READ RW114  ->  D0097]----------------------------|
   |           |/* Reads the input data semaphor */                       |
   |           |                                                         |
   |           +[00100 TON T056][ RST R0736][ RST R0073][ +1 D4001]-------|
   |           |                                                         |
   |           |                                                         |
   |           +[D0097  =  00001][ SET R073C][ RST R073B]-----------------|
   |                                                                     |
   |R074F R073C                                                          |
16 |-| |---| |-+[ 00000 MOV D0098][ 00262 MOV RW114][ 00001 MOV RW115]---  |
   |           |                                                         |
   |           |                                                         |
   |           +[D0098 WRITE RW114  ->  H0001][ SET R073D][ RST R073C]----|
   |            /*Writes "0" in the input data semaphor*/                 |
   |R074F R073D                                                          |
17 |-| |---| |--[ 00001 TON T057][ SET R073E][ RST R073D]----------------  |
   |            /* Waits for loopback time */                            |
   |R074F R073E                                                          |
18 |-| |---| |-+[ 00001 MOV D0096]--------------------------------------  |
   |           |                                                         |
   |           |                                                         |
   |           +[ 00261 MOV RW112][ 00001  MOV RW113]---------------------|
   |           |                                                         |
   |           |                                                         |
   |           +[D0096 WRITE RW112  ->  H0001][ SET R073F][ RST R073E]----|
   |            /* Writes "1" in the output data semaphore */            |
   |R074F R073F                                                          |
19 |-| |---| |-+[ 00261 MOV RW112][ 00001 MOV RW113]--------------------  |
   |           |                                                         |
   |           |                                                         |
   |           +[H0001 READ RW112  ->  D0010]----------------------------|
   |           |                                                         |
   |           |                                                         |
   |           +[D0010  =  00000][ SET R0740][ RST R073F]-----------------|
   |            /* Checks the output data semaphore for clear */         |
   |R074F R0740                                                          |
20 |-| |---| |-+[ 00262 MOV RW114][ 00001 MOV RW115][ 00000 MOV D0097]---  |
   |           |                                                         |
   |           |                                                         |
   |           +[H0001 READ RW114  ->  D0097]----------------------------|
   |           |/* Reads the input data semaphore */                      |
   |           |                                                         |
   |           +[00100  TON  T058][ RST R073B][ RST R0073][ +1 D4002]-----|
   |           |                                                         |
   |           |                                                         |
   |           +[D0097  =  00001][ SET R0741][ RST R0740]-----------------|
```


R074F R0741
21
[D2502 MOV RW124][D2503 MOV RW125]
[H0001 READ RW124 -> D2100]
/* Reads polling reception data of node address = 1 */
[D2538 MOV RW124][D2539 RW125]
[H0001 READ RW124 -> D2103]
/* Reads polling reception data of node address = 6 */
[D2622 MOV RW124][D2623 MOV RW125]
[H0001 READ RW124 -> D2107]
/* Reads polling reception data of node address=20 */
[D2548 MOV RW124][D2549 MOV RW125]
[H0001 READ RW124 -> D2106]
/* Reads bit strobe reception data of node address=8 */
[D2632 MOV RW124][D2633 MOV RW125]
[H0001 READ RW124 -> D2110][SET R0717][RST R0716]
/* Reads bit strobe reception data of node address=22 */
R074F R0742
22
[00000 MOV D0098][00262 MOV RW114][00001 MOV RW115]
[D0098 WRITE RW114 -> H0001][SET R0743][RST R0742]
/* Writes "0" in the input data semaphore */
R074F R0743
23
[RST R074A][D1710 = D2102][SET R074A]
[RST R074B][D1712 = D2105][SET R074B]
[RST R074C][D1714 = D2109][SET R074C]
R074A R074B R074C
[SET R0744][RST R0743][+1 D0000]
[00005 TON T034][RST R0743][RST R0073][+1 D4003]
/* Compares transmission data with reception data */
R074F R0744
24
[+1 D1710][-1 D1712][+1 D1714]
/* Updates transmission data */
[RST R0734][RST R0744]

6. RAS Information (except RAS area on communication memory)

This chapter describes the following RAS functions of the DN211.

1. Indicators on the front panel
   - Module status / network status LED (MS/NS)
   - 7-segment LED (NA/ERROR)
2. Information by reading RAS Information
   - RAS history counter
   - Event history

See "4.3 The RAS information Area" for the RAS information area on the DN211 communication memory.

⚠ CAUTION
1. This chapter describes the subjects necessary for using many functions of the DN211 from the T2/T2E/T2N. Try to understand well before writing programs. Chapter 5 explains a sample program that can read RAS information. Because the sample program is basic, you need to discuss it before applying to real systems.

6.1 Module Status / Network Status LED (MS/NS)

The 2-color light-emitting diode (LED) on the front panel of the DN211 (module status/network status LED) has two colors (green/red) to light, and blinking/not lit states, which distinctively indicates the module status (MS) and the network status (NS).

Table 6.1 Module Status / Network Status LED

LED	Indication state	Meaning of indication (major trouble)
MS	Not lit	• No power is supplied to the DN211. • Although the power is supplied to the DN211, it is not in run mode.
		While the 7-segment LED node address/error code is indicating the local station node address, the power is supplied.
	Green lighting	• The DN211 is normally operating.
	Green blinking	• The DN211 is reading switch settings.
	Red blinking	• The DN211 is encountering a recoverable trouble. → Switch setting abnormal (DIP switch / rotary switch), etc.
	Red lighting	• The DN211 is encountering an unrecoverable trouble (down state). Yoy may have to replace the module.
NS	Not lit	•No power is supplied to the DN211 (check MS). • Although the power is supplied to the DN211, it is not in run mode (check MS). • The DN211 is encountering an unrecoverable trouble (down state: check MS). • No network power is supplied to the DN211.
	Green lighting	• The DN211 is normally communicating with slave devices.
	Green blinking	• No communication is established between the DN211 and slave devices. • Not a single slave device is registered in the DN211.
	Red blinking	• The DN211 is unable to communicate with an abnormal slave device.
	Red lighting	• Communication halted due to busoff in the DN211. • Communication halted due to an overlapped node address.

6.2 Indications of the 7-Segment LED

The 7-segment LED (NA/ERROR) on the front panel of the DN211 is used for indicating a node address/error code.

When the DN211 is normally transmitting with slave devices, the local station node address (value set by the rotary switch on the side panel of the module) is displayed.

Moreover, if one of the following troubles occurs, the 7-segment LED indicates the state of the module or the network.

- When the DN211/network/slave device is encountering trouble
- When an error occurs with requests from the T2/T2E/T2N
- When the DN211 is downed

This LED is blinking the local station node address while creating a scan list at the step of setting slave device parameters.

Table 6.2 and Table 6.3 describe combinations in the 7-segment LED for module status / network status, and their meanings. The mark "⇔" in the tables indicates alternative display of indications on both sides.

Table 6.2.7 Combined Indications of the 7-segment LED and 2-Color LED
M: DN211 node address S: Slave device node address

7-segment LED	MS	NS	Description
Not lit	Not lit	Not lit	No power is supplied to the T2/T2E/T2N Initialization is underway after reset request.
M lighting	Not lit	Not lit	Indicates standby mode (Just after switching ON the power; after reset request)
M blinking	Not lit	Not lit	In the processing of setting slave device parameters
M lighting	Green lighting	Green lighting	Is engaging in normal transmission (both module and network have no trouble)
70 ⇔ M	Green lighting	Red lighting	The DN211 detected an duplicated node address with a slave device.
72 ⇔ S	Green lighting	Red blinking	1) When the response from a slave device ceased during normal transmission 2) When setting no polling mode to enabled state at operation mode setting though polling mode devices are found in the scan list 3) When setting no bit strobe mode to enabled state at operation mode setting though bit strobe mode devices are found in the scan list 4) When setting slave device parameters, reception data size or scan type is different from the actual one.
73 ⇔ S	Green lighting	Red blinking	When setting slave device parameters, the vendor ID, product type, or product code is different from the actual one.
75 ⇔ M	Green lighting	Red blinking	No slave device is found on the network when starting transmission (this indication only)
75 ⇔ M	Green lighting	Green blinking	1) When run mode is requested without setting the parameters of a slave device * This state can occur before the DN211 and a slave device start transmission. If this state lasts for 30 seconds or more, check the parameters of the slave device.

77 ⇔ S	Green lighting	Red blinking	Transmission size is different from the actual size when setting slave device parameters.

Table 6. 3 Combined Indications of the 7-Segment LED and 2-Color LED
M: DN211 node address S: Slave device node address

7-segment LED	MS	NS	Description
78 ⇔ S	Green lighting	Red blinking	When unable to start communicating with one or more slave devices in the scan list
79 ⇔ M	Green lighting	Red blinking	1) When the "START" bit was not set to "1" at run request (followed by the indication of 78 ⇔ S) 2) When response from all slaves ceased during normal transmission (followed by the indication of 72 ⇔ S) 3) No slave device is found in network when starting transmission (this display only)
84 ⇔ M	Green lighting	Green blinking	When the slave devices were not initialized
91 ⇔ M	Green lighting	Red lighting	When busoff occurred (communication halt was chosen when busoff occurred)
92 ⇔ M	Green lighting	Not lit	1) No network power is supplied to the 1DN211. 2) The network connector on the DN211 was disconnected.
A0 - CA	Irregular	Irregular	When requests to the T2/T2E/T2N are completed unsuccessfully, completion status (Table 4.17) is indicated on the 7-segment LED.
F0 ⇔ M	Red lighting	Not lit	Down mode: Watchdog timeout error
F1 ⇔ M	Red blinking	Not lit	Down mode: Memory bus trouble occurred
F2 ⇔ M	Red blinking	Not lit	Down mode: TRAP occurred
F3 ⇔ M	Red lighting	Not lit	Down mode: BCC check error occurred on ROM (at DN211 startup)
F4 ⇔ M	Red lighting	Not lit	Down mode: Read/write error occurred on RAM (at DN211 startup)
F5 ⇔ M	Red lighting	Not lit	Down mode: Read/write error occurred on the T2/T2E/T2N communication memory at DN211 startup
F6 ⇔ M	Red blinking	Not lit	Down mode: DN211 node address setting abnormal
F7 ⇔ M	Red blinking	Not lit	Down mode: DN211 network communication rate setting abnormal
F8 ⇔ M	Red blinking	Not lit	Down mode: EEPROM for scan list read error occurred

6.3 RAS Information Reading Data

This section describes the RAS information of the DN211 (RAS counter, event history, execution node information) read by the ladder program. See "4.6.6 RAS Information Read Request" for RAS information reading request.

6.3.1 The RAS Counter

When you specify "1" for request information type at RAS information read request, the RAS counter can be read on to the acknowledgement area. Individual items in the RAS counter of the DN211 have one byte data in size.

"H" or "L" in address column in Table 6.4 indicates the high-order byte or the low-order byte of the register area read.

H: F-8 bits side
L: 7-0 bits side

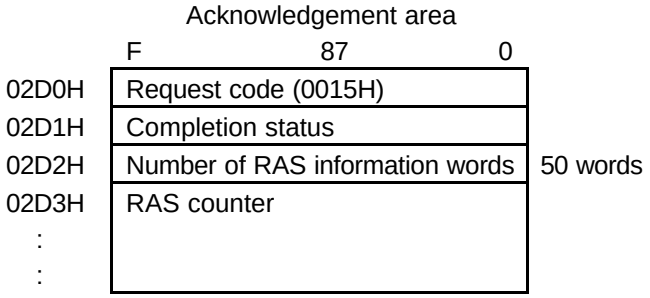


Table 6.4 List of RAS Counters (1)

Symbol name	Address		Description
RAS_CNT[0]	02D3H	L	Abnormal interrupt (intret)
RAS_CNT[1]	02D3H	H	Abnormal interrupt (trap)
RAS_CNT[2]	02D4H	L	Number of HOST interrupt times
RAS_CNT[3]	02D4H	H	Number of port request interrupt times
RAS_CNT[4]	02D5H	L	Number of reception response interrupt times
RAS_CNT[5]	02D5H	H	Reception response ID abnormal
RAS_CNT[6]	02D6H	L	Reception response request code invalid
RAS_CNT[7]	02D6H	H	Number of port request reception times
RAS_CNT[8]	02D7H	L	Number of times other than port request register ON
RAS_CNT[9]	02D7H	H	Number of port memory pool abnormal times
RAS_CNT[10]	02D8H	L	Status code of port memory pool abnormal
RAS_CNT[11]	02D8H	H	Number of reset request times
RAS_CNT[12]	02D9H	L	Reset response
RAS_CNT[13]	02D9H	H	Number of parameter request times
RAS_CNT[14]	02DAH	L	Number of parameter response times
RAS_CNT[15]	02DAH	H	Number of control request times
RAS_CNT[16]	02DBH	L	Number of control response times
RAS_CNT[17]	02DBH	H	Number of RAS read request times
RAS_CNT[18]	02DCH	L	Number of RAS read response
RAS_CNT[19]	02DCH	H	Number of time setting request times

Table 6.5 List of RAS Counters (2)

Symbol name	Address		Description
RAS_CNT[20]	02DDH	L	Number of time setting response times
RAS_CNT[21]	02DDH	H	Number of input data read request times
RAS_CNT[22]	02DEH	L	Number of input data read response times
RAS_CNT[23]	02DEH	H	Number of output data write request times (bit strobe)
RAS_CNT[24]	02DFH	L	Number of output data write response times (bit strobe)
RAS_CNT[25]	02DFH	H	Number of output data write request times (polling)
RAS_CNT[26]	02E0H	L	Number of output data write response times (polling)
RAS_CNT[27]	02E0H	H	Number of explicit message request times
RAS_CNT[28]	02E1H	L	Number of explicit message response times
RAS_CNT[29]	02E1H	H	Number of invalid request code reception times
RAS_CNT[30]	02E2H	L	Content of invalid request code reception
RAS_CNT[31]	02E2H	H	Number of normal response times
RAS_CNT[32]	02E3H	L	Number of abnormal response times
RAS_CNT[33]	02E3H	H	Transmission MBX memory pool abnormal (for data)
RAS_CNT[34]	02E4H	L	Transmission MBX memory pool abnormal (MBX)
RAS_CNT[35]	02E4H	H	MBX transmission abnormal
RAS_CNT[36]	02E5H	L	MBX reception abnormal
RAS_CNT[37]	02E5H	H	Reception data size 0 byte
RAS_CNT[38]	02E6H	L	Reception MBX release abnormal (for data)
RAS_CNT[39]	02E6H	H	MBX Reception normal
RAS_CNT[40]	02E7H	L	Down code
RAS_CNT[41]	02E7H	H	Down detail code
RAS_CNT[42]	02E8H	L	Number of confirm register 2-second waiting times
RAS_CNT[43]	02E8H	H	Number of indication register 2-second waiting times
RAS_CNT[44]	02E9H	L	EP-ROM SCAN list CRC error
RAS_CNT[45]	02E9H	H	Number of DBASE normal SCAN lists
RAS_CNT[46]	02EAH	L	Number of SCAN list settings (EP-ROM)
RAS_CNT[47]	02EAH	H	Bit strobe 20 ms response wait
RAS_CNT[48]	02EBH	L	Number of overrun times
RAS_CNT[49]	02EBH	H	Number of error active times
RAS_CNT[50]	02ECH	L	Number of error passives times
RAS_CNT[51]	02ECH	H	Number of busoff times
RAS_CNT[52]	02EDH	L	Number of transmission interrupt times
RAS_CNT[53]	02EDH	H	Number of reception data ID abnormal times
RAS_CNT[54]	02EEH	L	NMI error
RAS_CNT[55]	02EEH	H	DEVICE-NET request data timeout
RAS_CNT[56]	02EFH	L	I/O connection inactivity timeout
RAS_CNT[57]	02EFH	H	Explicit connection inactivity timeout
RAS_CNT[58]	02F0H	L	Vendor ID invalid
RAS_CNT[59]	02F0H	H	Project type invalid

Table 6.6 List of RAS Counters (3)

Symbol name	Address		Description
RAS_CNT[60]	02F1H	L	Project code invalid
RAS_CNT[61]	02F1H	H	Transmission maximum data length unmatched (polling)
RAS_CNT[62]	02F2H	L	Transmission maximum data length unmatched (COS)
RAS_CNT[63]	02F2H	H	Reception maximum data length unmatched (NO fragment)
RAS_CNT[64]	02F3H	L	Connection table fragment buffer acquisition failed
RAS_CNT[65]	02F3H	H	Fragment data type abnormal
RAS_CNT[66]	02F4H	L	Fragment data intermediate counter abnormal
RAS_CNT[67]	02F4H	H	Fragment data final counter abnormal
RAS_CNT[68]	02F5H	L	Reception maximum size over
RAS_CNT[69]	02F5H	H	Reception data length abnormal (fragment data)
RAS_CNT[70]	02F6H	L	Polling 20 ms response wait
RAS_CNT[71]	02F6H	H	NMI read port reading value
RAS_CNT[72]	02F7H	L	Number of CAN transmission times
RAS_CNT[73]	02F7H	H	CAN transmission disabled (content of status register)
RAS_CNT[74]	02F8H	L	
RAS_CNT[75]	02F8H	H	
RAS_CNT[76]	02F9H	L	
RAS_CNT[77]	02F9H	H	
RAS_CNT[78]	02FAH	L	
RAS_CNT[79]	02FAH	H	
RAS_CNT[80]	02FBH	L	
RAS_CNT[81]	02FBH	H	
RAS_CNT[82]	02FCH	L	
RAS_CNT[83]	02FCH	H	
RAS_CNT[84]	02FDH	L	
RAS_CNT[85]	02FDH	H	
RAS_CNT[86]	02FEH	L	
RAS_CNT[87]	02FEH	H	
RAS_CNT[88]	02FFH	L	
RAS_CNT[89]	02FFH	H	
RAS_CNT[90]	0300H	L	
RAS_CNT[91]	0300H	H	
RAS_CNT[92]	0301H	L	
RAS_CNT[93]	0301H	H	
RAS_CNT[94]	0302H	L	
RAS_CNT[95]	0302H	H	
RAS_CNT[96]	0303H	L	
RAS_CNT[97]	0303H	H	
RAS_CNT[98]	0304H	L	
RAS_CNT[99]	0304H	H	

6.3.2 Event History

When you specify "2" for RAS information read request at request information type, event history data can be read into the acknowledgement area.

	Acknowledgement area	
02D0H	Request code (0015H)	
02D1H	Completion status	
02D2H	Number of RAS information words	n pieces × 8 words
02D3H	Event history	(max. 80 words)
:		
:		

➢Event history composition

- Record capacity: 8 word
- Number of records: 160 pieces
- Operation when overflowed: Old information is updated. Thus, 160 of event traces can be checked from new information.
- Format: Binary code is used because the format is for the DN211 internal information. See Table 6.7 and Table 6.8 for the contents of the binary codes. Note, however, the BCD time is displayed.

	F	0	
02D3H	Event code		1st event history
02D4H	Detailed information 1		
02D5H	Detailed information 2		
02D6H	Detailed information 3		
02D7H	Detailed information 4		
02D8H	Month	Year	
02D9H	Hour	Day	
02DAH	Second	Minute	
02DBH	Event code		2nd event history
02DCH	Detailed information 1		
02DDH	Detailed information 2		
02DEH	Detailed information 3		
02DFH	Detailed information 4		
02E0H	Month	Year	
02E1H	Hour	Day	
02E2H	Second	Minute	

Figure 6.1 Event History Composition (when reading 2 events)

Table 6.7 Event Trace Items (1)

Event Code	Detailed Information 1 (H)	Detailed Information 2 (H)	Detailed Information 3 (H)	Detailed Information 4 (H)	Description
0001H	Down code	1: Memory check 2: TRAP 3: WDT	 Content of read port Content of WDT_FLG		When module downed
0002H	Startup type 01: Power 02: Soft reset 03: T2/E/N HALT	 Station status Station Status	 Write port Write port	 Read port	DN startup Reset accept abnormal T2/E/N HALT
0003H	Before mode change	After mode change			Station mode change
0004H	Request mode	Reception request code	Comparison ID	Reception ID	Reception instruction response
0005H	1 2	EP_ROM composition data EP_ROM_CRC	Number of DBASE settings Calculation CRC		Creating a scan list
0050H	Request code	Completion status			Loader processing
0100H	Request ID	Request code	Completion status		Control port
0111H	Station status	Contents of write port			Reset request
0112H	Type 00: Local station setting	 01: Port No error 02: Node address unmatched 03: Polling mode 04: Scan time 05: Skipped 06: Transmission counter			Parameter request
	01: Slave setting	01: Number of pieces abnormal 02: Port No error 03: Node address abnormal 04: Specifying as the local station node address 05: Data length abnormal			
0113H	Type 01: Unassigned BITON 02: Identical request 03: Permission bit ON (invalid in STBY) 04: STBY + RUN 05: RUN among RUNs 06: Task activation abnormal 07: STBY among STBY 08: Composition data end	Request node Parameter setting flag	Present station status Completion status		Control request
0118H	Request code (18H)	Completion status			Time setting
0200H	Request ID	Request code	Completion status		
0241H	Request device ID	Scan type			Data read
0242H	Type 01: Size abnormal	 Request device	 Scan type	 Data size	Data write

	02: Scan type	Request device	Scan type		

Table 6.8 Event Trace Items (2)

Event Code	Detailed Information 1 (H)	Detailed Information 2 (H)	Detailed Information 3 (H)	Detailed Information 4 (H)	Description
0300H	MBX-ID	Event ID	Server node address	Client node address	MBX transmission abnormal
0401H	Node address	Reception vendor ID			Reception vendor ID abnormal
0402H	Node address	Reception project			Project type
0403H	Node address	Reception project			Project code
0404H	Node address	Reception data length			Data length abnormal
0405H	Node address	Data length			Reception data length abnormal
0406H	Error code	Node address	Reception node address		Duplicated node address reception
0407H	Error code				Duplicated node address abnormal
0408H	Node address				Strobe deletion
0409H	Node address				Polling deletion
FFFFH	Pre-station status	Station status	Error code	Detailed code	System down

6.3.3 Execution Node Information

When you specify "3" for request information type at RAS information read request, the execution information of the slave devices (module status, 7-segment LED status) can be read into the acknowledgement area.

	Acknowledgement area	
02D0H	Request code (0015H)	
02D1H	Completion status	
02D2H	Number of RAS information words	64 words
02D3H	Execution node information	
:		
0312H		

(1) Module Status (02D3H - 02F2H: 32 words)

02D3H-02F2H in the acknowledgement area are used for module status.

Module status indicates the operations in code that the DN211 is executing with slave devices and the network. "NA = " in Table 6.9 shows a node address.

Table 6.9 Module Status

	F 8	7 0		F 8	7 0
02D3H	NA = 1	NA = 0	02E3H	NA = 33	NA = 32
02D4H	NA = 3	NA = 2	02E4H	NA = 35	NA = 34
02D5H	NA = 5	NA = 4	02E5H	NA = 37	NA = 36
02D6H	NA = 7	NA = 6	02E6H	NA = 39	NA = 38
02D7H	NA = 9	NA = 8	02E7H	NA = 41	NA = 40
02D8H	NA = 11	NA = 10	02E8H	NA = 43	NA = 42
02D9H	NA = 13	NA = 12	02E9H	NA = 45	NA = 44
02DAH	NA = 15	NA = 14	02EAH	NA = 47	NA = 46
02DBH	NA = 17	NA = 16	02EBH	NA = 49	NA = 48
02DCH	NA = 19	NA = 18	02ECH	NA = 51	NA = 50
02DDH	NA = 21	NA = 20	02EDH	NA = 53	NA = 52
02DEH	NA = 23	NA = 22	02EEH	NA = 55	NA = 54
02DFH	NA = 25	NA = 24	02EFH	NA = 57	NA = 56
02E0H	NA = 27	NA = 26	02F0H	NA = 59	NA = 58
02E1H	NA = 29	NA = 28	02F1H	NA = 61	NA = 60
02E2H	NA = 31	NA = 30	02F2H	NA = 63	NA = 62

Table 6.10 Module Status Code

Module status code	Description
0 (00H)	Normal status
1 (01H)	Not set to transmittable status enabled
2 (02H)	No data flows onto the transmission path
3 (03H)	Communication error occurred.
4 (04H)	The scan list differs from the actual slave composition.
5 (05H)	The network is encountering trouble.
6 (06H)	Abnormal network power is detected.
9 (09H)	Busoff is detected.
10 (0AH)	An Duplicated node address is detected.

(2) 7-Segment LED Status (02F3H - 0312H: 32 words)

02F3H-0312H in the acknowledgement area are used for the 7-segment LED status. The 7-segment LED status shows the DN211 status, network status, and status of the slave devices the DN211 manages. It corresponds with the error code indication on the front panel of the of DN211 (some of the statuses are not displayed on Table 6. 2 and Table 6.3). "NA = □ " in Table 6.11 shows a node address.

Table 6.11 7-Segment LED Status

	F 8	7 0		F 8	7 0
02F3H	NA = 1	NA = 0	0303H	NA = 33	NA = 32
02F4H	NA = 3	NA = 2	0304H	NA = 35	NA = 34
02F5H	NA = 5	NA = 4	0305H	NA = 37	NA = 36
02F6H	NA = 7	NA = 6	0306H	NA = 39	NA = 38
02F7H	NA = 9	NA = 8	0307H	NA = 41	NA = 40
02F8H	NA = 11	NA = 10	0308H	NA = 43	NA = 42
02F9H	NA = 13	NA = 12	0309H	NA = 45	NA = 44
02FAH	NA = 15	NA = 14	030AH	NA = 47	NA = 46
02FBH	NA = 17	NA = 16	030BH	NA = 49	NA = 48
02FCH	NA = 19	NA = 18	030CH	NA = 51	NA = 50
02FDH	NA = 21	NA = 20	030DH	NA = 53	NA = 52
02FEH	NA = 23	NA = 22	030EH	NA = 55	NA = 54
02FFH	NA = 25	NA = 24	030FH	NA = 57	NA = 56
0300H	NA = 27	NA = 26	0310H	NA = 59	NA = 58
0301H	NA = 29	NA = 28	0311H	NA = 61	NA = 60
0302H	NA = 31	NA = 30	0312H	NA = 63	NA = 62

Table 6.12 7-Segment LED Status Code

Module status code	Description
70 (46H)	DN211 is encountering trouble at duplicated node address checking.
72 (48H)	DN211 cannot communicate with slave devices.
73 (49H)	The vendor ID, product type, or product code of a slave device differ from those in the scan list of the DN211.
75 (4BH)	No slave device is found on the network. No slave device is registered in the scan list.
76 (4CH)	DN211 has detected communication timeout since no response from slave devices.
77 (4DH)	When the transmission size of a slave device differs from the size in the scan list of DN211.
78 (4EH)	DN211 cannot start transmission with slave devices.
79 (4FH)	DN211 cannot send to slave devices.
80 (50H)	DN211's communication port is set to IDLE mode.
81 (51H)	DN211's communication port is set to FAULT mode.
82 (52H)	An error occurred due to fragmented transmission/reception data.
83 (53H)	Slave device initialization was refused.
84 (54H)	Slave device initialization is not completed.
85 (55H)	DN211 reception buffer has an overflow.
91 (5BH)	Busoff has occurred at DN211.
92 (5CH)	Network power of DN211 has trouble.

7. Troubleshooting

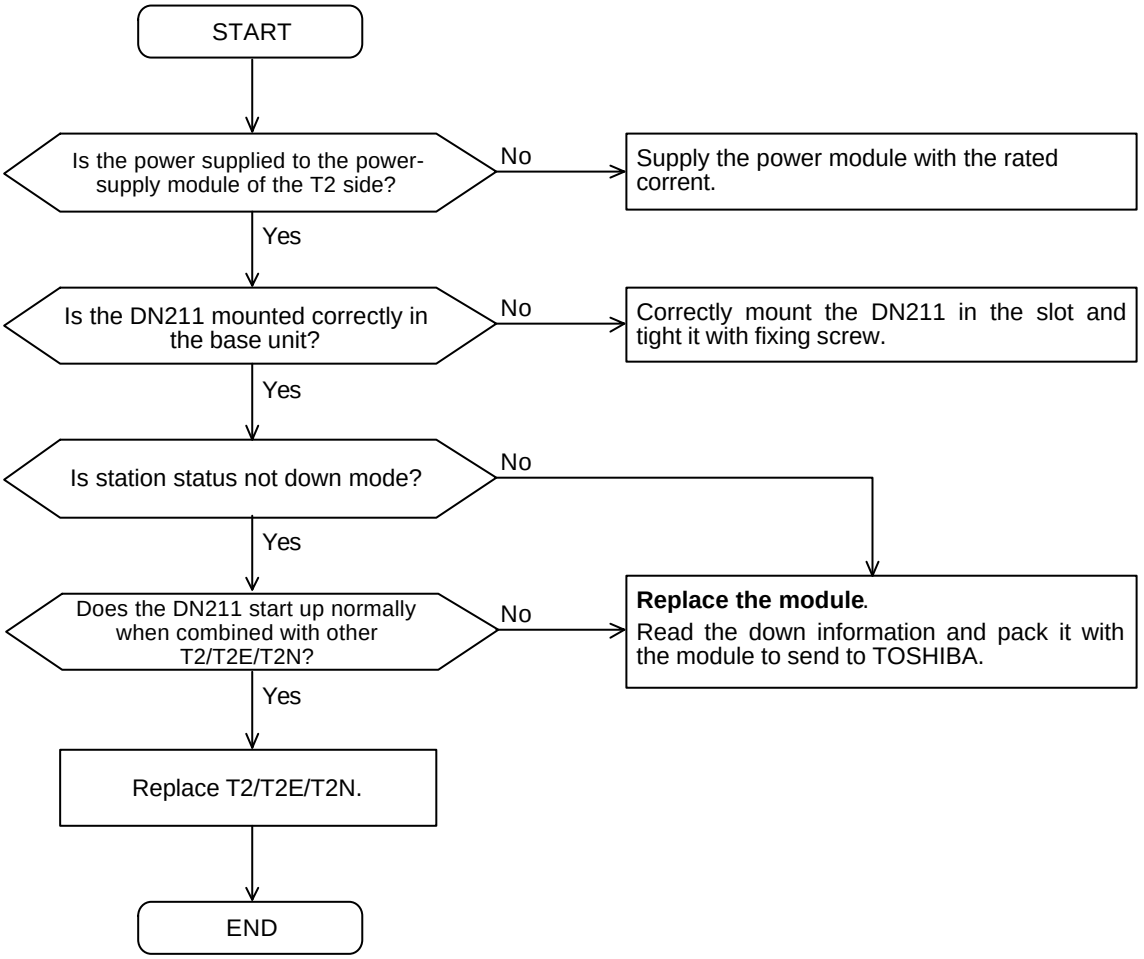
This chapter discusses how to find the cause of the trouble and countermeasures during the DN211 operation. Also refer to the T2/T2E/T2N Main Unit User's Manual when encountering trouble.

7.1 When Starting up the Module

(1) If the module does not start up normally (becoming no standby status)

When the module is normal, the DN211 starts module initialization when the power is turned ON or reset is requested, and then becomes standby status.

Standby status: MS, NS: Not lit 7-Segment LED: Node address is lighting.

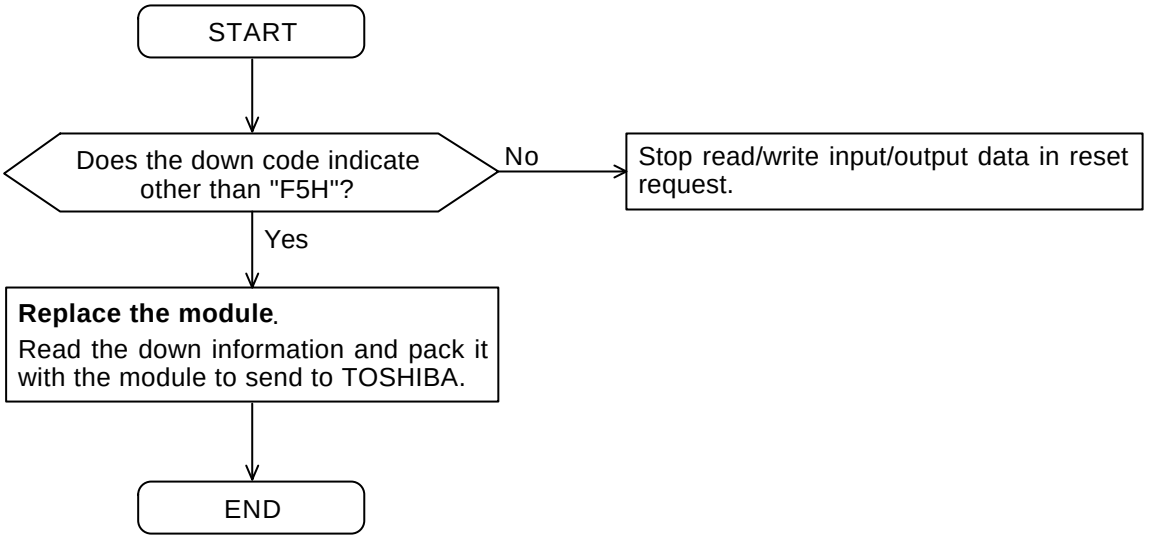


(2) When Encountering Down Mode While Communicating with Slave Devices

Countermeasure	**Replace the modules**. Record the down information before replacing the module (as noted on the module front). Send the downed module and down information to TOSHIBA.

7.2 Reset Request (scan list clear)

(1) The module Becomes Down Mode After Issuing a Reset Request



(2) The Module Doesn't Return to Standby Mode When Requesting Reset with Scan List Clear

When scan list clear is specified and when the scan list is unassigned, the reset request takes about 9 seconds. When it takes a longer time, reset the power.

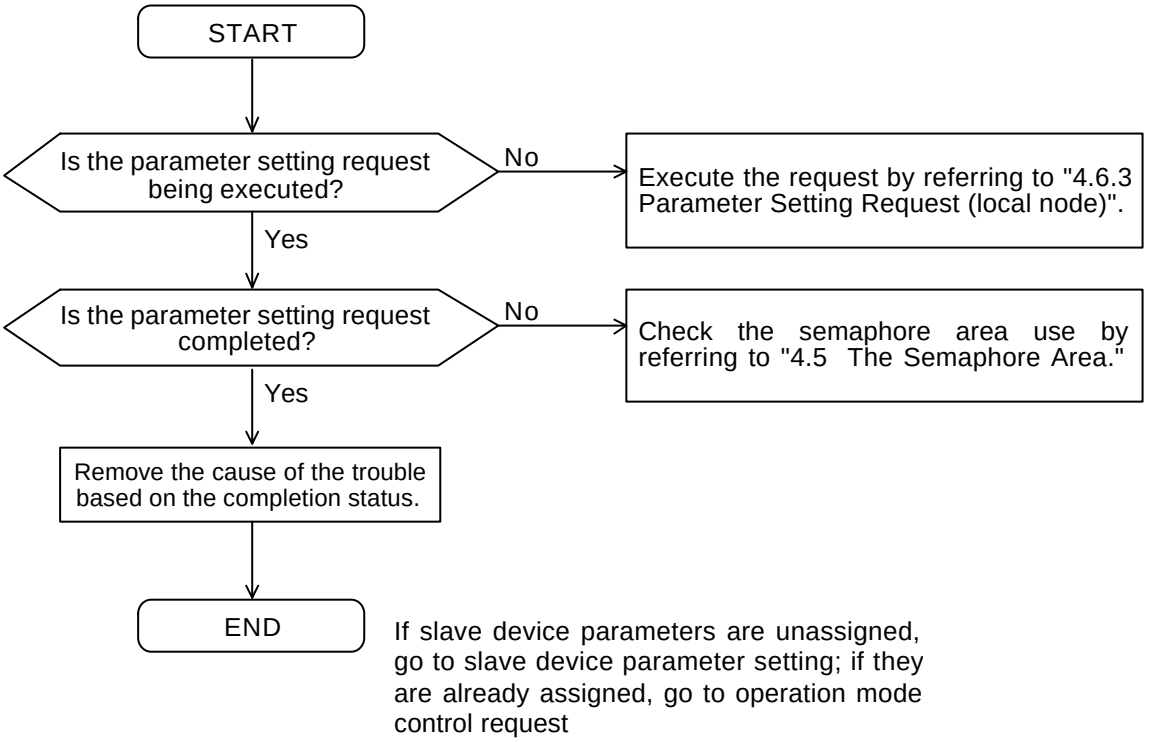
If it takes 9 seconds or more after resetting the power, **replace the module**.

7.3 When the Module Doesn't Become Run Mode

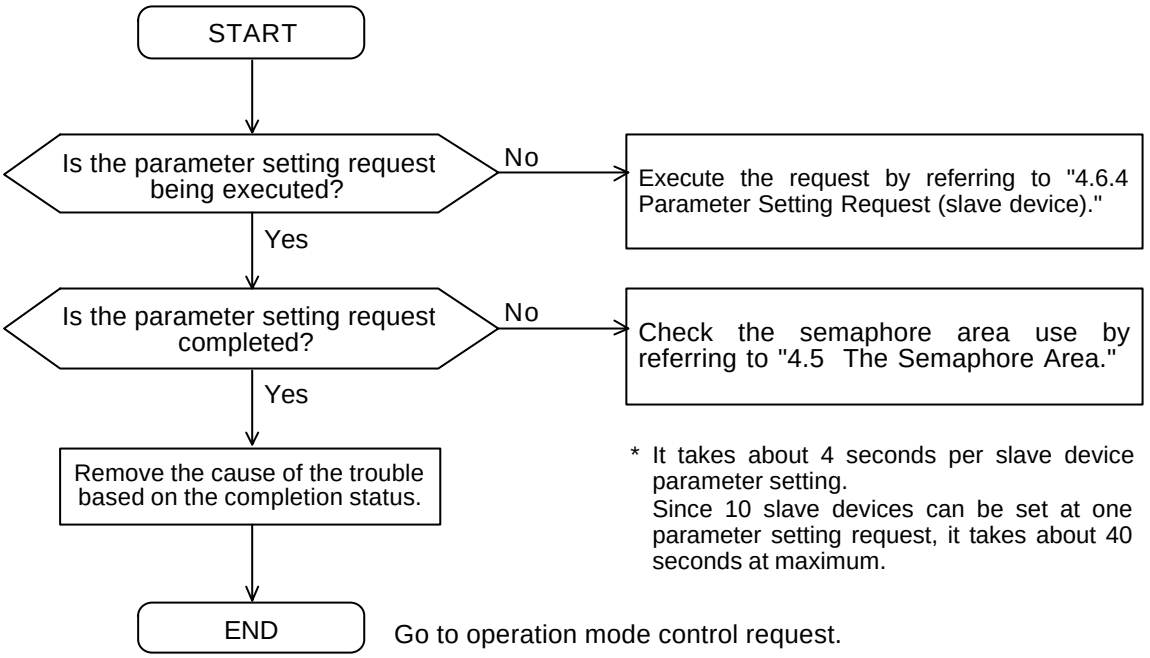
This section describes on the assumption that the module has started up normally.

Set the parameters of the local station at parameter setting request before issuing an operation mode control request when you are changing to run mode from standby mode after having started up the module. Also, clear the scan list before setting slave device parameters at parameter setting request when the configuration of the slave devices is changed.

(1) Local Node Parameter Setting Request



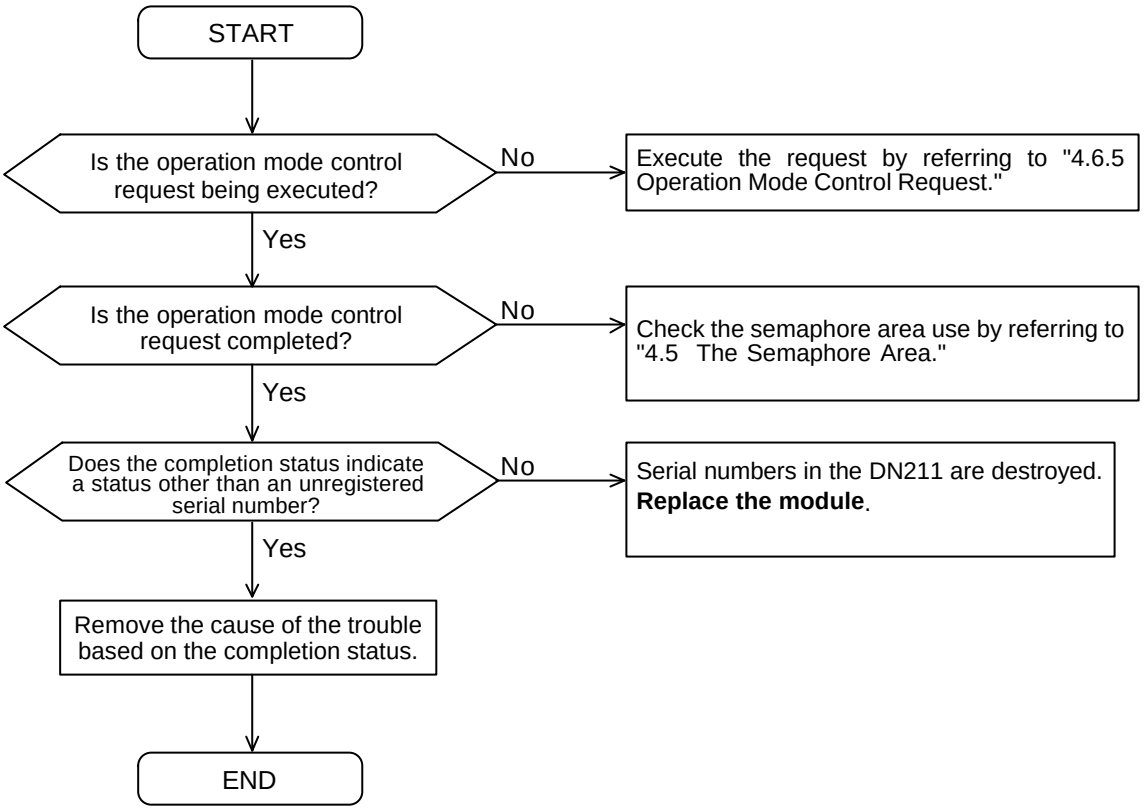
(2) Slave Device Parameter Setting Request



* It takes about 4 seconds per slave device parameter setting.
Since 10 slave devices can be set at one parameter setting request, it takes about 40 seconds at maximum.

Go to operation mode control request.

(3) Operation Mode Control Request



7.4 Data Communication with Slave Devices

(1) Data Communications with Slave Devices Don't Start

When the 7-segment LED indicates an error, try to remove the cause of the trouble by referring to "6.2 Indications of the 7-Segment LED."

	Checking objects
DN211	Check the T2/T2E/T2N side power-supplies.
	Check the connection of the network cables (mis-wiring, disconnection). Refer to "3.4 Connection with the Network."
	Check the node address setting (for node address duplicated). Refer to "3.2.2 Rotary Switch for Node Address Setting."
	Check the setting of the network communication rate (for the same communication rate). Refer to "3.2.1 DIP Switch for Setting Operation Mode / Communication Rate."
	Check the local node parameter setting and the scan list. Refer to "4.6.3 Parameter Setting Request (local node)" and "4.6.4 Parameter Setting Request (slave device)".
	Check the slave devices for normal operation by referring to the slave device description.
Slave device	Check the slave device main unit for the power.
	Check the connection of the network cables (mis-wiring, disconnection).
	Check the node address settings (for node address overlapped).
	Check the network communication rates (for the same communication rate).
	Check setting items specific to individual slave devices.
	Check the terminal resistor on both ends of the trunk cable (121Ω).
Network	Check the maximum network length specified. Refer to "1.2.2 Trunk Line/Drop Line and Maximum Cable Length."
	Check the drops cable length (less than 6 m).
	Check the total extension of drops cables. Refer to "1.2.2 Trunk Line/Drop Line and Maximum Cable Length."
	Check the network power mechanism and the power capacity. Refer to "3.5.1 The Network Power Mechanism" and "3.5.3 The Network Power Unit (24vdc)."
	Check the grounding of the network cables. Refer to "3.5.4 The Network Grounding."

(2) Communication with Slave Devices Aborted

When the 7-segment LED indicates an abnormal code, remove the cause of the trouble by referring to "6.2 Indications of the 7-Ssegment LED."

	Checking objects
DN211	Check the T2/T2E/T2N side power-supplies.
	Check the connection of the network cables (mis-wiring, disconnection). Refer to "3.4 Connection with the Network."
	Check the node address setting (for node address duplicated). Refer to "3.2.2 Rotary Switch for Node Address Setting."
	Check the setting of the network communication rate (for the same communication rate). Refer to "3.2.1 DIP Switch for Setting Operation Mode / Communication Rate."
	Check the local node parameter setting and the scan list. Refer to "4.6.3 Parameter Setting Request (local node)" and "4.6.4 Parameter Setting Request (slave device)".
Slave device	Check the slave devices for normal operation by referring to the slave device description.
	Check the slave device main unit for the power.
	Check the connection of the network cables (mis-wiring, disconnection).
	Check the node address settings (for node address overlapped).
	Check the network communication rates (for the same communication rate).
	Check setting items specific to individual slave devices.
Network	Check the terminal resistor on both ends of the trunk cable (121Ω).
	Check the maximum network length specified. Refer to "1.2.2 Trunk Line/Drop Line and Maximum Cable Length."
	Check the drops cable length (less than 6 m).
	Check the total extension of drops cables. Refer to "1.2.2 Trunk Line/Drop Line and Maximum Cable Length."
	Check the network power mechanism and the power capacity. Refer to "3.5.1 The Network Power Mechanism" and "3.5.3 The Network Power Unit (24vdc)."
	Check the grounding of the network cables. Refer to "3.5.4 The Network Grounding."

(3) Overrun Errors Occur

An overrun error occurs when data slave devices transmitted cannot be received by the DN211 (the number of overrun error times is stored at 02C5H in the RAS information area).

How to Solve Overrun Error:

1) **Lower the network communication rate when overrun errors occur.**
(500 kbps → 250 kbps → 125 kbps)

2) **Set the polling transmission mode to "1" at local station parameter setting request when the polling slaves and bit strobe slave devices have been intermingled.**
(waiting for polling response after polling request by a slave device is issued)

8. Installation/Wiring Work

8.1 Installation Environment and Mounting in the Base Unit

Use your DN211 in the installation environment specified in the "Installation Environment" of "T2 User's Manual","T2E User's Manual", and/or"T2N User's Manual." Also, follow the instructions specified in "Installation Environment" when you are installing the control board containing your DN211.

Read the instructions relating to the base unit mounting specified in the "T2 User's Manual/T2E User's Manual/T2N User's Manual" before you mount the base unit.

⚠ CAUTION

1. Apply the environment specified in the User's Manual of the T2/T2E/T2N.

   When using your DN211 in the environment other than specified, the DN211 can cause electric shock, fire, failure, and/or malfunction.

2. Mount your DN211 in the way specified in the User's Manual of the T2/T2E/T2N.

   If mounted in the direction other than specified or if mounted incorrectly, the DN211 could fall off, or cause fire, failure, and/or malfunction.

8.2 Mounting/Removing the Module

Follow the instructions specified in "Mounting the Module" of the "T2 User's Manual", "T2E User's Manual", and "T2N User's Manual" when you are mounting/removing the module.

⚠ CAUTION

1. Since the DN211 is designed for the T2 series, be sure to attach it to the base unit. Don't use your DN211 in stand-alone state or to other applications.

   Failing to do so could cause electric shock, injury, and/or failure.

2. Be sure to turn OFF the power before mounting, removing, wiring, or un-wiring the DN211. Failing to do so can cause electric shock, malfunction, and/or failure.

3. Keep your DN211 free from foreign matter such as electric-wire waste. Failing to do so could cause fire, failure, and/or malfunction.

4. Check the connectors and cables and the DN211 mount in the base unit, for their firm connection and mount using stoppers/screws. Loose connection and mounting becomes shaky and easily disconnected, resulting in failure or malfunction.

8.3 Power Unit Wiring/Grounding

8.3.1 Power Unit Wiring

(1) T2/T2E/T2N Side Power Unit Wiring

Follow the instructions in "Power Unit Wiring" of the "T2 User's Manual/T2E/T2N" when wiring them.

(2) Network Power Unit Wiring

Refer to "3.5 Network Power/Grounding" in this instruction manual.

8.3.2 Grounding

(1) T2/T2E/T2N Side Ground Wiring

Follow the instructions in "Grounding" and "Installation Method" in "T2 User's Manual/T2E /T2N" when wiring

(2) Ground Wiring of the Network Power Unit

Refer to "3.5 Network Power Unit/Grounding" in this manual.

⚠ CAUTION

1. Be sure to turn OFF the power before wiring cables. Failing to do so could cause electric shock.
2. Use crimp-on connectors with sheath or cover the conducting part with tape when wiring your T2/T2E/T2N power module. Also, handle the terminal block cover correctly to avoid fall-off and damage when fixing. Be sure to fix the cover on the terminal block when completing the wiring. If the conducting part is exposed, you can have electric shock.
3. Be sure to have grounding. When not grounded, electric shock and/or malfunction can occur.
4. Make sure the wiring is correct when connecting the DeviceNet cables to the network side connector. The short circuit of the network power, etc. can fail communication with other nodes.
5. When you are going to detach or connect the network side connector to/from the device side connector on the DN211 front panel, don't engage yourself while the T2/T2E/T2N side power is rising. Failing to do so can cause the DN211 to fail or malfunction.
6. Attaching the opposite end of the network side connector with/from the device side connector is not possible because of the specific form. Trying connecting the wrong end by excessive force can damage both the network side connector and the device side connector.
7. Ask a qualified person to wire cables. Incorrect wiring can cause fire, failure, and/or electric shock.

8.4 Network Installation

Refer to "3.6 The Network Components" for the network components.

This section describes the installation gists both for outside and inside the control board.

⚠ CAUTION
1. Ask the qualified subcontractor for sufficient safety and noise-suppression measures when installing the DeviceNet cable. Refer to DeviceNet Volume I, Release 1.3, for the standard installation. 2. It is recommended to consign a subcontractor specialized in safety measures and standards. 3. Avoid the network components for the DeviceNet cable from installing into a noisy environment. When installing, be sure to furnish noise-suppression measures as described in the following section.

8.4.1 Installation Gists Outside the Control Board

(1) Installation Environment and Application Construction:

Performs the cable installation work as shown in the following table, depending on the environment.

Table 8.1 Installation Environment and Application Construction

Environment for cable installation		Work description
Large classification	**Small classification**	
Site that cables get damaged		Installation work except piping /Piping work
Site that cables get damaged	Place where people and things move	Piping work
	Place subject to humidity, chemicals, oil, heat, etc.	Metal piping work
	Place where cables are subject to damage by rats and other animals	Piping work
	Place subject to strong mechanical shock or pressure by heavy stuff	Metal piping work
Place subject to possible electromagnetic interference		Cable separation and protection work Metal piping work

Either metal pipes or hard vinyl pipes are good for "piping work."

(2) Installation Work Without Piping

① Install a floor duct to protect cables or use wire protector cable covers.Don't intermingle these cables with high-voltage current cables when installing them.

② Wire cables along the wall to avoid cable damage, or under the floor where an electromagnetic interference device is not installed.

③ Keep the standard separation distance for the cables when they are going to be wired in parallel, or wired close, or crossed with low-voltage cables for the building.

④ Fix the cable on the wall in every 3-meter distance to protect them when you wire them on the wall or when you wire them vertically.

⑤ Don't bend cables in circle of a radius smaller than the minimum bending radius.

(3) Cautions in Piping Work

① Don't mix these cable with high-voltage current cables in the same piping.

② Keep the bending angle of piping within 90 degrees.

③ Keep the bending radius of piping 6 times or larger than the inner radius of piping; keep the bending radius of piping larger than the minimum bending radius of the cables in the pipe.

④ Ground metal pipes.

(4) Separation from Other Wiring

Keep the network cables 2 meters away from electric power lines and from those devices which generate magnetic fields and electric fields. When you are wiring cables at a distance smaller than 2 meters, refer to the following table to find a minimum permissible distance based on the actual voltage and current of the induction source.

Note, however, that the induction source must be kept at 440 V and 100 A or less to protect weak signals.

Table 8.2 Minimum Distance of Separation Recommended

Induction source voltage and current	Minimum distance of parallel lines (mm)			
	Over 100 A	100 A or less	50 A or less	10 A or less
Over 440 V	2000	2000	2000	2000
440 V or less	2000	600	600	600
220 V or less	2000	600	600	500
110 V or less	2000	600	500	300
60 V or less	2000	500	300	150

It is recommended to use a metal cable duct with lid or a protective pipe made from steel in consideration of noise-proof nature. The following table shows electric power lines in parallel wiring and a recommended minimum distance table.

Table 8.3 Recommended Minimum Distance (metal duct with lid, and metal piping work) in mm

Cable Installation		Duct with lid or protective steel piping					
Parallel distance		10 m or less	25 m or less	100 m or less	200 m or less	500 m or less	501 m or more
Electric power cable	125 V and 10A, or less	10	10	50	100	200	250
	250 V and 50A, or less	10	50	150	200	250	250
	400 V and 100A, or less	50	100	200	250	250	250
	500 V and 200A, or less	100	200	250	250	250	250
	Exceding the above	500 or more					

<Microcomputer–Applied Measuring Instrument Installation Guideline>
By Japan Electrical Measurement Equipment Industry Association

Place a separator (steel) in the cable duct as shown below to separate from electric power lines.

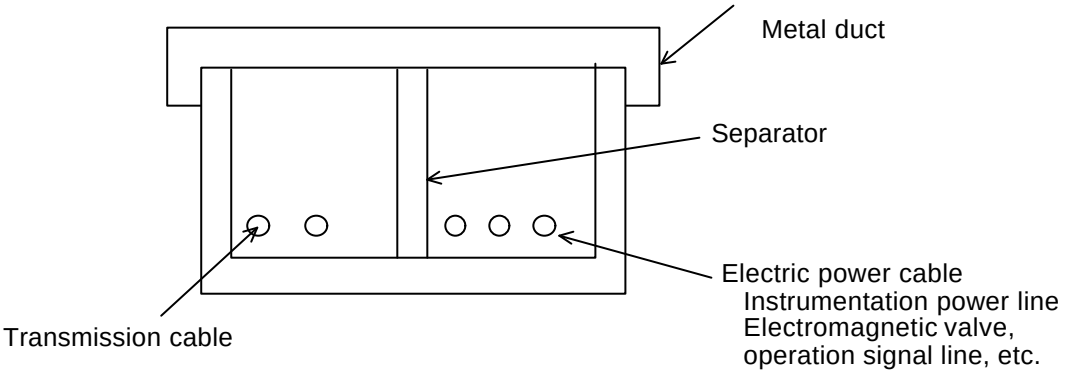


Figure 8.1 Example of Installation in the Duct

Use a separator to install cables in the pit as in the duct.

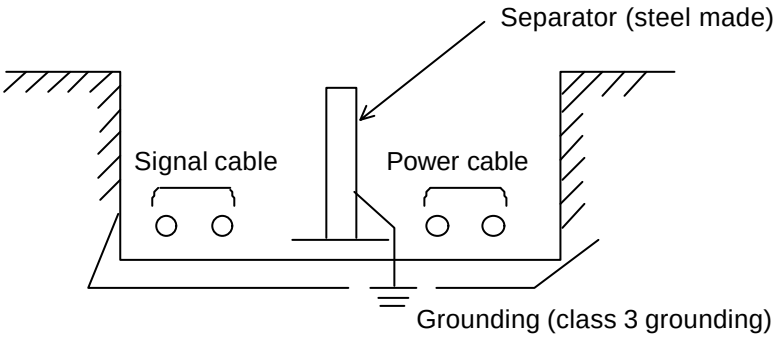


Figure 8.2 Example of Installation in the Pit

(5) Installation Routes

The following route order is recommended to install transmission cables.

① Using the leased route

② Using the computer system leased route

③ Using the general instrumentation route

④ Using the leased route for plant control

8.4.2 Installation Gists Inside the Control Board

Abide by the following points when installing the DeviceNet cable in the Control board.

1) Wiring route

   Use the weak signal route in the Control board when wiring DeviceNet cables.

   In particular, keep these cables 50 cm away from the power cable.

2) Fixing the Cables

   Use clamps to bear the weight of the cable so that the connector doesn't bear it.

   Don't bend the cable in circle smaller the minimum bending radius.

3) Ask the manufacturer for the bending radius of the cable and other physical characteristic values.

4) Don't install cables at a place that has a high temperature, humid environment, dust, or oil mist.

Appendix 1 Maintenance and Inspection

<Periodical Inspection>

Perform periodical inspection (once for every six months or so). Also perform inspection when the surroundings or environment is changed.

Table 1 Periodical Inspection Items

Check item	Check content	Judgment standard	Measure when abnormal
Power, etc. (T2 side power/network power)	Measure the voltage on power terminal.	Must be within the limits specified.	Keep the input voltage within the limits specified.
	Is a power terminal screw loose?	Not loose.	Turn OFF the power to tighten the loose screw.
	Is a wired cable damaged?	Not damaged	Turn OFF the power to wire the cable again.
Attachment state	Is the module fixed firmly?	Not loose, not saccadic	Tighten the screwdriver.
Connecting network cables	Is the network cable fixed with the network side connector?	No loose cable fixing screw	Loose the cable fixing screws and tighten them again.
	Is the connection cable is nearly broken?	No abnormal appearance	Strip the cable coating and connect the cable core with the connector.
	Is the network side connector completely inserted into the module side?	No loose module side connector	Firmly insert the network side connector into the module side before tightening the fixing screws.
Wiring transmission cables (see "8.4 Network Installation")	Is the trunk/drops cable not damaged?	No damage.	Stop the system; turn OFF the power; wire the cables again.
	Is a cable not wired near the power cable, etc.?	No power line near the cable	Keep the cable distance from the power cable. Cover the cable with shield.
Surrondings	Check whether the temperature, humidity, vibration, dust, etc. are within the specification.	Within general specification.	Improve them into permissible range specified.

⚠ CAUTION

1. Be sure to turn OFF the power mounting or removing the module, terminal block, and cable. Failing to do so can cause electric shock, malfunction, and/or failure.
2. Carry out daily check, periodical check, and cleaning to keep the system in normal condition.
3. If your DN211 does not operate normally, refer to "7. Troubleshooting" to identify the cause of the trouble.

   Contact a Toshiba's branch office (or dealer) or service agency for returning your DN211 for repair when failed. Operation and safety of your DN211 can be guaranteed only when repaired by Toshiba or a Toshiba's authorized service agency.
4. Neither try to disassemble nor modify the hardware of the module. Similarly, don't modify the software by any means. Failing to do so could cause fire, electric shock, and/or injury due to failure or malfunctioning.
5. Make sure you are safe when measuring the voltage on the connector of the module.

   Failing to do so could cause electric shock.
6. Stop the network and turn OFF the T2/T2E/T2N side power before replacing the module.

   Failing to do so could cause electric shock, malfunction, and/or failure.
7. Don't use your DN211 in abnormal condition such as smoking or nasty smelling.

   Failing to do so could cause fire, electric shock, and/or failure.

   If such an abnormal condition happens, turn OFF all the power supplies immediately and contact a Toshiba branch office (or dealer) or authorized service agency.

   Since it is very dangerous, don't engage yourself in modifying or repairing your DN211 by any means.

Appendix 2 READ/WRITE Instruction Execution Time

The READ and WRITE instructions have different execution times, depending on the T2/T2E/T2N.

1) For the T2 (basic/extension base unit)

- READ instruction

  Instruction execution time (μs) = 720 (μs) + 9.0 (μs/word) × N (word)

- WRITE instruction

  Instruction execution time (μs) = 721 (μs) + 15.0 (μs/word) × N (word)

2) For the T2E/T2N (basic/extension base unit)

- READ instruction

  Instruction execution time (μs) = 430 (μs) + 5.6 (μs/word) × N (word)

- WRITE instruction

  Instruction execution time (μs) = 127 (μs) + 10.6 (μs/word) × N (word)

Appendix 3 DN211A

In DN211A, the function enhancing old model DN211 and the problem are corrected.

A. Feature of DN211A

A-1 DN211A has passed ODVA conformance test

A-2 Compatibility with old model DN211

(a) DeviceNet communication function

It has not changed with old model DN211 (polling instruction / response mode and bit strobe instruction / response mode are supported).

(b) The communication memory map between T2E/T2N and DN211A

It has not changed with old model DN211.

(c) Station status

A bit 0 displays network power supply normal / abnormal in DN211A. (In old model DN211, it was a "reservation bit")

ON : Network power abnormal

OFF: Network power normal

(d) Parameter setting request (slave device)

In specifing scan type of slave device, "the mix of polling and bit strobe" was available at old model DN211, but this specification is stopped using in DN211A.

This is because the slave which uses the mix of polling and a bit strobe does not exist.

(e) Operation mode control request

Although the bit 4 was "transmission start / stop bit" in old model DN211, this bit does not influence operation of DN211A even if it is operated .

In DN211A, if it becomes the run mode and it will become the "transmission start", if it becomes the standby mode and it will become "transmission stop."

However, In DN211A, ON/OFF of bit 4 is reflected in the bit 4 of station status for compatibility with the radder program of old model DN211.

(f) 7 segment LED display

Situation	Old model DN211	DN211A
The slave which does not exist on a network was registered into the master, and transmission was started.	“72” and the node address of the slave which does not exist are displayed by turns.	“78” and the node address of the slave which does not exist are displayed by turns.
The response of a slave were lost during normal transmission between master and slave.	“72” and the node address of the slave which does not exist are displayed by turns.	“78” and the node address of the slave which does not exist are displayed by turns.
The receiving size of the slave registered into the master differed from the receiving size of an actual slave.	"72" and the node address of the slave from which reception size is different are displayed by turns.	"77" and the node address of the slave from which reception size is different are displayed by turns.
The scan type of the slave registered into the master differed from the scan type of an actual slave.	“72” and the node address of the slave from which scan type is different are displayed by turns.	“83” and the node address of the slave from which scan type is different are displayed by turns.

B. "Local node parameter" is written in DN211A.

Using old model DN211, the user must set the local node parameter in DN211 by the ladder program at each time of control power supply turning on (or module reset).

DN211A memorizes the local node parameter to the nonvolatile memory in oneself (as well as the slave device parameter).

For this reason, if the local node parameter and the slave device parameter are set once as DN211A, a user can make DN211A the run mode after a control power supply turning on (or module reset) using the operation mode control request.

C. DN211A corresponds to DeviceNet Wizard for TOSHIBA.

C-1 Registration of local node parameter and slave device parameter

The user needed to carry out the local node parameter setup and the slave device parameter registration to old model DN211 by the ladder program.

DN211A can use DeviceNet Wizard for TOSHIBA (option), the user can register a self-node parameter and a slave device parameter into DN211A using DeviceNet Wizard for TOSHIBA.

The local node parameter registration and slave device parameter registration which used the ladder program of course are also possible in DN211A.

C-2 Allocating slave device data to the input/output data area in DN211A

In old model DN211, the slave device data is allocated from the head of input/output data area for DN211 in order with small node address of the registered slave device (Refer to 4.4 Allocating Slave Device Data to the Input/Output Data Area).

In DN211A, after setting the slave device parameter in DN211A by using DeviceNet Wizard for TOSHIBA, the user can freely allocate the slave device data to input/output data area of DN211A.

C-3 The parameter registration by ladder program and the parameter registration by DeviceNet

Wizard for TOSHIBA

Registration by the ladder program and registration by DeviceNet Wizard for TOSHIBA must not exist together (The example:The node parameter is registerd by the ladder program and the slave device parameter is registerd by DeviceNet Wizard for TOSHIBA).

If registration by both is intermingled, rewriting of the contents of registration etc. occurs and there is a possibility that the allocation of slave device data to input/output data area may become impossible.

D. Problem in old model DN211

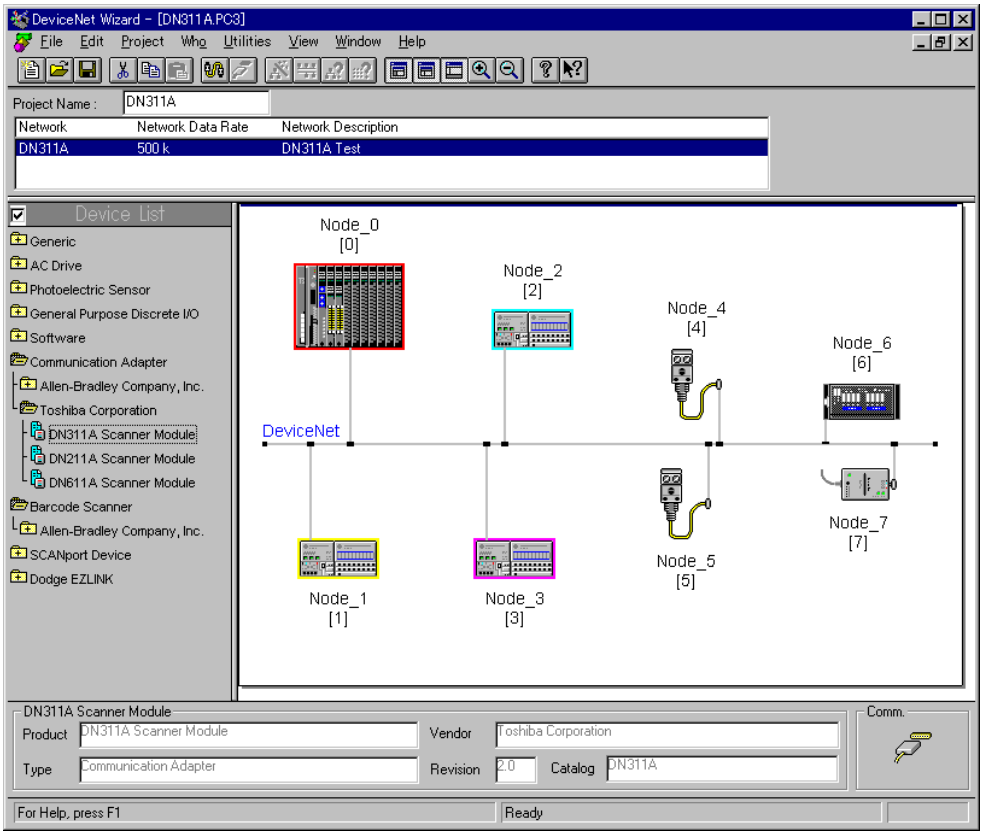
The following restriction which was in old model DN211 is solved in DN211A.

Using the polling mode slave device which transmission data size from master device is "0 bytes", when that slave device fails to communicate with DN211 due to some reason (power of that slave device side turned OFF, connector removed, etc.), DN211 cannot identify that slave device being malfunctioned. Even after the cause of the failure is solved, no communication between that slave device and DN211 can be resumed.

E. DeviceNet Wizard for TOSHIBA

DeviceNet Wizard for TOSHIBA is software which works on Microsoft Windows 95/98/NT4.0. The user can keep handy with the registration of the slave parameter to the master module and the allocation of the slave data to master module input/output area by graphical user interface like the figure below.

Please buy DeviceNet Wizard for TOSHIBA from our company. Product code:TDW33E2SS



The personal computer in which DeviceNet Wizard for TOSHIBA is installed is connected with the DeviceNet network and actual, various work is done. There are three kinds of interfaces of the following by which the personal computer is connected with the DeviceNet network. Please buy the product from each maker's agency.

Product code	Explanation	Maker
1770- KFD	RS-232C interface	Rockwell Automation
1784- PCD	PCMCIA interface	Rockwell Automation
5136- DN	ISA bus interface	S-S Technologies