

USER'S MANUAL

CompoBus/D (DeviceNet) Communications Unit

MODEL 3G3MV-PDRT1-SINV

(For SYSDRIVE 3G3MV Multi-function Compact Inverters)

Thank you for choosing a 3G3MV Multi-function Compact Inverter and CompoBus/D Communications Unit. This manual describes the specifications and operating methods of the CompoBus/D Communications Unit used for exchanging data between an Inverter and a Programmable Controller. Specifically, it describes the operation methods, communications methods, and data setting methods of the 3G3MV-PDRT1-SINV CompoBus/D Communications Unit. Proper use and handling of the product will help ensure proper product performance, will lengthen product life, and may prevent possible accidents.

Please read this manual thoroughly and handle and operate the product with care. For details about the 3G3MV Inverter and CompoBus/D communications system, refer to the following manuals.

SYSDRIVE 3G3MV User's Manual (I527)
CompoBus/D Operation Manual (W267)

NOTICE

1. This manual describes the functions of the product and relations with other products. You should assume that anything not described in this manual is not possible.
2. The name "SYSMAC" in this manual refers to the SYSMAC C200HX/HG/HE and CV-series Programmable Controllers that can be connected to a CompoBus/D System. (C200HS Programmable Controllers support only the remote I/O function.)
3. Although care has been given in documenting the product, please contact your OMRON representative if you have any suggestions on improving this manual.
4. The product contains potentially dangerous parts under the cover. Do not attempt to open the cover under any circumstances. Doing so may result in injury or death and may damage the product. Never attempt to repair or disassemble the product.
5. We recommend that you add the following precautions to any instruction manuals you prepare for the system into which the product is being installed.
 - Precautions on the dangers of high-voltage equipment.
 - Precautions on touching the terminals of the product even after power has been turned off. (These terminals are live even with the power turned off.)
6. Specifications and functions may be changed without notice in order to improve product performance.

Items to Check Before Unpacking


Check the following items before removing the product from the package:


- Has the correct product been delivered (i.e., the correct model number and specifications)?
- Has the product been damaged in shipping?
- Are any screws or bolts loose?
- Have all accessories been delivered together with or attached to the product?


Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

 **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.










Note Indicates information of particular interest for efficient and convenient operation of the product.


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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.


■ Transportation, Installation, Wiring, and Maintenance Precautions

-  **WARNING** Do not touch the conductive parts such as internal PCBs or terminal blocks while power is being supplied. Doing so may result in electrical shock.
-  **WARNING** Turn ON the input power supply only after mounting the front cover, terminal covers, bottom cover, Operator, and optional items. Leave them mounted in place while power is being supplied. Not doing so may result in electrical shock, malfunction, or damage to the product.
-  **WARNING** Wiring, maintenance, or inspection must be performed by authorized personnel. Not doing so may result in electrical shock or fire.
-  **WARNING** Wiring, maintenance, or inspection must be performed after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) is OFF, and after waiting for the time specified on the Inverter front cover. Not doing so may result in electrical shock.
-  **WARNING** Do not damage, pull on, apply stress to, place heavy objects on, or pinch the cables. Doing so may result in electrical shock, operation stoppage, or burning.
-  **WARNING** Do not attempt to disassemble or repair the Unit. Doing either of these may result in electrical shock, injury, or damage to the product.
-  **Caution** Do not store, install, or operate the product in the following places. Doing so may result in electrical shock, fire or damage to the product.
- Locations subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Locations subject to corrosive or flammable gases.
 - Locations subject to exposure to combustibles.
 - Locations subject to dust (especially iron dust) or salts.
 - Locations subject to exposure to water, oil, or chemicals.
 - Locations subject to shock or vibration.
-  **Caution** Do not allow foreign objects to enter inside the product. Doing so may result in fire or malfunction.
-  **Caution** Do not apply any strong impact. Doing so may result in damage to the product or malfunction.

 **Caution** Be sure to wire correctly and securely. Not doing so may result in injury or damage to the product.


 **Caution** Be sure to firmly tighten the screws on the terminal block. Not doing so may result in fire, injury, or damage to the product.

 **Caution** Carefully handle the product because it uses semiconductor elements. Careless handling may result in malfunction.

 **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations. Not doing so may result in equipment damage.

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields and magnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

■ Operation and Adjustment Precautions

 **Caution** Do not carelessly change Inverter's settings. Doing so may result in injury or damage to the product.


 **Caution** Be sure to perform the setting switch settings correctly and confirm the settings before starting operation. Not doing so may result in malfunction or damage to the product.

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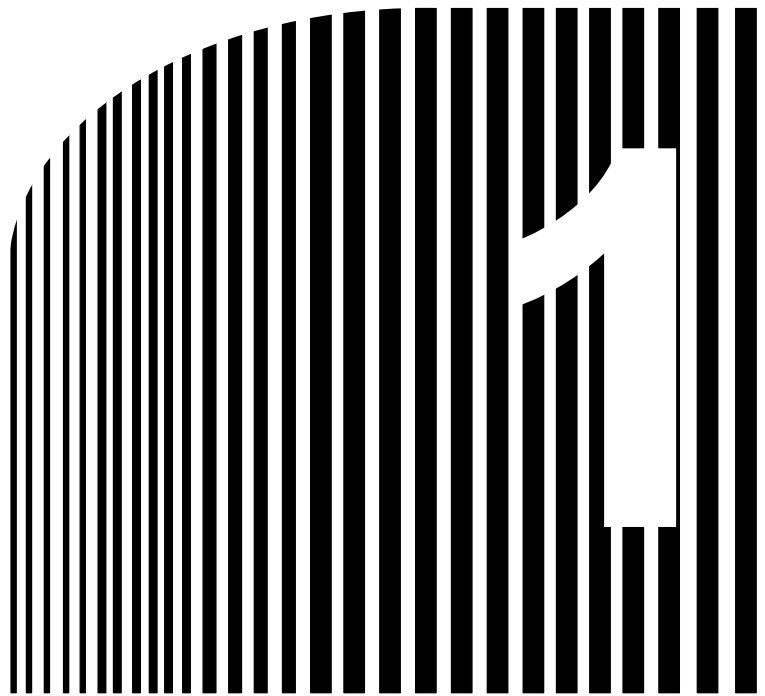
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Chapter 1

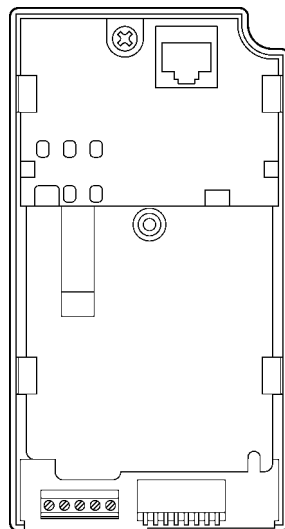
• Functions and System Configuration •

- 1-1 Functions
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1-1 Functions

The 3G3MV-PDRT1-SINV CompoBus/D Communications Unit is a dedicated communications interface Unit that makes it possible for the SYSDRIVE 3G3MV Multi-function Compact Inverter to communicate with SYSMAC Programmable Controllers. Installing a CompoBus/D Communications Unit in the SYSDRIVE 3G3MV Inverter permits a Programmable Controller to monitor RUN/STOP and operating conditions, and to make changes in set values.

Note When the CompoBus/D Communications Unit is used, the RS-422/485 of the Inverter cannot be used for communications.



3G3MV-PDRT1-SINV
CompoBus/D Communications Unit

■ Easy Communications

The following two functions can be used simultaneously in CompoBus/D communications between the CPU Unit of a SYSMAC PC and the SYSDRIVE 3G3MV Inverter.

- Remote I/O Communications

I/O is automatically transferred between Slaves and the CPU Unit without any special programming in the CPU Unit. (Automatically transmits Inverter control inputs such as RUN or STOP from a SYSMAC PC to the SYSDRIVE 3G3MV Inverter and returns operation status of the Inverter or output frequency monitor data.)

- Message Communications

Message communications are performed between a CPU Unit to which a Master Unit is mounted and Slaves (SYSDRIVE 3G3MV Inverters) by executing specific instructions (such as CMND and IOWR, depending on the model of SYSMAC PC used) from the program in the CPU Unit. (Allows some parameter setting and monitoring, Inverter output frequency, output voltage, or output current. If the remote I/O communications is not performed, Inverter control data such as RUN or STOP can be input through this message communications function.)

Remote I/O communications for the CompoBus/D Communications Unit are performed using either 4 or 6 words allocated in the I/O Area of the SYSMAC PC. The Inverter can be controlled using remote I/O communications because the basic control I/O functions, frequency setting functions, and output frequency monitoring functions are assigned to remote I/O. This allows the Inverter to be controlled through simple I/O processing.

■ **Communications with SYSMAC CS1-series, SYSMAC C200HX/HG/HE and CV-series PCs**

The CompoBus/D communications system is supported by SYSMAC CS1-series, SYSMAC C200HX/HG/HE and CV-series Programmable Controllers. Up to twice as many Inverters can be connected in comparison to SYSMAC BUS Remote I/O Systems to support even larger control systems.

Note 1. The maximum number of nodes that can be connected to the system depends on the type of Master Unit used, whether the message function is used, and the number of words used by remote I/O communications. See *1-3 CompoBus/D System Configuration* for further details.

Note 2. The SYSMAC CS1 Series includes the CS1G and CS1H Programmable Controllers. The SYSMAC CV Series includes the CV1000, CV2000, and CVM1 Programmable Controllers. SYSMAC C200HS PCs support only remote I/O communications.

■ **Multi-vendor Network**

The CompoBus/D conforms to the DeviceNet open field network specification, which means that devices (Masters and Slaves) produced by other manufacturers can also be connected to the Network. The CompoBus/D Communications Unit supports the DeviceNet AC/DC drive object, so that the functions available for CompoBus/D communications can be used in DeviceNet communications.

■ **Choice of Communications Functions**

The CompoBus/D Communications Unit has various functions to choose from to suit the Inverter applications.

- Remote I/O Communications

Either basic remote I/O control or special remote I/O can be chosen for remote I/O allocation to suit the application. Special I/O control can be used to control and set all functions for 3G3MV-series Inverters.

- Message Communications

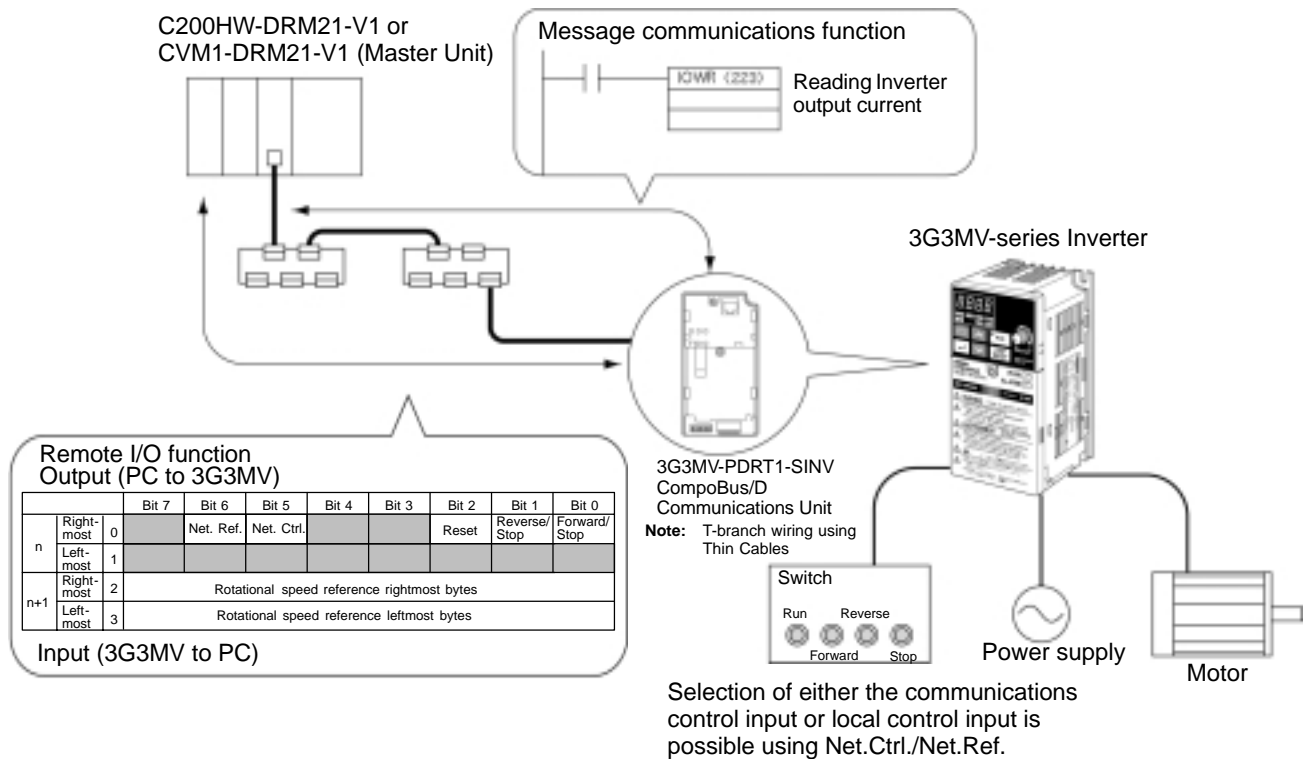
Basic Inverter control and monitoring is possible with DeviceNet explicit messages, which are defined for AC/DC driver objects. Remote I/O and message communications can be used simultaneously, i.e., remote I/O control can be performed at the same time as other control using message communications.

■ Applicable to Various System Configurations

Remote I/O communications and message communications are available as communications functions. Normal control inputs are controlled by the remote I/O communications function. When necessary, the message communications function is used to monitor each Inverter. It is possible to control the selection of either the communications control input or local control input.

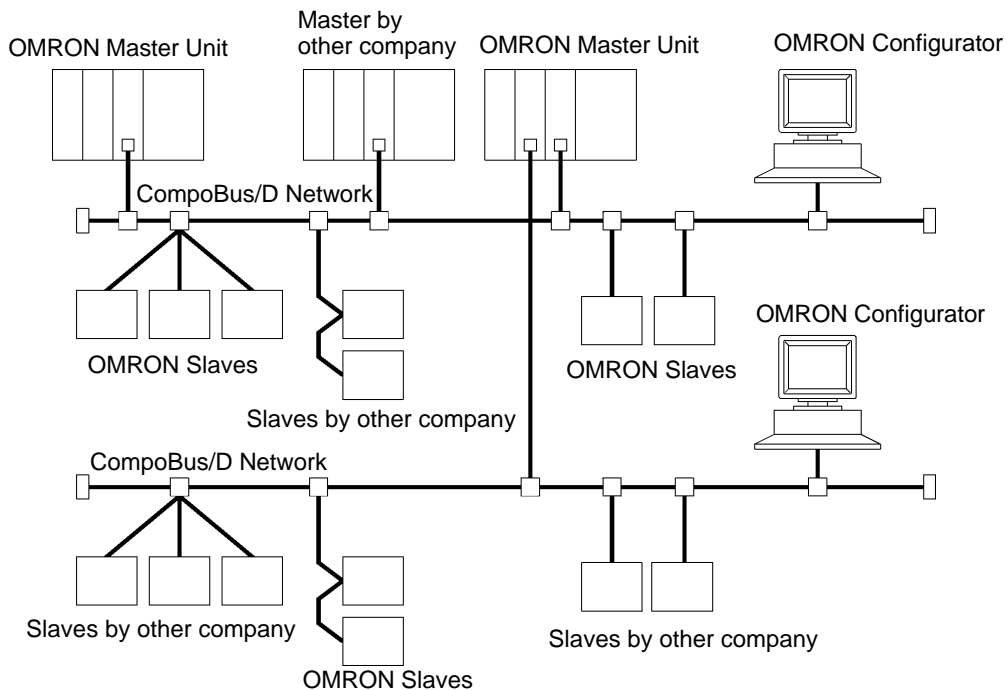
Note For connecting the CompoBus/D Communications Unit of the Inverter, use DCA1-5C10 Thin Cables and branch them from the T-branch Tap.

Thick Cables cannot be used for this kind of wiring because of the terminal block dimensions. As for multi-drop wiring, use Thin Cables for direct insertion. Thick Cables cannot be used for this kind of wiring.



1-2 CompoBus/D Features

■ System Configuration Example



■ Multi-vendor Network

The CompoBus/D conforms to the DeviceNet open field network specification, which means that devices (Masters and Slaves) produced by other manufacturers can also be connected to the Network. Therefore, a wide range of field-level applications can be supported by combining valve devices, sensors, and other devices.

■ Simultaneous Remote I/O and Message Services

Remote I/O communications to constantly exchange I/O data between the PC and Slaves can be executed simultaneously with message communications, to send/receive Master Unit data as required by the application. Therefore, a CompoBus/D Network can be installed to flexibly handle applications that require both bit data and message data. Message communications can be achieved either by using OMRON's FINS commands or by using DeviceNet explicit messages.

■ Connect Multiple PCs to the Same Network

A Configurator (sold separately) can be used to enable connection of more than one Master to the Network, allowing message communications between PCs and between multiple groups of PCs and Slaves. This allows the CompoBus/D Network to be used as a common bus to unify controls while reducing wiring.

■ Handle Multi-point Control and Line Expansions with Multi-layer Networks

A Configurator (sold separately) can be used to enable mounting more than one Master Unit to a single PC, allowing control of many more points. This feature can easily handle line expansions and other applications.

■ **Free Remote I/O Allocation**

A Configurator (sold separately) can be used to enable flexible allocation of I/O, i.e., in any area and in any order. This allows I/O allocations that suit the application to simplify programming and enable effective usage of PC memory areas.

■ **Handle Slaves with Different Response Speeds**

A Configurator (sold separately) can be used to set the communications cycle time, enabling usage of Slaves with slow response times.

■ **Easily Expand or Change Lines with Various Connection Methods**

Use a multi-drop trunk line, T-branch multi-drop lines, or daisy-chain drop lines. All three connection methods can be combined to flexibly construct a Network that meets the needs of the application.

Note For connecting the CompoBus/D Communications Unit of the Inverter, use DCA1-5C10 Thin Cables and branch them from the T-branch Tap.

1-3 CompoBus/D System Configuration

1-3-1 System Configuration

CompoBus/D is a multi-bit, multi-vendor network that combines controls and data on a machine/line-control level and that conforms to DeviceNet open field network specifications.

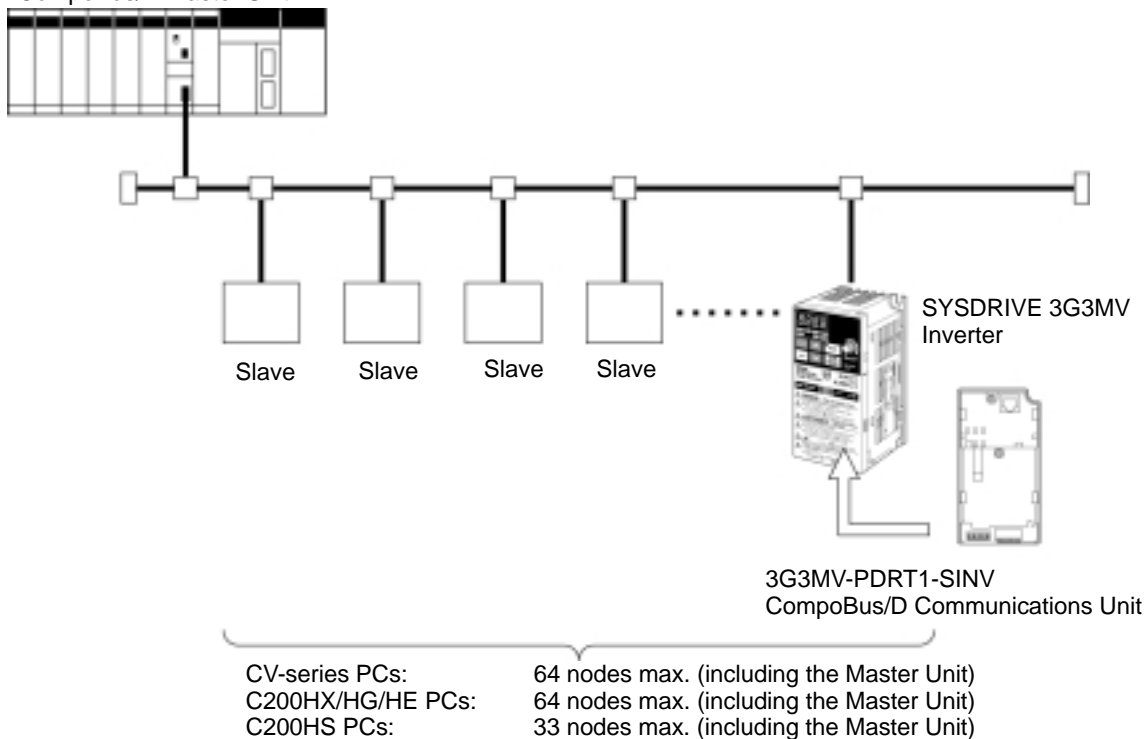
Two types of communications are supported: 1) Remote I/O communications that automatically transfer I/O between Slaves and the CPU Unit of a SYSMAC PC without any special programming in the CPU Unit and 2) Message communications are performed between a CPU Unit to which a Master Unit is mounted and Slaves by executing specific instructions (such as CMND and IOWR, depending on the model of SYSMAC PC used) from the program in the CPU Unit.

A Configurator (sold separately) can be used to enable following. This allows the support of an even larger control system.

- I/O area words can be flexibly allocated for remote I/O communications.
- More than one Master Unit can be mounted to a single PC.
- More than one Master Unit can be connected in a single Network.

■ Fixed Allocation: Configuration without a Configurator

C200HW-DRM21-V1 or CVM1-DRM21-V1
CompoBus/D Master Unit



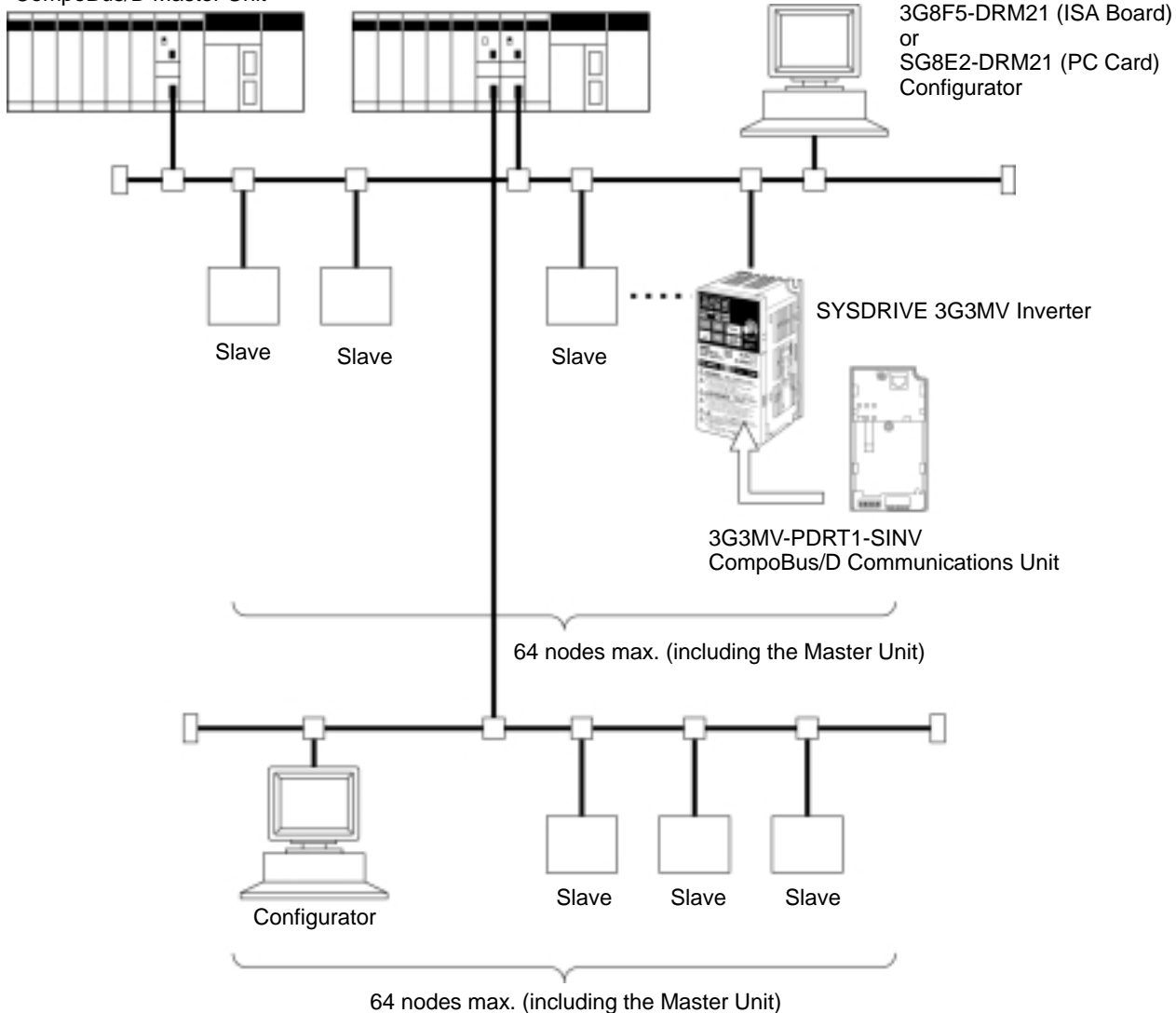
Note 1. The Master Unit occupies one node of the CompoBus/D Network.

Note 2. If C200HS PCs are used, only remote I/O communications are possible.

Note 3. If one node uses more than one word, the maximum number of nodes will be reduced by one node for each extra word that is used.

■ Free Allocation: Configuration with a Configurator

C200HW-DRM21-V1 or CVM1-DRM21-V1
CompoBus/D Master Unit



- Note 1.** The Master Unit and Configurator each occupy one node of the CompoBus/D Network.
- Note 2.** If C200HS PCs are used, only remote I/O communications are possible.
- Note 3.** The maximum number of nodes that can be connected to the Network will be limited by the maximum number of control points of the PC used.

1-3-2 Configurator Overview

The Configurator is software application run on an IBM PC/AT or compatible computer and is used to support a CompoBus/D communications system. OMRON provides interfaces (hardware) for connecting computers to the CompoBus/D Network. The Configurator occupies one node on the CompoBus/D Network, but has no specific functions on the network itself. The Configurator provides the following functions.

- Free Allocation of Remote I/O
 - The remote I/O allocations in the PCs can be changed from the Configurator. I/O can be flexibly allocated for each node within the specified I/O areas.
- More than One Master Unit per Network
 - Slaves can be set for each Master Unit from the Configurator enabling communications between multiple groups of PCs and Slaves. The maximum number of nodes connected to one Network remains at 64. One Slave can be connected to no more than one Master Unit.
- More than one Master Unit per PC
 - Remote I/O can be allocated for each Slave of the Master Unit from the Configurator, so more than one Master Unit can be mounted to the same PC.

Note In allocating Remote I/O for each Master Unit, be careful not to allow any dual allocation.

■ Configurator Specifications

Item		3G8F5-DRM21	3G8E2-DRM21
Personal computer		Desktop model	Notebook model
Components		Installation disk (software) Dedicated ISA Board	Installation disk (software) Dedicated PMCIA Card CompoBus/D Interface Unit
Operating environment	Hardware	Computer: IBM PC/AT or compatible CPU: With Windows 95: 66 MHz i486 DX2 min. With Windows NT: 90 MHz Pentium min. Memory: With Windows 95: 12 MB min. (16 MB or more recommended) With Windows NT: 16 MB min. (24 MB or more recommended) Hard disk: 5 MB min. free space	
	OS	Windows 95 or Windows NT 3.51/4.0	Windows 95
	CompoBus/D interface	Dedicated ISA Board	Dedicated PMCIA Card CompoBus/D Interface Unit
Relation to Network		Operates as one node on the Network, requires one node address, and only one Configurator can be connected to the Network. (The Configurator can be disconnected from the Network after remote I/O has been allocated.)	

1-3-3 CompoBus/D Communications Specifications

Item		Specifications
Communications protocol		DeviceNet
Supported connections (communications)		Master-Slave: Remote I/O and explicit messages Peer-to-peer: FINS messages Both conform to DeviceNet specifications.
Connection forms		Combination of multi-drop and T-branch connections (for trunk and drop lines)
Baud rate		500 Kbps, 250 Kbps, or 125 Kbps (switchable)
Communications media		Special 5-wire cables (2 signal lines, 2 power lines, and 1 shield line) Thick Cable: DCA2-5C10 (100 m) Thin Cable: DCA1-5C10 (100 m)
Communications distances	500 Kbps	Network length: 100 m max. Drop line length: 6 m max. Total drop line length: 39 m max.
	250 Kbps	Network length: 250 m max. Drop line length: 6 m max. Total drop line length: 78 m max.
	125 Kbps	Network length: 500 m max. Drop line length: 6 m max. Total drop line length: 156 m max.
Communications power supply		24 V DC \pm 1%, supplied externally (Slave power supply: 11 to 25 V DC) Recommended power supply: OMRON S82H Series or S82J Series
Maximum number of nodes		64 nodes
Maximum number of Masters		Without Configurator: 1 With Configurator: 63
Maximum number of Slaves		Without Configurator: 63 With Configurator: 63
Error control		CRC check

1-3-4 Inverter

The maximum number of Inverters that can be connected to one Network depends on the PC model that is used, the remote I/O functions of the Inverter, and whether message communications are used or not. (Use the message communications function for setting some parameters and for monitoring the output current.) The differences between models are provided in the following tables.

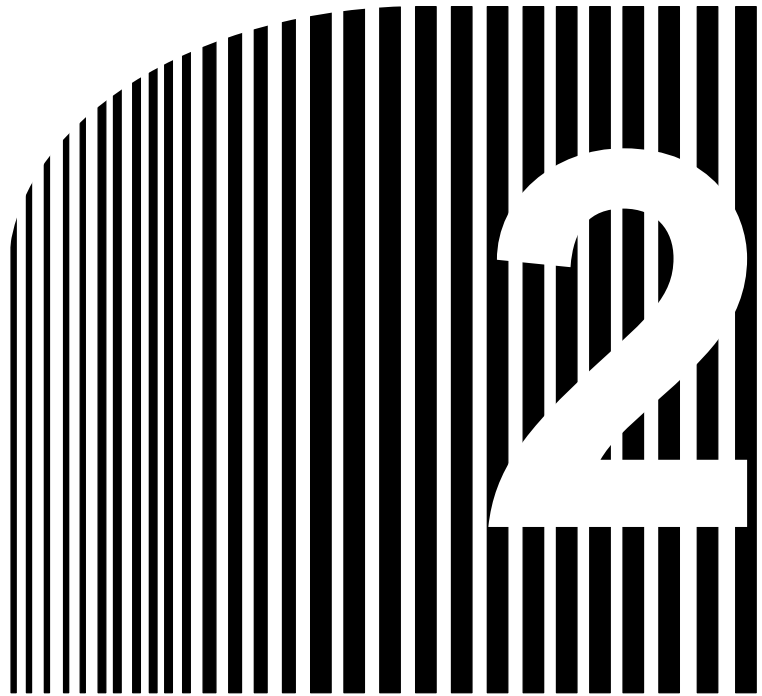
■ Communications without Configurator: Fixed Allocation

Applicable PC		CV Series	CS1 Series and C200HX/HG/HE	C200HS
Master Unit		CVM1-DRM21-V1	C200HW-DRM21-V1	
Supported communications		Remote I/O and messages	Remote I/O and messages	Remote I/O
Maximum number of Slaves per Master Unit		63	50	32
Maximum number of controlled points per Master Unit		2,048	1,600	1,024
Allocation areas		OUT: CIO 1900 to CIO 1963 IN: CIO 2000 to CIO 2063	OUT: IR 050 to IR 099 IN: IR 350 to IR 399	OUT: IR 50 to IR 81 IN: IR 350 to IR 381
Allocation method		Words are allocated for each node to the above data areas in node address order only. 8-point Slaves: Allocated 1 word 16-point Slaves: Allocated 1 word Slaves with more than 16 points: Allocated multiple words		
Maximum number of Inverters	Without explicit messages	4 words remote I/O: 32 6 words remote I/O: 21	4 words remote I/O: 25 6 words remote I/O: 16	4 words remote I/O: 16 6 words remote I/O: 10
	With explicit messages	4 words remote I/O: 32 6 words remote I/O: 21	4 words remote I/O: 25 6 words remote I/O: 16	---

■ Communications with Configurator: Free Allocation

Applicable PC		CV-series	CS1 Series and C200HX/HG/HE	C200HS
Master Unit		CVM1-DRM21-V1	C200HW-DRM21-V1	
Supported communications		Remote I/O and messages	Remote I/O and messages	Remote I/O
Maximum number of Slaves per Master Unit		63	63	63
Maximum number of controlled points per Master Unit		6,400 (100 words × 4 blocks)	Without messages: 4,800 With messages: 1,600	1,280 (total of 4 blocks)

Applicable PC		CV-series	CS1 Series and C200HX/HG/HE	C200HS
Allocation areas		Core I/O Area: CIO 0000 to CIO 2555 CIO 0000 to CIO 2427 for CV500/CVM1-CPU01(-V□)	IR Area 1: IR 000 to IR 235 IR Area 2: IR 300 to IR 511	
		CPU Bus Link Area: G008 to G255	<u>CS1</u> HR: H000 to H099 CIO: 1000 to 1063 <u>C200HX/HG/HE</u> HR Area: HR 00 to HR 99 LR Area: LR 00 to LR 63	HR Area: HR 00 to HR 99 LR Area: LR 00 to LR 63
		DM Area: D00000 to D24575 D00000 to D08191 for CV500/CVM1-CPU01 (-V□)	<u>CS1</u> DM: D00000 to D05999 <u>C200HX/HG/HE</u> DM: DM 0000 to DM 5999 (DM 0000 to DM 4095 for C200HE-CPU11(-Z)E)	DM Area: DM 0000 to DM 5999
Allocation method		<p>Words are allocated to each node in the above data areas in any order using the Configurator.</p> <p>The following limitations apply:</p> <p style="padding-left: 40px;">The allocation areas are in 4 blocks (OUT 1, OUT 2, IN 1, and IN 2). Each block consists of sequential words.</p> <p style="padding-left: 40px;">100 words max. per block.</p> <p style="padding-left: 40px;">For Slaves with more than 8 points, the first byte cannot be specified in leftmost bits (7 to 15).</p> <p>Words are allocated to Slaves as follows:</p> <p>8-point Slaves: Allocated leftmost or rightmost byte of 1 word</p> <p>16-point Slaves: Allocated 1 word</p> <p>Slaves with more than 16-points: Allocated multiple words (For Slaves with an odd number of bytes, the last byte will be the rightmost byte)</p>		
Maximum number of Inverters (using one Master Unit only)	Without explicit messages	63	4 remote I/O words: 63 6 remote I/O words: 50	4 words remote I/O: 20 6 words remote I/O: 13
	With explicit messages	63	4 remote I/O words: 25 6 remote I/O words: 16	---
Maximum number of Inverters with more than one Master Unit		<p>Calculate from the number of words allocated in the data areas and the number of words allocated to the Inverters (4 or 6 words).</p> <p>Note 1. The DM Area cannot be manipulated by bit, so it cannot be allocated for remote I/O for Inverters.</p> <p>Note 2. If the CPU Bus Link is used with a CV-series PC, the CPU Bus Link Area will be used for the CPU Bus Link Therefore, the CPU Bus Link Area cannot be allocated to Inverters if the CPU Bus Link is used.</p>		



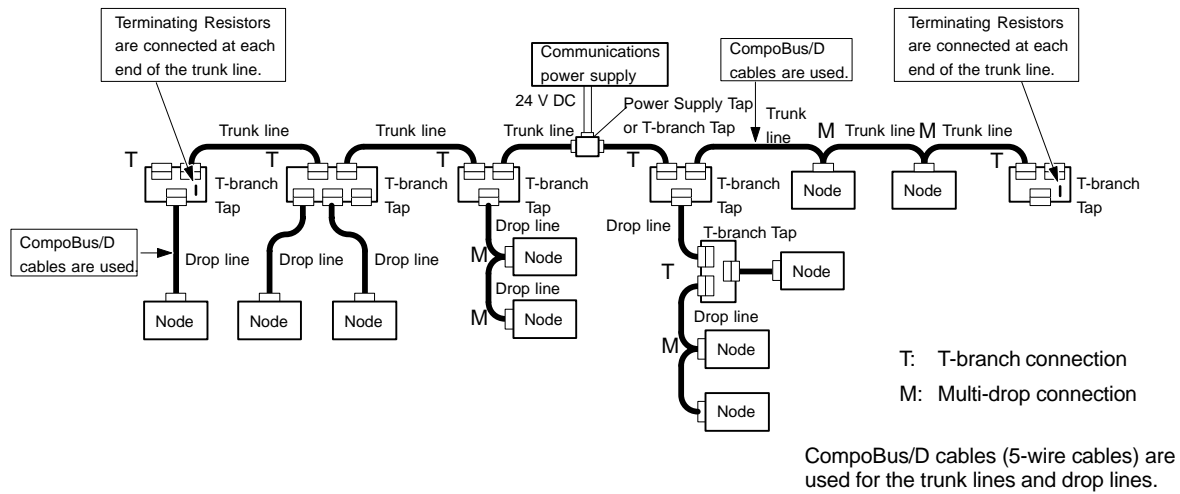
Chapter 2

- **CompoBus/D
Communications Line
Design •**

- 2-1 Network Configuration Overview
- 2-2 Network Configuration Restrictions
- 2-3 Communications Power Supply
- 2-4 Communications Line Noise Prevention

2-1 Network Configuration Overview

The following diagram shows the configuration of a CompoBus/D Network.



2-1-1 Network Components

■ Nodes

There are two kinds of nodes on a CompoBus/D Network: The Master and Slaves. The Slaves connect to external I/O and the Master administers the Network and manages the external I/O of the Slaves. The Master and Slaves can be connected at any location in the Network, as shown in the preceding diagram.

■ Trunk/Drop Lines

The trunk line refers to the cable that has Terminating Resistors on both ends. Cables branching from the trunk line are known as drop lines. The trunk line length does not necessarily coincide with the maximum length of the Network. CompoBus/D communications are transmitted through 5-wire cables. The cables come in thick and thin versions.

■ Connection Methods

Two methods can be used to connect CompoBus/D nodes: The T-branch method and the multi-drop method. With the T-branch method, the node is connected to a drop line created with a T-branch Tap. With the multi-drop method, the node is directly connected to the trunk line or the drop line. Secondary branches can be made from a drop line. Both of these connection methods can be used in the same Network.

■ Terminating Resistors

Terminating Resistors are connected at each end of the trunk line to reduce signal reflection and stabilize communications. There are two kinds of Terminating Resistors available: One that is provided with a T-branch Tap and a Terminal-block Terminating Resistor. Use a CompoBus/D Cable when connecting a Terminal-block Terminating Resistor.

■ Communications Power Supplies

To use CompoBus/D, connect a communications power supply to the communications connector of each node with a 5-wire cable. Basically, a communications power supply, internal circuit power supply, and I/O power supply must be provided separately.

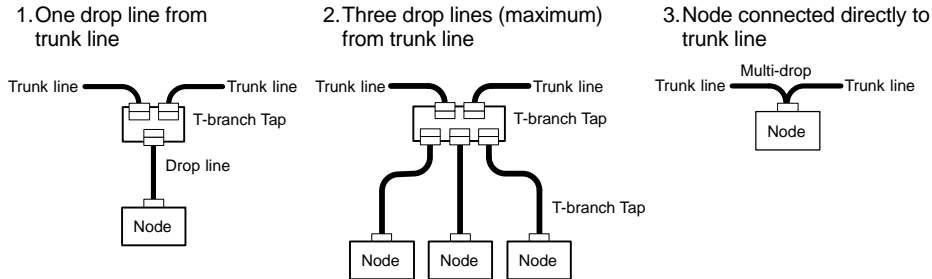
2-1-2 Connections

■ Trunk and Drop Lines

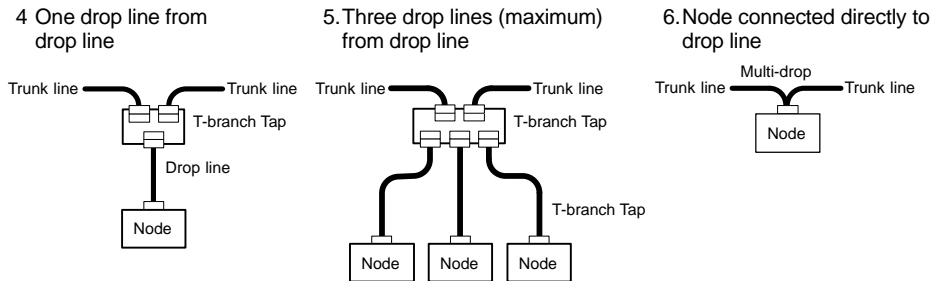
The trunk line is a cable to which Terminating Resistors are connected at the ends. Drop lines are cables that branch from the trunk lines. A special 5-wire cable is used for both the trunk lines and the drop lines.

■ Branching Patterns

Branching Patterns from Trunk Line



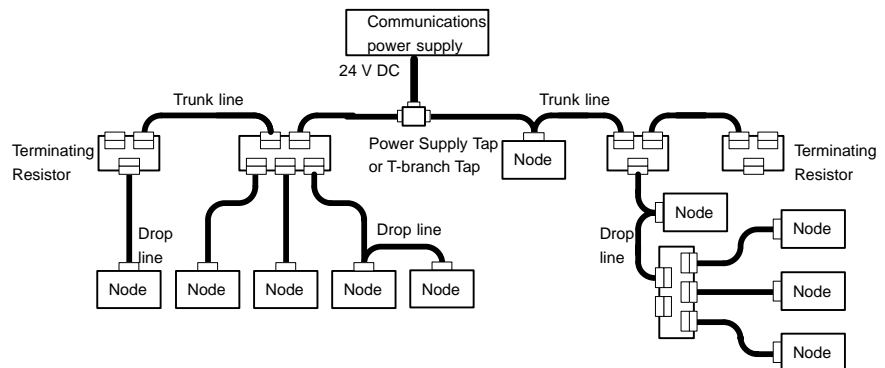
Branching Patterns from Drop Line



Various forms of connection can be used on the same Network, as shown in the following diagram. Any number of nodes up to 63 can be connected onto a single drop line.

If a SYSMAC CS1-series, C200HX/HG/HE or a C200HS PC is being used without a Configurator to allocate remote I/o, the maximum number of nodes that can be connected to a single drop line is 51 for C200HX/HG/HE PCs and 33 for C200HS PCs.

Note Design the Inverter wiring for T-branch wiring purposes using Thin Cables.



2-2 Network Configuration Restrictions

CompoBus/D communications are designed to meet a wide range of applications by providing a choice of baud rates and allowing different combinations of T-branch and multi-drop connections. The restrictions of CompoBus/D communications that are required to enable the various communications possibilities are described here.

2-2-1 Baud Rate and Communications Distance

The maximum length of the CompoBus/D communications cables is restricted by the baud rate and the type of cable used. The three types of restrictions on CompoBus/D communications cable length are as follows:

- Maximum network length
- Drop line length
- Total drop line length

Be sure to design and configure a Network that meets the conditions provided below to ensure reliable communications.

■ Maximum Communications Distance

Baud rate	Maximum network length		Drop line length	Total drop line length
	Thick Cable	Thin Cable		
500 kbps	100 m max.	100 m max.	6 m max.	39 m max.
250 kbps	250 m max.	100 m max.	6 m max.	78 m max.
125 kbps	500 m max.	100 m max.	6 m max.	156 m max.

Note Thick Cable (5-wire): DCA2-5C10 (100 m)

Thin Cable (5-wire): DCA1-5C10 (100 m)

■ Maximum Network Length

The length of the Network is longest at either the distance between the two most distant nodes or at the distance between the Terminating Resistors.

There are two types of cables: Thick Cables and Thin Cables. The cable thickness affects signal deterioration. The maximum length of the Network therefore depends on the type of cable used as shown in the previous table.

The following restrictions apply to Networks in which both Thick and Thin Cables are combined.

Baud rate	Maximum Network length
500 kbps	Thick Cable length + Thin Cable length \leq 100 m
250 kbps	Thick Cable length + $2.5 \times$ Thin Cable length \leq 250 m
125 kbps	Thick Cable length + $5.0 \times$ Thin Cable length \leq 500 m

■ Drop Line Length

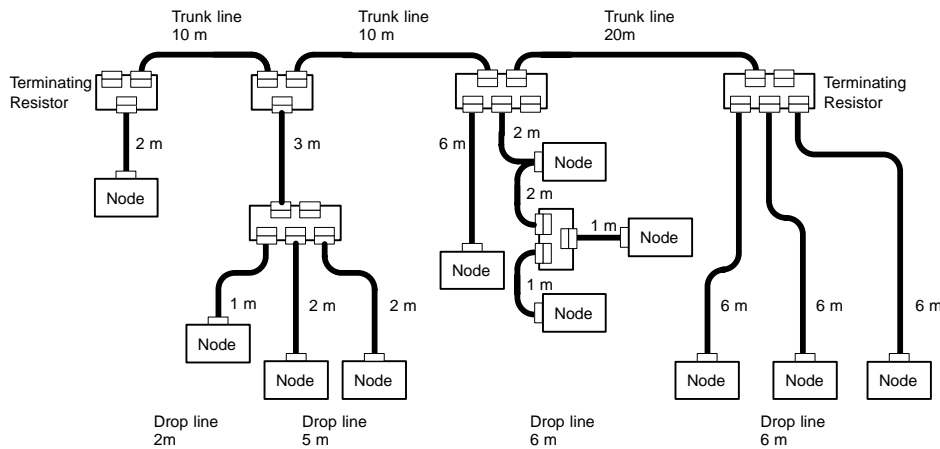
The length of the drop line is measured from the point in the trunk line where the original branch was made to the end of the branch. The maximum length of a drop line is 6 m. It is possible to make a secondary branch from a drop line.

■ **Total Drop Line Length**

The total drop line length is the total sum length of all the drop lines (but not including the trunk line). Do not exceed the maximum total drop line length (even when the length of each individual drop line is 6 m or less). The standard for the total drop line length varies with the baud rate as shown in the previous table.

■ **Configuration Example**

The following configuration example shows the maximum length of the Network, the drop line lengths, and the total drop line length.



Maximum Network Length

The longest distance between nodes is 48 m, and the distance between the two Terminating Resistors is 40 m. The maximum Network length is therefore 48 m.

Drop Line Length

There are four branch points in the trunk line. The length of each drop line is shown in the diagram. The maximum drop line length is 6 m.

Total Drop Line Length

The sum of all the drop lines is 40 m.

2-2-2 Locating Terminating Resistors

Be sure to connect the Terminating Resistors at both ends of the trunk line to reduce signal reflection and stabilize communications.

When there is a T-branch Tap 6 m or less from the end of the trunk line (or the node):

A Terminating Resistor attached to a T-branch Tap can easily be mounted without taking up much space.

When there is not a T-branch Tap 6 meters or less from the end of the trunk line (or the node):

A Terminating Resistor must be connected before that point. Either a T-branch Tap mounted to a Terminating Resistor or a terminal block with Terminating Resistor can be used. In this case, be sure to make the cable length 1 m or less from the node to the Terminating Resistor.



2-3 Communications Power Supply

2-3-1 Locating the Communications Power Supply

■ Basic Concept

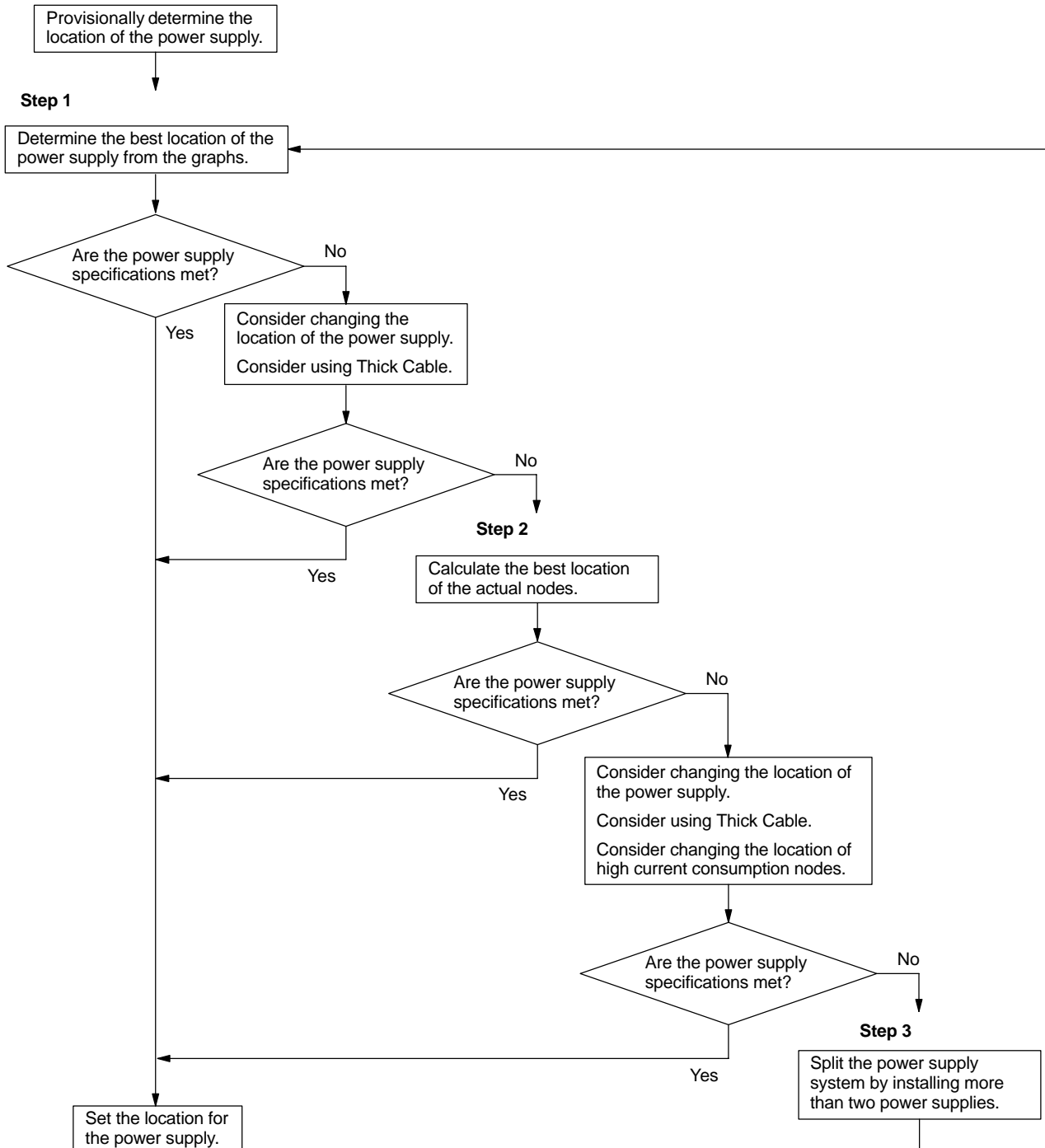
- The communications power supply must be 24 V DC.
- Make sure that the power is supplied from the trunk line.
- When providing power to several nodes from one power supply, if possible try to locate the nodes in both directions from the power supply.
- Provide power through Power Supply Taps. It is, however, possible to use T-branch Taps instead when there is one communications power supply in the system and the total current consumption is less than 5 A.
- The power supply capacity for cables is restricted to 8 A for Thick Cables and 3 A for Thin Cables.
- A single Network is usually supplied by one power supply. It is, however, possible to have more than one power supply when power supply specifications cannot be met with a single power supply. (See 2-3-4 Step 3: *Splitting the System into Multiple Power Supplies.*)
- Fully consider the power supply capacity allowance in the design.
- If the power supply is switched OFF during the operation of the Network, there may be a malfunction in the nodes.
- The current capacity of the drop line varies according to its length. The longer the drop line, the lower its maximum capacity becomes. This is the same whether the cable is thick or thin. Calculate the current capacity passing through the drop line I (the total current consumption at the drop line) using the following formula.

$$I = 4.57/L$$

I: Permissible current (A)
L: Length of the drop line (m)

Flowchart

Use the flowchart below to determine the communications power supply on the trunk line. Satisfy the conditions for each drop line on page 2-6.

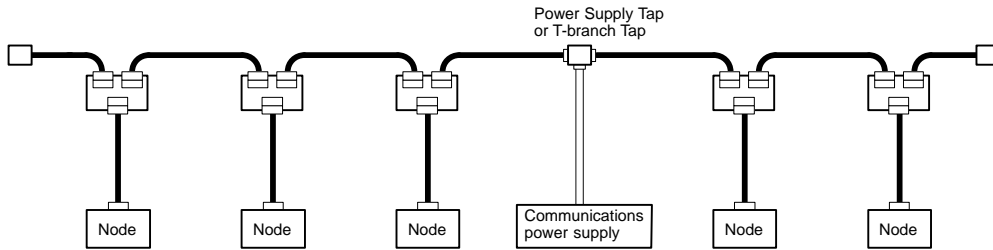


Power Supply Location Patterns

The power supply can be located in the configurations shown below. Basically, select from the configurations 1 and 2.

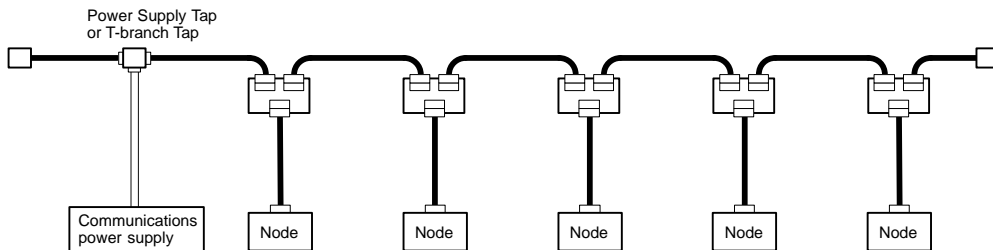
Consider using configuration 3 when power supply specifications cannot be met by configurations 1 and 2. It is possible to use configuration 4 for a duplex power supply.

1 Locating the Nodes on Both Sides of the Power Supply

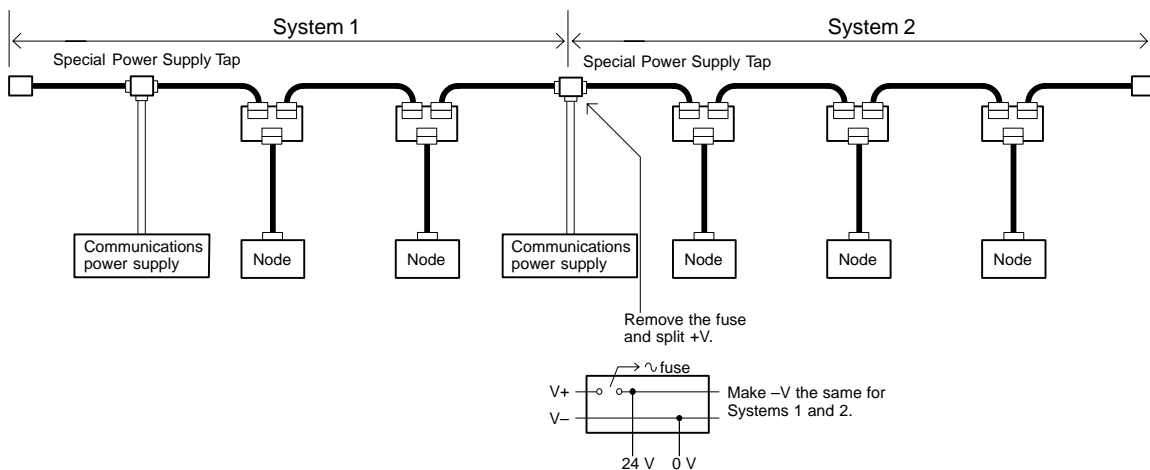


2 Locating the Nodes on One Side of the Power Supply

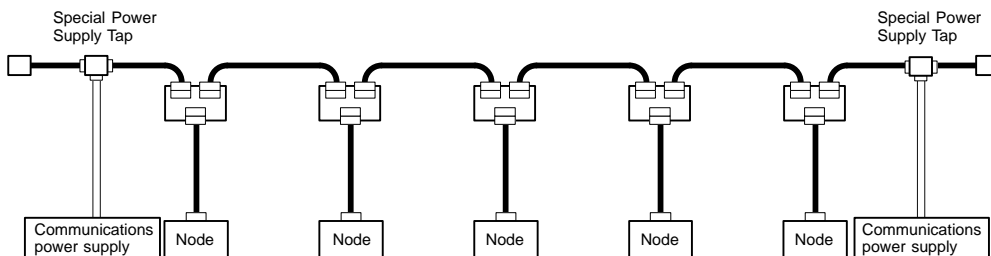
Note Configuration 1 is recommended for a single power supply to several nodes.



3 Splitting the Power Supply System with Multiple Power Supplies



4 Duplex Power Supply with Multiple Power Supplies



Note 1. If power supply specifications cannot be met with a single power supply when the current capacity of the Thick Cable exceeds 8 A even after the power supply location is modified, use more than one communications power supply.

Note 2. In configuration 1, the power can be supplied in two directions to the trunk line as long as the current capacity of each is 8 A or less when using Thick Cable, i.e., it is possible to have a configuration with a total maximum current capacity of up to 16 A.

Note 3. Consider changing to Thick Cable to meet specifications if the current capacity of the Thin Cable exceeds 3 A when using Thin Cable for the trunk line.

■ Setting the Power Supply Location

Determine whether or not the current can be supplied normally by finding the current capacity required by each node and the voltage drop in the cables to be used to provide power. Calculate the values below in advance.

- The current capacity required by each node
- The distance between the power supply and each node

The current capacity of the 3G3MV-PDRT1-SINV CompoBus/D Communications Unit is approximately 20 mA.

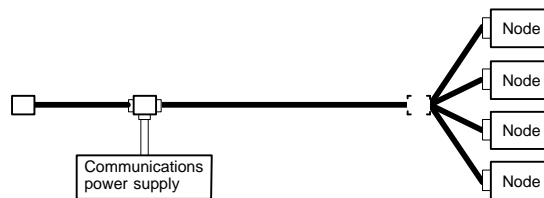
■ Calculating the Power Supply Location

There are two methods to find the best location of the communications power supply on the trunk line.

- Simple calculation from a graph
- Calculation by formula (Calculating the voltage drop from resistance and current consumption of the communications cables).

Each drop line must satisfy the equation on page 2-6, which represents the relationship between the drop line length and the current capacity for the drop line.

Note 1. From the graph, a hypothetical power supply location can be determined if the conditions calculated in the graph are met by estimating the worst configuration (that has the maximum voltage drop as shown in the diagram below).



Note 2. Even if the power supply specifications cannot be met using the graph, the conditions can be met and a hypothetical power supply location determined by using the formula.

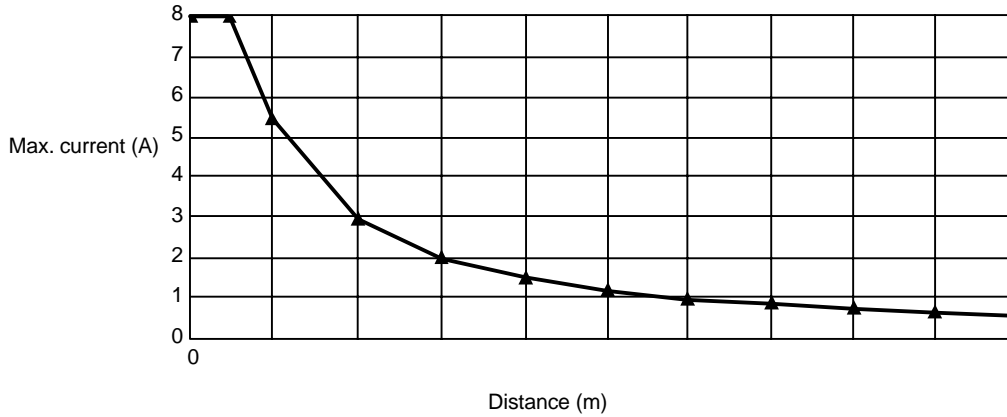
Note 3. When the communications power supply and the internal circuit supply are the same, use the formula to calculate a hypothetical power supply location because it cannot be determined by using the graph.

2-3-2 Step 1: Determining the Best Location for the Power Supply from a Graph

A voltage drop occurs when a current flows through a communications cable. The longer the communications cable and the larger the current, the greater the voltage drop. The communications power supply at each node must be 11 V DC or more. To ensure the correct power supply, the relationship is plotted as shown in the following graph to find the maximum current that satisfies the voltage of the communications power supply at different trunk line lengths even if there is a voltage drop due to cable resistance.

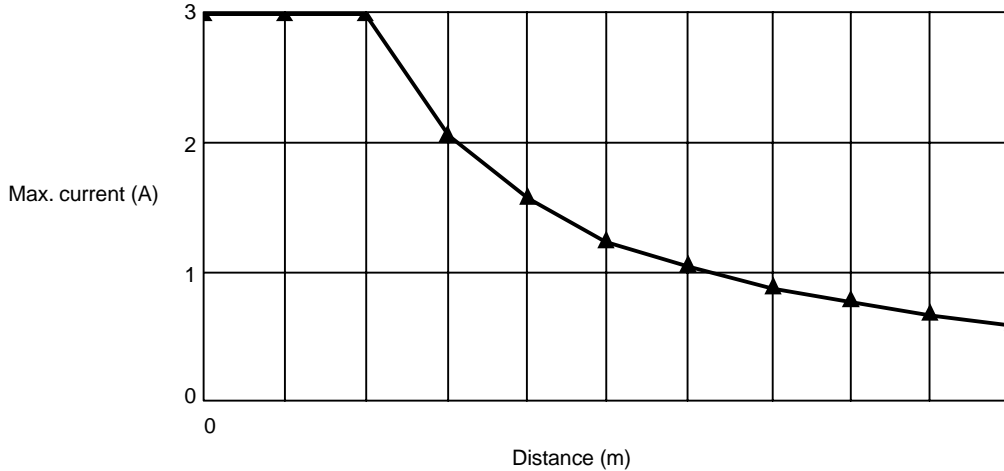
■ Thick Cable

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



■ Thin Cable

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



■ Determining the Best Location of the Power Supply from a Graph

Verify the Items 1 to 3 below for each node located in the same direction viewed from the power supply. Therefore, if nodes are located on both sides of the power supply, these items must be verified for all nodes located in each direction.

- 1 Find A, the total current consumption of all the nodes to which communications power is to be supplied.
- 2 Using the graph compute B, the maximum current flow in each cable from the power supply to the end of the trunk line according to the types of cables (Thick Cables or Thin Cables).

3 Compare the values found in steps 1 and 2, above. If the first value (A) is less than the second (B), this shows that power supply specifications are met and power can be supplied to all nodes at any point in the Network.

Note Be sure to refer to the correct graph as the maximum current flow is different for Thick and Thin Cables.

Countermeasures

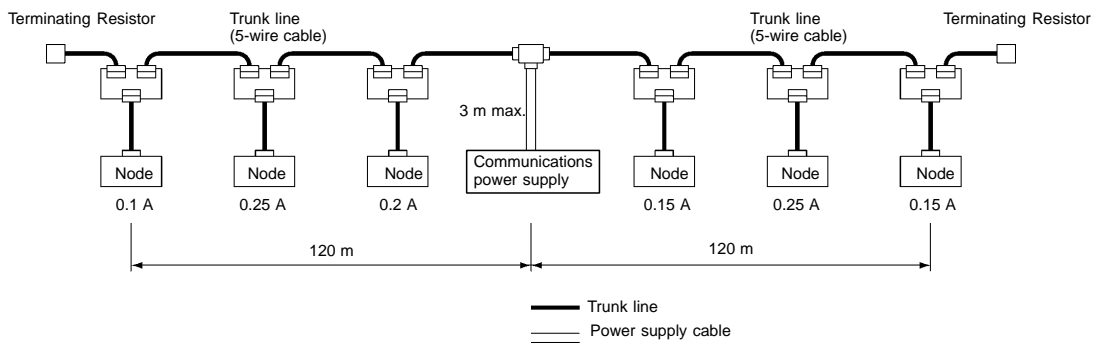
If the second value (B) is less than the first (A), use the following procedure to locate the communications power supply.

- Locate the communications power supply in the center of the Network and the nodes to both sides of it.
- If the nodes are already located at both sides of the power supply, move the power supply in the direction that requires the larger current capacity.
- If Thin Cable is being used, replace it with Thick Cable.

Note If, after following the above procedure, B is still less than A, go to Step 2 and determine the actual position of the nodes by the formula calculation method.

Calculation Example

The following example shows a Network that requires power to be supplied for 240 m on Thick Cable. The power supply is located in the center of the Network. Because the power supply is in the center, the maximum current will flow both to the left and to the right, enabling the supply of at least twice the maximum current as when the power supply is placed on the end of the Network. The current consumption for individual nodes is as follows:



Total power supply length on left = Total power supply length on right = 120 m

Total current consumption on left: $0.1 + 0.25 + 0.2 = 0.55 \text{ A}$

Total current consumption on right: $0.15 + 0.25 + 0.15 = 0.55 \text{ A}$

Maximum current for the left side of the Thick Cable (see previous table) = approx. 2.5 A

Maximum current for the right side of the Thick Cable (see previous table) = approx. 2.5 A (using straight line approximation between 100 to 150 m)

2-3-3 Step 2: Calculating the Best Location of the Actual Nodes

Go to Step 2 if the best location for the power supply according to the specifications cannot be determined from the graphs. The second method calculates the best location for each actual node and does not estimate the worst possible configuration for the power supply.

Basically, in the CompoBus/D Network the permissible maximum voltage drop within the system can be specified at 5 V for a power supply line (+V or -V), by calculating the specifications for the voltage of the communications power supply (24 V DC) and the input voltage of the communications power supply of each device (11 to 25 V DC).

Of the permissible 5-V maximum voltage drop within the system, the permissible voltage drop is 4.65 V in the trunk lines and 0.35 V in the drop lines.

The following formulae are applicable when power is supplied independently for communications and the internal circuit. For details on voltage drop and formulae when the communications power supply and internal circuit power supply are shared, refer to the *CompoBus/D (DeviceNet) Operation Manual*.

■ Formulae

Try to calculate the best location for each node using the formula below. If the best location for each node can be determined using the formula, the specifications for the power supply to each node can also be met. Do not exceed the maximum current capacity of the cable (Thick Cable: 8 A and Thin Cable: 3 A).

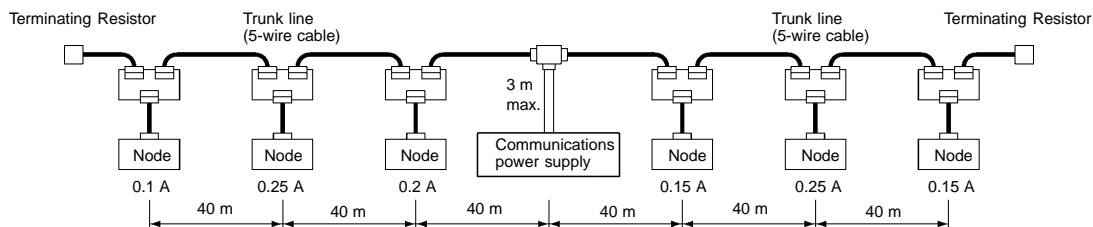
$$\{(L_1 \times R_C + N_1 \times 0.005) \times I_1\} + \{(L_2 \times R_C + N_2 \times 0.005) \times I_2\} + \dots + \{(L_n \times R_C + N_n \times 0.005) \times I_n\} \leq 4.65 \text{ V}$$

- Li: The distance (m) of the trunk line between the power supply and node i.
- Rc: Maximum cable resistance for approx. 1 m
(Thick Cable: 0.015 Ω/m, Thin Cable: 0.069 Ω/m)
- Ni: The number of T-branch Taps on the trunk line between the power supply and node i.
- Ii: The consumption current required for the communications power supply for node i.
- 0.005 Ω = The contact resistance of the T-branch Taps.

Note If there are nodes on both sides of the power supply, the formula is used to calculate the best location in each direction, and if the conditions are satisfied, then the locations are valid. The conditions are satisfied if the following equations are true.

- Voltage drop (V) on trunk line at left side ≤ 4.65 V
- Voltage drop (V) on trunk line at right side ≤ 4.65 V

● Calculation Example



Left Side Equation

Node 1: $(120 \times 0.015 + 3 \times 0.005) \times 0.1 = 0.1815 \text{ (V)}$
 Node 2: $(80 \times 0.015 + 2 \times 0.005) \times 0.25 = 0.3025 \text{ (V)}$
 Node 3: $(40 \times 0.015 + 1 \times 0.005) \times 0.2 = 0.121 \text{ (V)}$
 If $0.1815 + 0.3025 + 0.121 = 0.605 \text{ V} \leq 4.65 \text{ V}$, the conditions are satisfied.

Right Side Calculation

Node 4: $(40 \times 0.015 + 1 \times 0.005) \times 0.15 = 0.09075 \text{ (V)}$

Node 5: $(80 \times 0.015 + 2 \times 0.005) \times 0.25 = 0.3025 \text{ (V)}$

Node 6: $(120 \times 0.015 + 3 \times 0.005) \times 0.15 = 0.27225 \text{ (V)}$

If $0.09075 + 0.3025 + 0.27225 = 0.6655 \text{ V} \ll 4.65 \text{ V}$, the conditions are satisfied.

2-3-4 Step 3: Splitting the System into Multiple Power Supplies

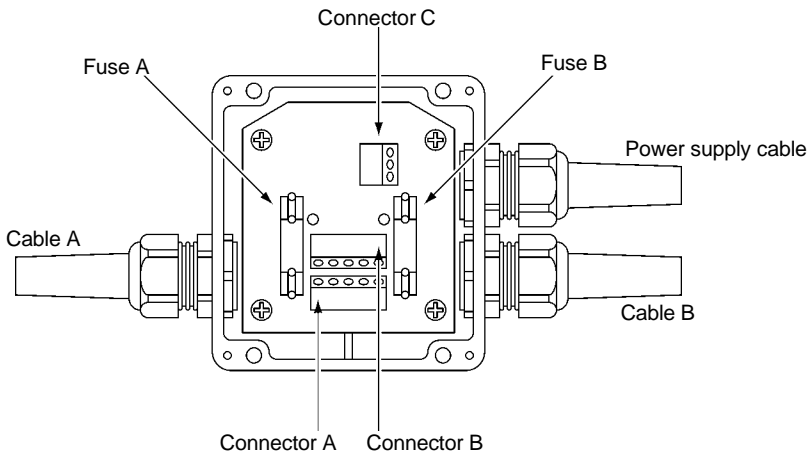
Go to Step 3 if the best location for the nodes cannot be calculated from the formulae. In the third step, there are multiple power supplies and the power supply system is split.

■ Splitting the Power Supply System

- Be sure to use a Power Supply Tap for each power supply when the Network is supplied by two or more power supplies.
- Remove the fuses in the Power Supply Tap to split the power supply system.

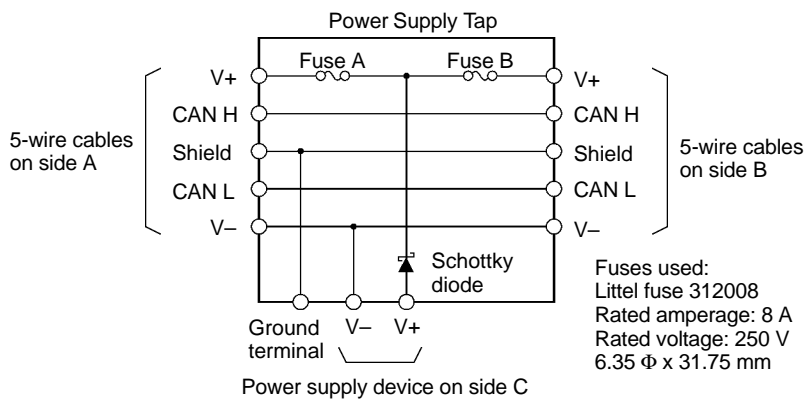
Once the power supply system is split, return to Step 1 or 2, and determine the best location of the nodes in each system.

■ Power Supply Tap Configuration



Model	1485T-R2T5-T5
Specification	Power supply tap (with a grounding terminal and reverse current prevention function)
Manufacturer	Allen-Bradley

■ Internal Circuitry of the Power Supply Tap



2-3-5 Dual Power Supplies

Because diodes are contained in Power Supply Taps, these taps can be used to construct a dual power supply system in the Network. Dual power supply differs from parallel operation of power supplies, so the following restrictions apply.

■ Restrictions

Dual power supply is basically used to ensure backup power supply, not parallel operation of power supplies. Therefore, each power supply to be used must meet the power allocation specifications (i.e., must satisfy steps 1 and 2).

2-4 Communications Line Noise Prevention

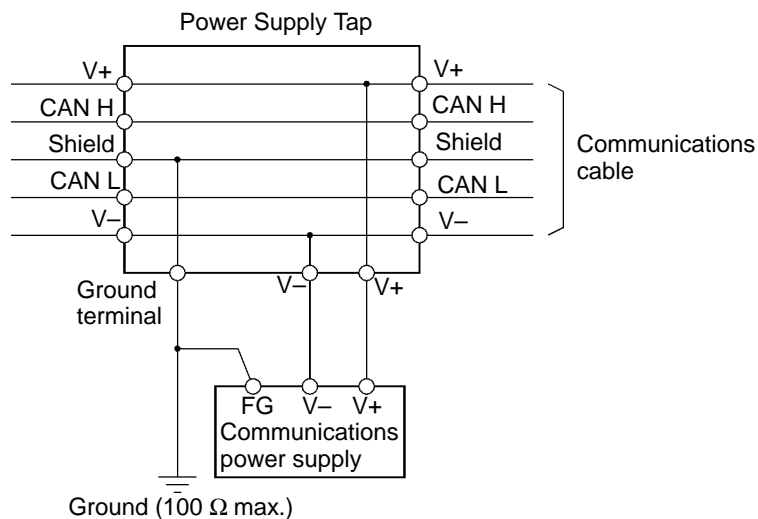
2-4-1 Communications Line Noise

The communications line sends and receives high-speed pulse signals, and checks whether the data is correct by checking the sequence of the signals. If the amount of noise on the communications line is too great, the interference will alter the communications signal data, and communications will be impossible. Communications lines are more sensitive and require higher speeds than normal I/O lines, so be sure that noise does not interfere with communications. Use the preventative noise countermeasures described here when configuring the system to ensure smooth system start up.

2-4-2 Grounding the Network

■ Grounding the Network

The CompoBus/D Network must be grounded at only one location so that a ground loop is not created. The ground should also be connected as close as possible to the center of the Network. Connect the cable shield to the ground terminal on the communications power supply and then connect to a ground of 100 Ω max., as shown in the following diagram.



If more than one communications power supply is connected to the same Network, ground only the one nearest the center of the Network. Do not connect the shield wire at the other power supplies.

Note 1. Always ground the communications cable shield at one and only one location in the Network.

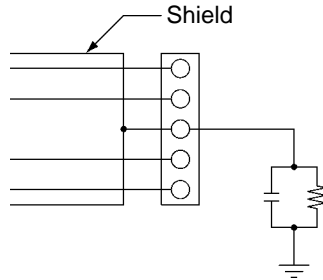
Note 2. Always ground to 100 Ω or less.

Note 3. Always use a separate ground. Never use the same ground as for Inverters or other drive system devices.

■ Grounding the CompoBus/D Communications Unit

The CompoBus/D Communications Unit should be grounded according to DeviceNet recommendations installing a noise filter as shown in the following diagram. The ground is normally wired to the ground terminal (⊕).

Note If the cable grounded to the Inverter is not sufficient and is receiving noise interference, disconnect the grounding cable.



2-4-3 Communications Power Supply Noise Prevention

The communications power supply is the most important power supply in a CompoBus/D Network. The following measures will prevent noise in the communications power supply.

- Use the recommended power supply (S82H/S82J) for communications.
- Use an independent power supply for communications.
- Make sure to install a noise filter on the primary AC input side of the communications power supply.
- Always use a control system power supply for the primary AC side of the communications power supply that is not shared with power devices, such as Inverters or motors.

If noise interference remains in cables for which noise countermeasures have been implemented, the following countermeasures may be effective.

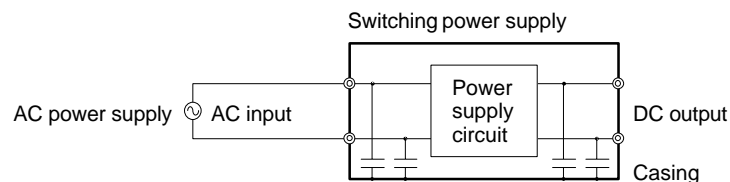
• Communications Cable Shielding

Suspend the communications cable shielding wire without grounding it. This will filter the noise that flows from the ground to the communications cable and will filter the noise current that flows in the shielding wire.

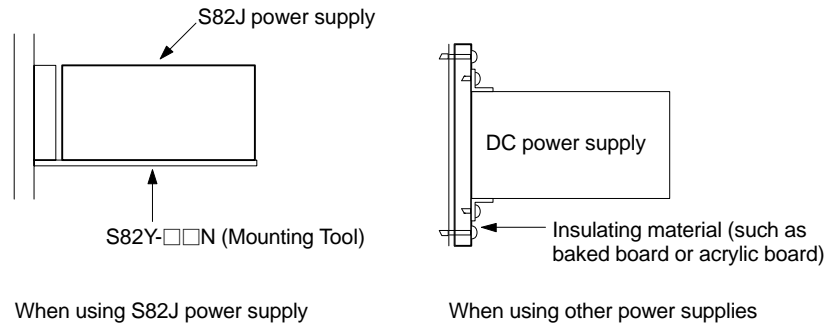
• Communications Power Supply

Suspend the communications power supply without grounding it. This will also filter the noise that flows from the communications power supply ground to the communications cable or the noise current that flows in the shielding wire. The switching power supply is usually connected to the case and the capacitor as shown below. The ground (FG) terminal must be suspended and the control panel for the power supply itself must be insulated.

Switching Power Supply Configuration

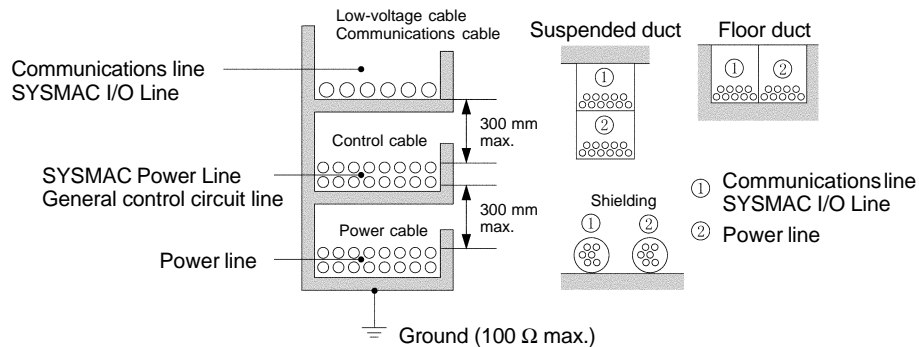


Suspending the Communications Power Supply



2-4-4 Noise Prevention Wiring

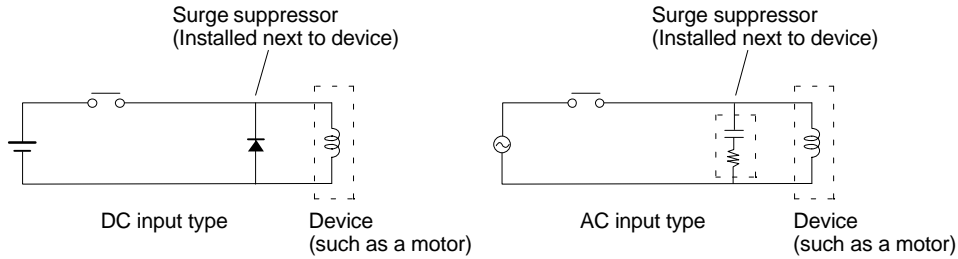
To prevent inductive noise, do not wire the communications line, SYSMAC power lines, and other power lines near to each other. Keep the power lines for Inverters, motors, regulators, and contactors, the communications lines, and the SYSMAC power lines separated from each other by at least 300 mm. Also, provide separate conduits or ducts for the communications lines and power lines.



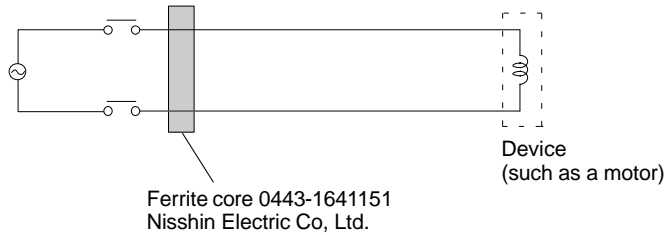
- Do not install communications lines and SYSMAC power lines onto the control panel on which high-voltage devices are mounted.
- Because noise currents flow through metallic equipment (such as casings), the communications cables should be placed as far away from metallic equipment as possible.
- Ground the shielding wire on the communications cable at one point.
- If the same ground is used for the communications cables and communications power supply, there is a possibility that noise may be transmitted through the ground line to the communications line. In order to avoid this, be sure that the power line ground and the grounds for the communications cables and the communications power supply are located as far from each other as possible.

2-4-5 Noise Prevention for Peripheral Devices

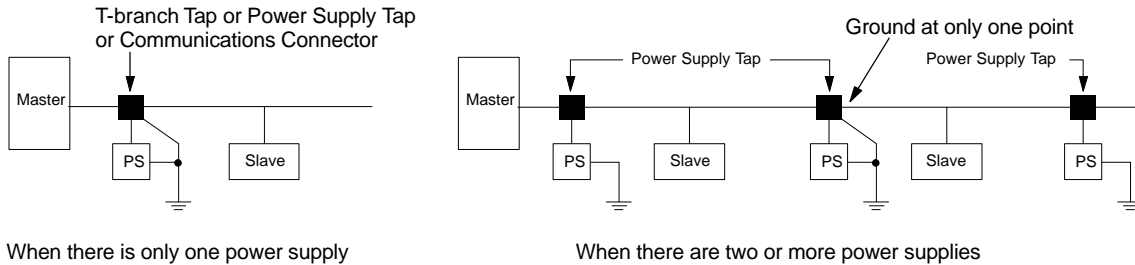
- Install surge suppressors on devices that generate noise, particularly devices that have an inductive component such as motors, transformers, solenoids, and magnetic coils.

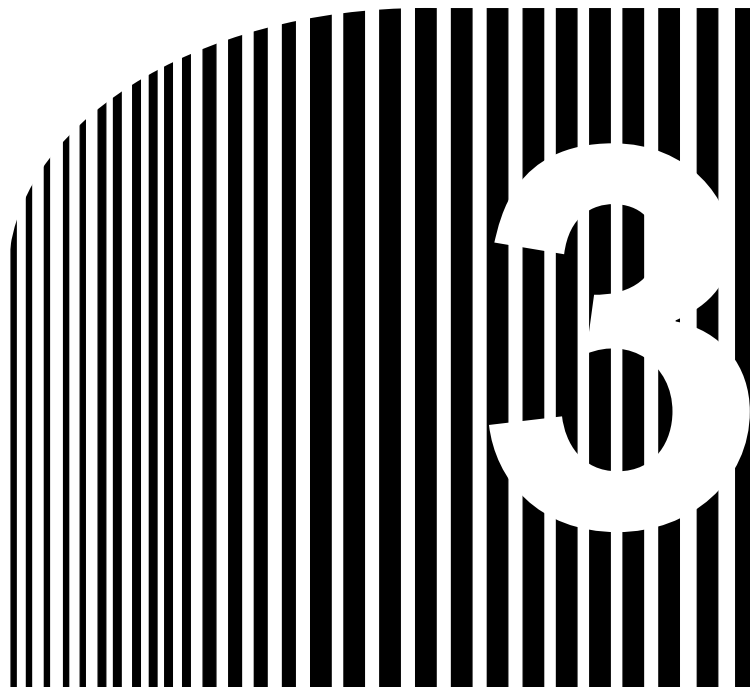


- If a surge suppressor does not fit on the device, installing a ferrite core directly next to the device's contactors, such as a contactor may be effective.



- Insert a line filter on the primary side of the communications power supply.
- When there are two or more communications power supplies, the communications power cables can be grounded by simply connecting a single Power Supply Tap near the center of the communications cable. Do not ground shielding wire at more than one place.





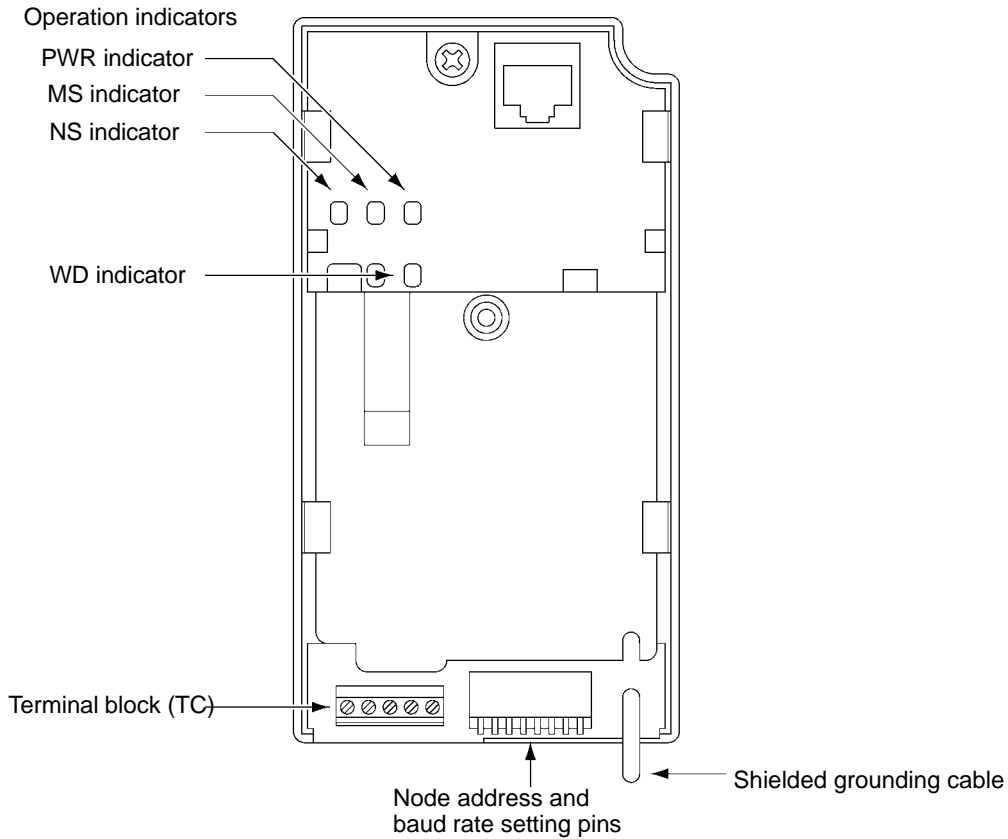
Chapter 3

• Setup and Wiring •

- 3-1 Nomenclature and Settings
- 3-2 Installation and Wiring

3-1 Nomenclature and Settings

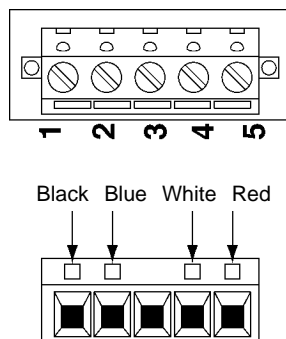
3-1-1 Names of Parts



3-1-2 Terminal Block

The following table provides details of the terminal block connected to the communications line.

Display	Sticker color	Code	Cable color	Details
1	Black	V-	Black	Communications power supply ground.
2	Blue	CAN L	Blue	Communications data low side.
3	---	SG	(Shield)	Shield connection.
4	White	CAN H	White	Communications data high side.
5	Red	V+	Red	Communications power supply, 24 V DC.



3-1-3 Operation Indicators

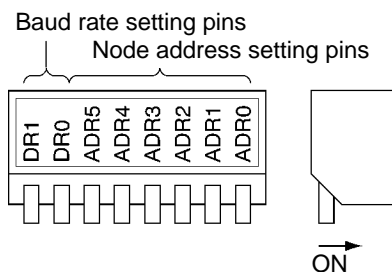
The CompoBus/D Communications Unit has 4 operation indicators that show the status of the power and communications as described in the following table.

Indicator	Display		Meaning
	Color	Status	
PWR	Green	Lit	Power is being supplied from the Inverter to the Unit.
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being supplied to it.
MS	Green	Lit	The Unit is operating normally.
		Flashing	Initial settings or necessary preparations for communications are incomplete.
	Red	Lit	A fatal error (hardware error) has occurred in the Unit.
		Flashing	A non-fatal error, such as a switch setting error, has occurred.
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being supplied to it.
NS	Green	Lit	The CompoBus/D Network (DeviceNet) is operating normally. (Communications connection established.)
		Flashing	The Network is normal, but the communications connection with the Master Unit is not established.
	Red	Lit	A fatal communications error has occurred. A CompoBus/D communications error was detected caused by node address duplication or Bus OFF. (These errors make communications impossible.)
		Flashing	A non-fatal communications error has occurred due to communications timeout.
	---	Not lit	A CompoBus/D Network error has occurred. For example, the Network does not exist, power is not supplied to the Unit, or the baud rates do not match.
WD	Green	Flashing	The CPU Unit of the Unit is operating normally.
	Red	Lit	The CPU Unit of the Unit is not ready or the CPU Unit has malfunctioned.
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being supplied to it.

Note When both of the baud rate setting pins DR0 and DR1 are set to ON, both the MS and NS will be lit in red.

3-1-4 Baud Rate and Node Address Settings

In a CompoBus/D Network, the baud rate can be set to 500 Kbps, 250 Kbps, or 125 Kbps. To manage Master/Slave communications, numbers are assigned as node addresses.



■ Baud Rate Setting Pins










Pin	500 Kbps	250 Kbps	125 Kbps
DR1	ON	OFF	OFF
DR0	OFF	ON	OFF

■ Node Address Setting Pins

Pin	Node Address																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	to	63
ADR5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	to	ON
ADR4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	to	ON
ADR3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	to	ON
ADR2	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	to	ON
ADR1	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	to	ON
ADR0	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	to	ON

- Note 1.** The same node address cannot be used for more than one Slave connected to the communications line.
- Note 2.** Remote I/O allocations in the CPU Unit are affected by the node addresses, so make sure that the remote I/O allocations do not overlap before setting a node address. Refer to *Chapter 4 CompoBus/D System Startup*.

3-2 Installation and Wiring

-  **WARNING** Do not touch the conductive parts such as internal PCBs or terminal blocks while power is being supplied. Doing so may result in electrical shock.
-  **WARNING** Turn ON the input power supply only after mounting the front cover, terminal covers, bottom cover, Operator, and optional items. Leave them mounted in place while power is being supplied. Not doing so may result in electrical shock, malfunction, or damage to the product.
-  **WARNING** Wiring, maintenance, or inspection must be performed by authorized personnel. Not doing so may result in electrical shock or fire.
-  **WARNING** Wiring, maintenance, or inspection must be performed after turning OFF the power supply, confirming that the CHARGE indicator (or status indicators) is OFF, and after waiting for the time specified on the Inverter front cover. Not doing so may result in electrical shock.
-  **WARNING** Do not damage, pull on, apply stress to, place heavy objects on, or pinch the cables. Doing so may result in electrical shock, operation stoppage, or burning.
-  **WARNING** Do not attempt to disassemble or repair the Unit. Doing either of these may result in electrical shock, injury, or damage to the product.
-  **Caution** Do not store, install, or operate the product in the following places. Doing so may result in electrical shock, fire or damage to the product.
- Locations subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Locations subject to corrosive or flammable gases.
 - Locations subject to exposure to combustibles.
 - Locations subject to dust (especially iron dust) or salts.
 - Locations subject to exposure to water, oil, or chemicals.
 - Locations subject to shock or vibration.
-  **Caution** Do not allow foreign objects to enter inside the product. Doing so may result in fire or malfunction.
-  **Caution** Do not apply any strong impact. Doing so may result in damage to the product or malfunction.

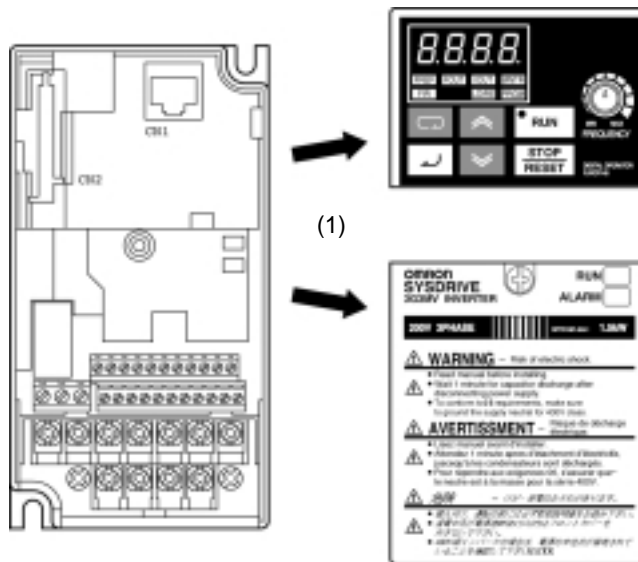
- ⚠ **Caution** Be sure to wire correctly and securely. Not doing so may result in injury or damage to the product.
- ⚠ **Caution** Be sure to firmly tighten the screws on the terminal block. Not doing so may result in fire, injury, or damage to the product.
- ⚠ **Caution** Carefully handle the product because it uses semiconductor elements. Careless handling may result in malfunction.
- ⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations. Not doing so may result in equipment damage.
 - Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields and magnetic fields.
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power supplies.

3-2-1 CompoBus/D Communications Unit Installation

- ⚠ **Caution** Before installing and wiring an Optional Unit, always turn OFF the power to the SYS-DRIVE 3G3MV Inverter and wait for the CHARGE indicator to turn OFF.

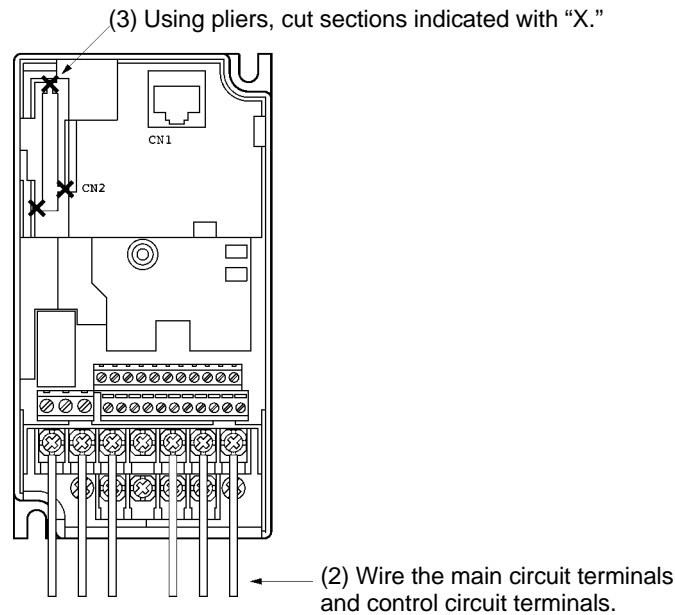
■ Mounting Procedure

1. Turn OFF the main circuit power supply for the Inverter, wait for at least one minute from the time the LED indicator or the CHARGE indicator goes out, and remove the front cover of the Inverter along with the Operator.

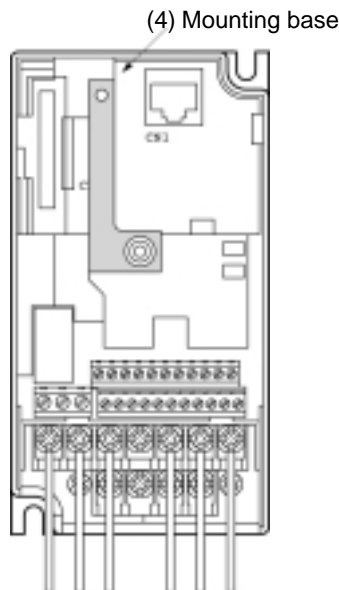


2. Wire the main circuit terminals and control circuit terminals of the Inverter. (When the Communications Unit is mounted, the terminal block of the Inverter will be covered. Therefore, be sure to complete wiring for the Inverter terminals first.)

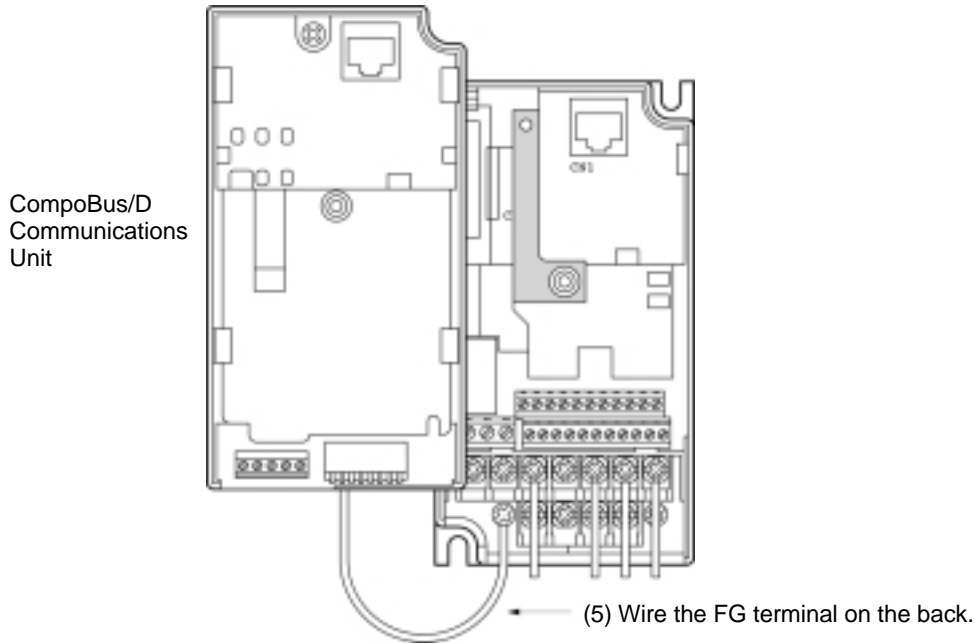
- When the Operator of the Inverter is removed, it will be possible to see a block secured at three places underneath. Using pliers or another appropriate tool, loosen the fixings, and remove the block. The connector for Optional Unit connections will become visible. At this point, ensure that dirt or foreign objects do not enter the connector.



- Mount the mounting base (included as an accessory) onto the screw-holes originally used for holding the Operator and the terminal cover to the body of the Inverter, and using the screws provided as accessories, secure the mounting base.



- On the opposite side of the CompoBus/D Communications Unit, there is a ground terminal that is connected to the shielded wire for the Communications Cable. Connect this ground terminal to the FG terminal of the Inverter.



- After aligning the positions of the CompoBus/D Communications Unit connector and the Inverter connector, push the frames of the Inverter and the Unit together until they click.
- Tighten the fixing screws on the upper part of the CompoBus/D Communications Unit, to the mounting base attached in step 4.
- Perform wiring for the communications cables, and perform the communications settings (baud rate and node address).
- Attach the Operator and the terminal cover to the front side of the CompoBus/D Communications Unit, and secure them by tightening the screw in the center.

3-2-2 Communications Cable Wiring

■ Connecting Communications Cables

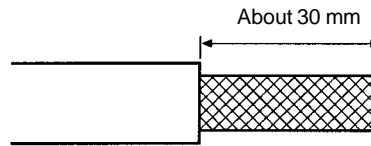
This section explains how to prepare and connect the communications cables to connectors for the CompoBus/D Network.

Use the following procedure to prepare and connect the communications cables to the connectors.

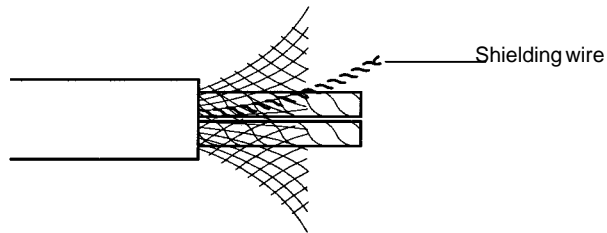
Note For connecting of the CompoBus/D Communications Unit of the Inverter, use DCA1-5C10 Thin Cables.

Thick Cables cannot be used for this kind of wiring because of the terminal block dimensions.

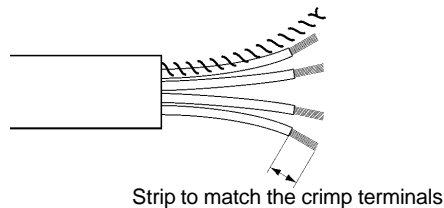
1. Remove about 30 mm of the cable covering, being careful not to damage the shield weaving underneath. Do not remove more than about 30 mm; removing too much of the covering can result in short circuits.



2. Carefully peel back the weaving to reveal the signal lines, power lines, and the shielding wire. The shielding wire will be loose on the outside of the other lines, but it is harder than the weaving.

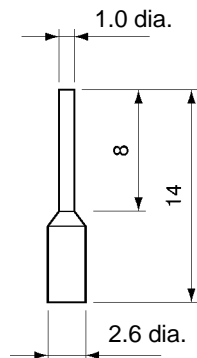


3. Remove the exposed weaving and the aluminum tape from the signal and power lines. Strip the covering from the signal and power lines to the proper length for the crimp terminals. Twist together the wires of each of the signal and power lines.



■ **CompoBus/D Communications Unit Crimp Terminal**

To further improve the reliability and ease of wiring, use the following straight crimp terminal when wiring the communications cable to the terminal block of the CompoBus/D Communications Unit.



Model: A1 0.5–8 WH (by Phoenix Contact)

Unit: mm

■ **CompoBus/D Communications Unit Terminal Block Wiring Procedure**

1. Loosen the terminal screws using a thin flat-blade screwdriver.
2. Insert the wires from underneath the terminal block.

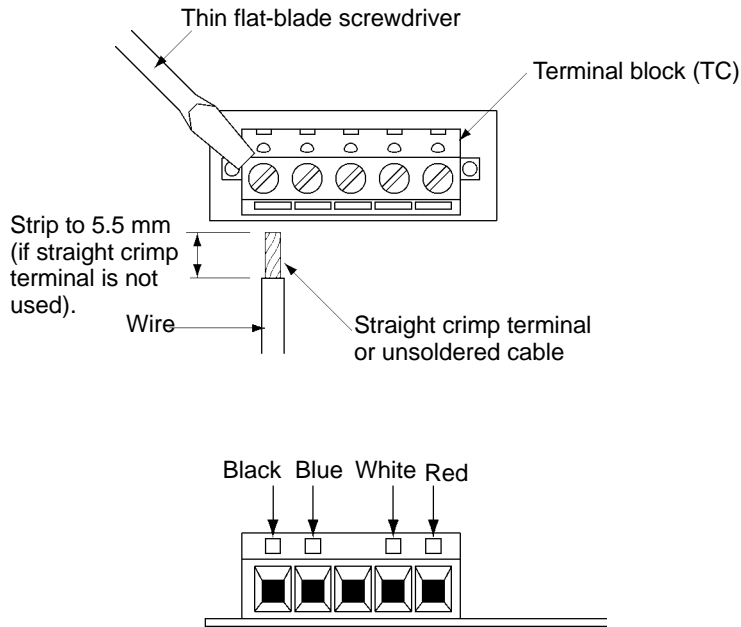
3. Tighten the terminal screws securely to a torque of 0.22 to 0.25 N□m.

Note 1. Separate the CompoBus/D communications cables from the main circuit wiring and other power lines.

Note 2. Do not solder the ends of the electric wires. Doing so may cause contact failure.

Note 3. If straight crimp terminals are not used, strip the electrical wires to a length of 5.5 mm.

Note 4. Do not tighten the screws to a torque exceeding 0.22 to 0.25 N□m. Doing so may damage the terminal block. If the screws are too loose, however, malfunctions or short circuits may result.



■ Connecting Communications Cables to T-branch Taps

For connecting the CompoBus/D Communications Unit, use DCA1-5C10 Thin Cables and branch them from the T-branch Tap. This is done for reasons of terminal block dimensions and easy maintenance.

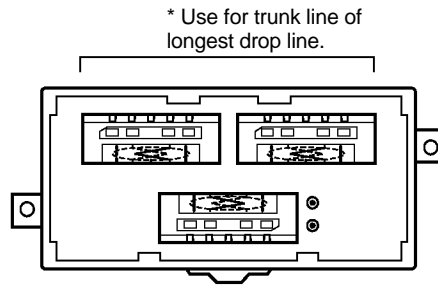
Note 1. Thick Cables cannot be used for this wiring.

Note 2. As for multi-drop wiring, use Thin Cables for direct insertion.

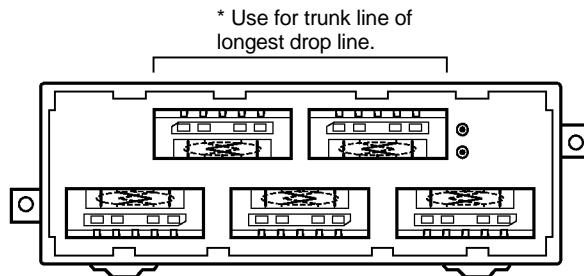
This section shows how to connect a communications cable with a connector attached to a T-branch Tap. There are two kinds of T-branch Taps, one makes a single branch and the other makes three branches, but the cable connections are the same for both.

The connectors indicated by asterisks in the following diagrams have the least resistance and these connectors should be used for the trunk line connections. When using a T-branch Tap on a drop line, connect the longest drop line to these connectors.

● DCN1-1C T-branch Tap



● DCN1-3C T-branch Tap

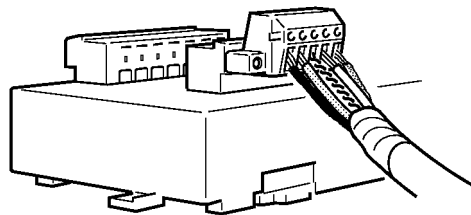


● T-branch Tap Connectors

The required number of connectors (on cable side) for T-branch Taps are supplied with the product.

Name	COMBICON Plug with Screw Flange
Model	MSTBP 2515-STF-5.08 AB AU SO
Manufacturer	Phoenix Contact

Align the cable connector with the socket on the T-branch Tap as shown in the following diagram and fully insert the connector into the socket. Tighten the set screws to secure the connection. Tighten the screws to a torque of 0.3 N□m.



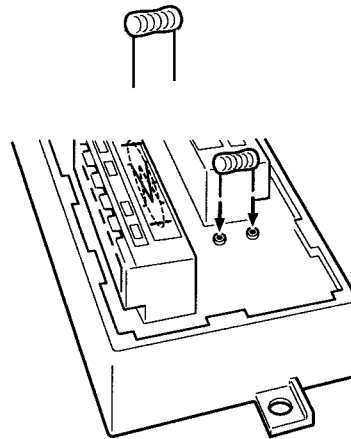
Note To avoid damaging the cable or breaking wires, do not pull on the cable or bend it too sharply when connecting it to the T-branch Tap. Also, never place heavy objects on top of the cable.

■ Connecting Terminating Resistors

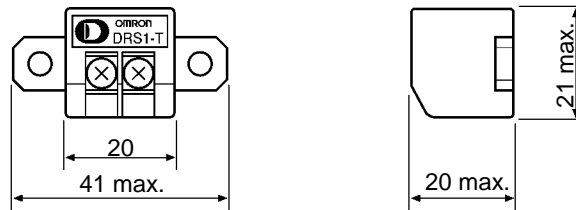
Terminating resistors must be connected at each end of the trunk line. Use the methods described here to connect the Terminating Resistors.

● T-branch Tap Terminating Resistor

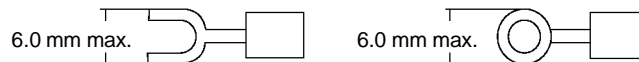
A Terminating Resistor is included with the T-branch Tap. Insert the Terminating Resistor into the T-branch Tap as shown in the following diagram. The Terminating Resistor can face in either direction.



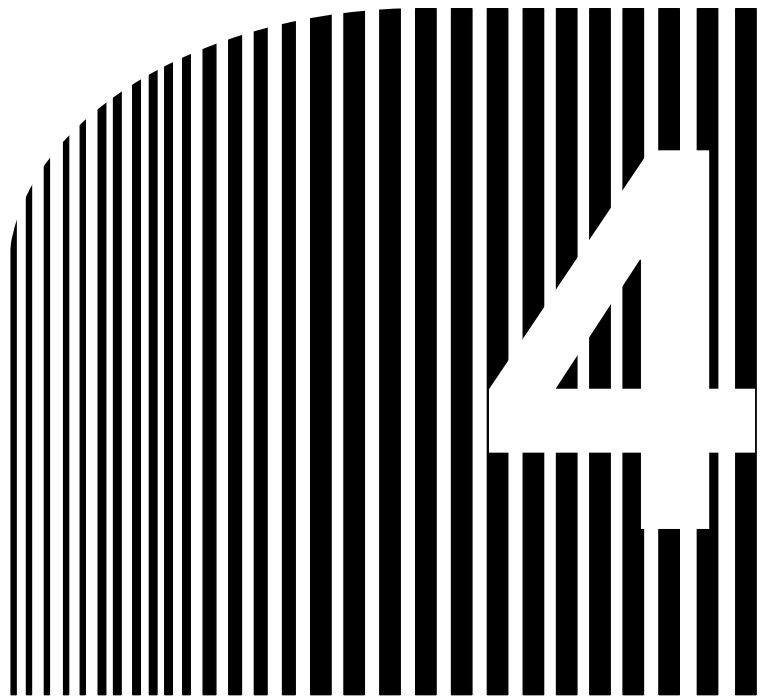
● Terminal-block Terminating Resistor



A Terminating Resistor is built into the Terminal-block Terminating Resistor. To connect the cable to the Terminating Resistor, attach standard M3 crimp terminals to the signal wires and securely screw the terminals to the Terminal-block Terminating Resistor. Tighten to a torque of 0.5 N·m.



Note To avoid damaging the cable or breaking wires, do not pull on the cable or bend it too sharply when connecting it to the terminal block. Also, never place heavy objects on top of the cable.



Chapter 4

• CompoBus/D System Startup •

- 4-1 SYSMAC Word Allocations and Scan List
- 4-2 SYSDRIVE 3G3MV Settings
- 4-3 Startup Procedure

4-1 SYSMAC Word Allocations and Scan List

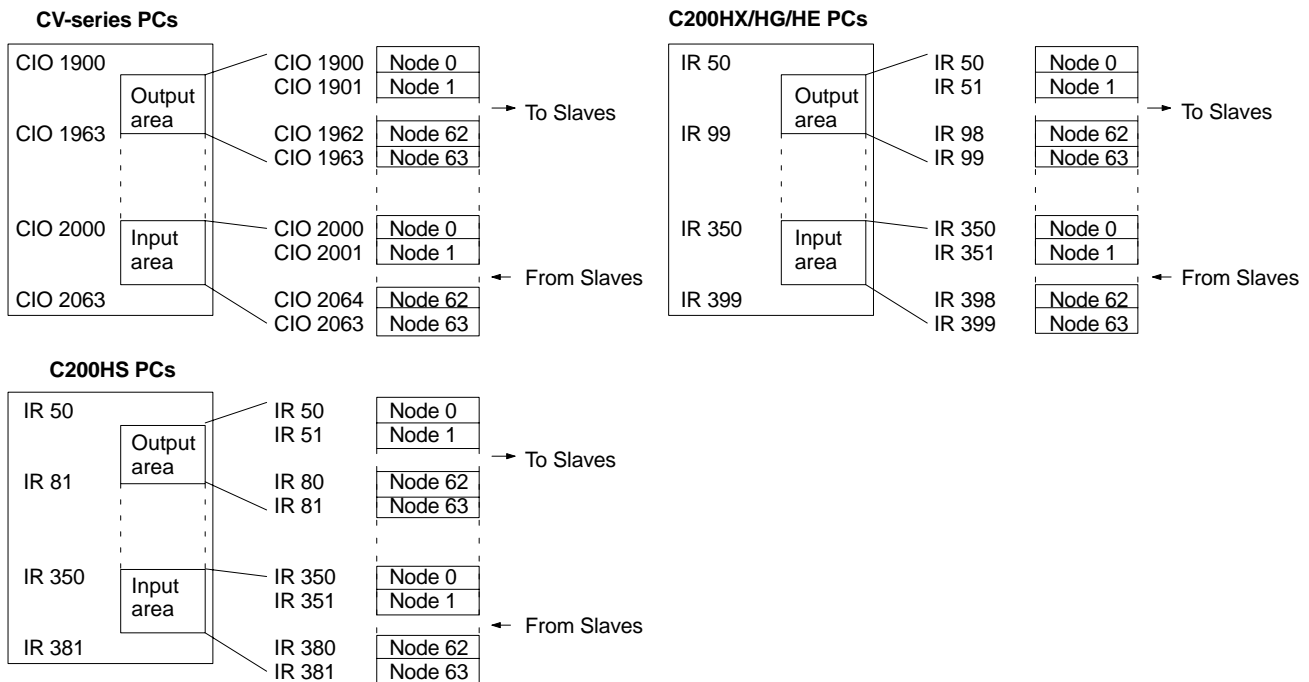
In a CompoBus/D Network, remote I/O and message communications can be used simultaneously. This section describes remote I/O communications, particularly the memory words allocated in the SYSMAC PC that correspond to the remote I/O of the Slaves.

4-1-1 Overview and Restrictions of Word Allocations

■ Fixed Allocation: Without Configurator

If a Configurator is not used, default word allocations are used in the CompoBus/D Master Unit. The remote I/O is allocated in the order of CompoBus/D node addresses and the words are divided into output areas and input areas. The word allocation default settings of the Master Unit are set based on the assumption that one node should occupy one input word and one output word. Output words will be allocated even to Units that are used only for input.

For Units that require two input words or two output words, the node addresses to which the second word is normally allocated cannot be set. If it is set, the word allocations will overlap.



Each node address is allocated one input and one output word starting from node 00. If a Slave requires more than one input or one output word, then it is assigned more than one node address. If a Slave requires less than one word, it simply uses the rightmost bits in the word allocated to it.

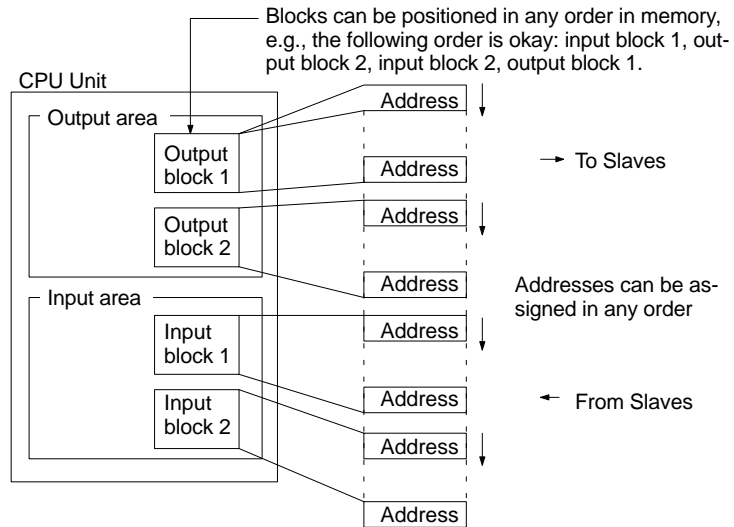
■ Free Allocation: With Configurator

A Configurator can be used to allocate words in the CompoBus/D Master Unit in any order by calling parameters of the Master Unit and changing the word allocation of parameters. The following allocations are possible when using a Configurator.

- Output words do not need to be allocated to Input Units, only input words.

- Slaves that require two words can be allocated two words using only one node address so that the next node addresses can be set for another Slave.
- Remote I/O words can be allocated in sequence regardless of the order of the node addresses.

Note The Configurator uses one node address. Therefore, the number of Slaves that can be connected is reduced if the Network is to be operated with the Configurator still connected. The Configurator can be removed, however, after the words have been allocated, and then another Slave can be connected to the Network in its place so that the number of Slaves that can be connected is not reduced.



Words are freely allocated to the Slaves and I/O blocks can be set as desired. Each node must be allocated at least one byte (leftmost or rightmost). If a Slave requires more than one input or one output word, then it can be allocated more than one input or output word. If a Slave requires less than one word, it will use either the rightmost or leftmost bits in the word allocated to it.

Free Allocation Restrictions

The following restrictions apply when freely allocating remote I/O.

- The remote I/O allocated to one Slave cannot be separated, i.e., all input words must be consecutive, as must all output words. Inputs and outputs, however, can be separated.
- With a Slave requiring more than one word, a series of allocations cannot be started from the leftmost byte of the remote I/O. The leftmost byte, however, can be allocated to a Slave requiring only 8 bits.
- Multiple words cannot be allocated as the remote I/O for a single Slave.
- A Slave cannot be assigned to more than one Master Unit.

4-1-2 Scan Lists

The Scan List

Scan lists record information in the Master Unit on the Slaves that are connected to them. If the scan list is enabled, the information on each Slave is recorded, and can be used to determine normal CompoBus/D communications. The scan list provides the following information on each Slave.

- Slave remote I/O allocations providing the number of I/O words allocated to and the node address set for each Slave.
- Communications parameters providing the initial remote I/O communications status and the communications cycle time settings.

■ **Scan List Application**

A scan list is not required for a Network with only one Master Unit and remote I/O that is allocated according to the fixed settings. The scan list is necessary, however, in the following cases.

- To confirm the increase or decrease of Slaves on the communications line, and to detect errors in a Network where the number of Slaves has increased or decreased, it is necessary to record the system status.
- For free allocation of remote I/O, it is necessary to record the number of I/O words allocated to each Slave.
- When using multiple Master Units to exchange information with the SYSMAC PC (CPU Unit), it is necessary for each Master Unit to record the node addresses for each Slave.

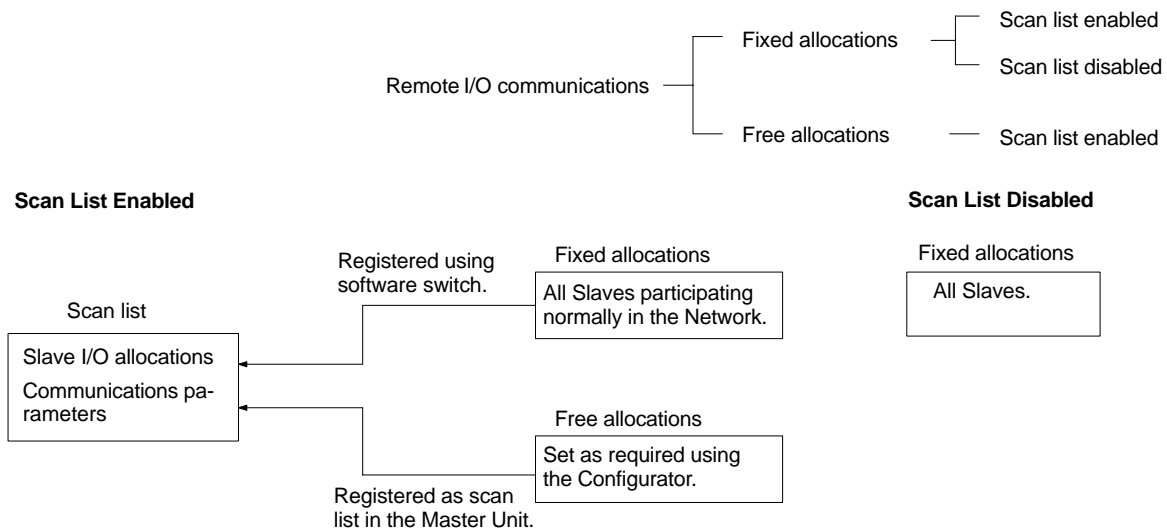
■ **Creating Scan Lists**

● **Fixed Remote I/O Allocations**

A scan list can be created by turning ON the Enable Scan List software switch when the CPU Unit is in PROGRAM mode, when communications are active and the scan list is disabled. All Slaves that are participating normally in the Network will be registered in the scan list.

● **Free Remote I/O Allocations**

The user creates the scan list using the Configurator and then registers it in the Master Unit. Settings for all Masters and Slaves participating normally in the Network are used as a basis for creating the scan list.



Note The scan lists created with the Configurator will be required again for registration in the Master Unit if the Master Unit is ever set to disable the scan list or if the Master Unit is replaced. Be sure to save any scan lists created with the Configurator as network files or master parameter files.

■ Using Scan Lists

● Enabling/Disabling a Scan List

To enable a scan list, turn ON the Enable Scan List software switch or use the Configurator. To disable a scan list, turn ON the Clear Scan List software switch.

Note 1. Scan lists cannot be disabled from the Configurator. The scan list will always be enabled when created on the Configurator and registered in a Master Unit.

Note 2. Always enable the scan list during actual system operation. Although operation is possible with the scan list disabled when the fixed allocations are used, communications will continue even if Slaves fail, creating the possibility of undetected errors in system operation.

● Scan List Enabled

When a scan list is enabled, communications are performed according to the scan list stored in the Master Unit's non-volatile memory. Either fixed allocation or free allocation of remote I/O is possible.

The Master will communicate only with the Slaves registered in the scan list. A verification error will occur if a Slave registered in the scan list does not exist in the Network or is not started when I/O communications begin. Even if it is properly connected in the Network, a Slave which is not registered in the scan list will not participate in communications and will not be checked for errors.

● Scan List Disabled

When a scan list is disabled, communications are performed without using the scan list. The scan list is disabled when the scan list has not been created or it has been cleared. Do not disable the scan list during actual system operation.

All of the Slaves in the Network can communicate with the scan list disabled, so Slaves can be added to the Network while communications are in progress. Without a scan list, however, there is no way to check for Slaves that have not started or have failed, and errors can thus go undetected. The communications cycle time will be much longer than the computational value when the scan list is disabled.

When a scan list is disabled, operation is possible only by using the fixed I/O allocations. Free allocation is not possible.

Note 1. The scan list is automatically enabled when the Configurator is used to allocate remote I/O. If the software switch is used to clear the scan list, remote I/O communications will operate under the default allocations with the scan list disabled. Always confirm that the system is stopped before disabling the scan list in a Master Unit. This is particularly important if there is more than one Master on the same Network. If the scan list is disabled for one of the Masters, normally communications will not be possible.

Note 2. The scan list data in a Master Unit is deleted whenever the scan list is disabled.

4-1-3 Fixed Word Allocations

■ Allocation Areas for Different PCs

If fixed allocations are used, the node addresses and the words allocated to them are determined according to the PC used. The remote I/O allocation area consists of the input area that receives input from the Slaves, and the output area that writes output data to the Slaves.

Node address	SYSMAC Programmable Controllers					
	CV-series PCs		CS1-series and C200HX/HG/HE PCs		C200HS PCs	
	Output area (CIO 1900 to CIO 1963)	Input area (CIO 2000 to CIO 2063)	Output area (IR 50 to IR 99)	Input area (IR 350 to IR 399)	Output area (IR 50 to IR 81)	Input area (IR 350 to IR 381)
0	CIO 1900	CIO 2000	IR 50	IR 350	IR 50	IR 350
1	CIO 1901	CIO 2001	IR 51	IR 351	IR 51	IR 351
2	CIO 1902	CIO 2002	IR 52	IR 352	IR 52	IR 352
...
30	CIO 1930	CIO 2030	IR 80	IR 380	IR 80	IR 380
31	CIO 1931	CIO 2031	IR 81	IR 381	IR 81	IR 381
32	CIO 1932	CIO 2032	IR 82	IR 382	---	---
...	---	---
48	CIO 1948	CIO 2048	IR 98	IR 398	---	---
49	CIO 1949	CIO 2049	IR 99	IR 399	---	---
50	CIO 1950	CIO 2050	---	---	---	---
...	---	---	---	---
62	CIO 1962	CIO 2062	---	---	---	---
63	CIO 1963	CIO 2063	---	---	---	---

Note 1. The words corresponding to the node address of the Master Unit are not actually used by the Master Unit, so they can be used by other Slaves. The actual node address of the Master Unit, however, cannot be the same as the node address of another Slave.

Note 2. When Slaves made by other companies are used that are for either output only or input only, both the output area and the input area may be used depending on the status information. Therefore, be sure to check the specifications of the Slave before using any word allocated to a Slave.

■ I/O Allocations and Errors

A setup error may occur when the scan list is disabled or a verification error may occur when the scan list is enabled if I/O allocations are not correct.

● Setup Error: I/O Area Overlap

A setup error (I/O Area Overlap) will occur and it will not be possible to start CompoBus/D communications if the same word is used by more than one Slave connected to a SYSMAC Master Unit. This error will occur only when the scan list is disabled.

To eliminate the I/O area overlap and clear this error, change the node address setting on one of the Slaves and restart the Master Unit by turning ON the power again or restarting.

● Setup Error: I/O Area Range Violation

A setup error (I/O Area Range Violation) will occur and it will not be possible to start CompoBus/D communications if node addresses are set at values that exceed the specified range, or if Slaves that use multiple words are using more words than are specified in the I/O area. This error will occur only when the scan list is disabled.

To eliminate the above problems and clear this error, change the node address setting on the Slaves and restart the Master Unit by turning ON the power again or restarting.

● **Verification Error: Slave I/O Size Differs**

A verification error (Slave I/O Size Differs) will occur and it will not be possible to start CompoBus/D communications if a Master Unit is being used with the scan list enabled and the type of I/O (input or output) or the number of I/O points registered for a Slave in the scan list does not match the actual I/O specifications of the Slave that is connected to the Master Unit. This error will occur only when the scan list is enabled.

To eliminate and clear this error, either create the scan list again or replace the Slave with the kind of Slave registered in the scan list.

Note The scan list verification is performed in byte units (8 bits). A verification error will therefore not occur if a 1-point Input Slave is used instead of an 8-point Input Slave.

■ **Fixed Allocation Example**

Node address	Output points	Input points		Output area		Input area	
0	0	8	CIO 1900	Allocation not possible		CIO 2000	Allocation not possible Allocated
1	8	0	CIO 1901	Allocation not possible Allocated		CIO 2001	Allocation not possible
2	0	16	CIO 1902	Allocation not possible		CIO 2002	Allocated
3	16	0	CIO 1903	Allocated		CIO 2003	Allocation not possible
4	8	8	CIO 1904	Allocation not possible Allocated		CIO 2004	Allocation not possible Allocated
5	16	16	CIO 1905	Allocated		CIO 2005	Allocated
6	0 ...	48	CIO 1906	Allocation not possible		CIO 2006	Allocated
7	Master Unit (see note 2)		CIO 1907	Allocation possible		CIO 2007	Allocated
8	32 ...	0	CIO 1908	Allocated		CIO 2008	Allocated
9	(see note 3)		CIO 1909	Allocated		CIO 2009	Allocation possible
10			CIO 1910	Allocated		CIO 2010	Allocated
11	32 ...	32	CIO 1911	Allocated		CIO 2011	Allocated
12	None	None	CIO 1912	Not used		CIO 2012	Not used
63	None	None	CIO 1963	Not used		CIO 2063	Not used

Note 1. The above example is for allocations in a CV-series PC.

Note 2. The Master Unit is not allocated any words, so any available node address can be used as node address 7.

Note 3. Slaves can be allocated to the words labeled “Allocation possible” as long as the same words are not allocated to more than one Slave.

■ **Basic Application Procedure**

1. Set the initial settings for the Master Unit:

Unit number (“UNIT No.” or “MACHINE No.” on front panel switch)

Node address (back panel DIP switch)

Baud rate (front panel DIP switch)

Communications continue/stop setting for communications error (front panel switch)

2. Set the initial settings for the Slaves:

Node address (DIP switch)
Baud rate (DIP switch)
Etc.

3. Mount the Master Unit and wire the Network.

For CV-series PCs, Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

For CS1-series PCs or C200HX/HG/HE PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

For C200HS PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

4. Connect a Programming Device to the PC and turn ON the power supply to the PC.

5. Generate the I/O table.

6. Turn ON the power supply to the Slaves and turn ON the communications power supply.

7. Switch the PC to PROGRAM mode.

8. Perform the following and go to step 11. if the scan list was disabled at startup.

- a) Confirm that communications are possible with the registered slaves by monitoring the Registered Slave Data Area.
- b) From a Programming Device connected to the PC, turn ON the Scan List Enable Bit in the software switches (bit 0).

Remote I/O communications will start with the scan list enabled. The software switches can be used to start and stop remote I/O communications.

9. Perform the following from the Programming Device connected to the PC and go to step 11. if the scan list was enabled at startup and you want to re-register the scan list.

- a) Turn ON the Scan List Clear Bit in the software switches (bit 1).
- b) Confirm that communications are possible with the registered slaves by monitoring the Registered Slave Data Area.
- c) Turn ON the Scan List Enable Bit in the software switches (bit 0).

Remote I/O communications will start with the scan list enabled. The software switches can be used to start and stop remote I/O communications.

10. Do nothing if the scan list was enabled at startup and the scan list does not need to be changed.

Remote I/O communications will start with the scan list enabled. The software switches can be used to start and stop remote I/O communications. Go to step 11.

11. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.

12. Switch the PC to RUN mode.

4-1-4 Free Allocations

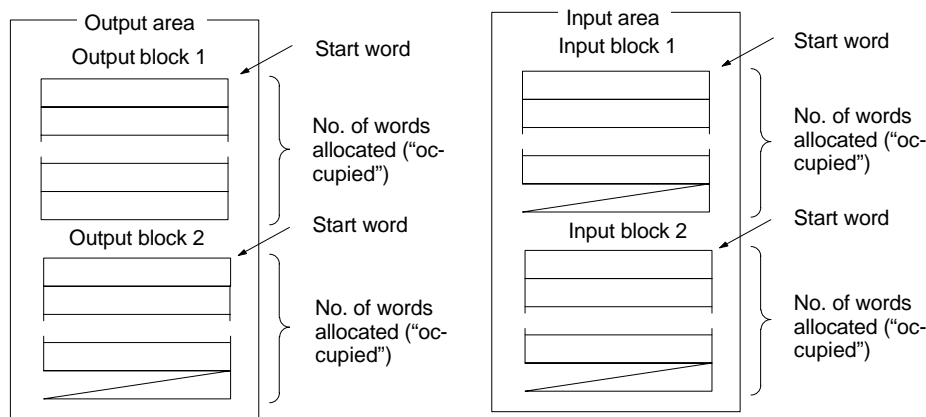
■ Allocation Areas and Maximum Words for Different PCs

When free allocations are used, the remote I/O areas consist of input blocks 1 and 2, which input Slave data to the PC, and output blocks 1 and 2, which output data from the PC to the Slaves. These four blocks can be allocated as desired using the following words. Each block, however, must consist of continuous words within one data area.

PC	SYSMAC Programmable Controllers					
	CV-series PCs		CS1-series PCs (all models)	C200HX/HG/HE PCs		C200HS PCs (all models)
	CV500/CVM1-CPU01-E	All other models		C200HE-CPU11-E	All other models	
Words that can be allocated	CIO 0000 to CIO 2427	CIO 0000 to CIO 2555	CIO 000 to CIO 235, CIO 300 to CIO 511	IR 000 to IR 235, IR 300 to IR 511		IR 000 to IR 235, IR 300 to IR 511
	G008 to G255		HR 000 to H099, CIO 1000 to CIO 1063	HR 00 to HR 99 LR 00 to LR 63		HR 00 to HR 99 LR 00 to LR 63
	D00000 to D08191	D00000 to D24575	D00000 to D05999	DM 0000 to DM 4095	DM 0000 to DM 5999	DM 0000 to DM 5999
Maximum number of words	Each block can be up to 100 words (including unused areas).		Each block can be up to 100 words (including unused areas). The total number of words in all four blocks must be 300 words or less (including unused areas). If message communications are used, the total number of words in all four blocks must be 100 words or less.		The total number of words in all four blocks must be 80 words or less (including unused areas).	

Note 1. The Data Memory (DM) Area cannot be manipulated by bit, so it is not suitable as the remote I/O allocation area for the Inverter.

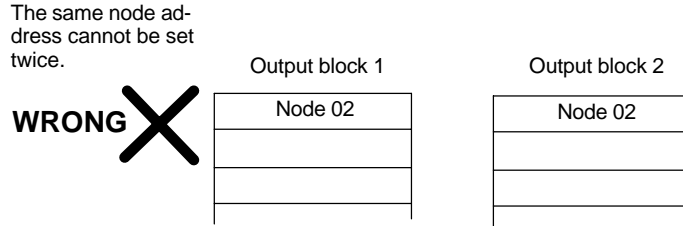
Note 2. If a CPU Bus Link is used with a CV-series PC, the G Area is used for the CPU Bus Link, making it impossible to use this area for CompoBus/D communications.



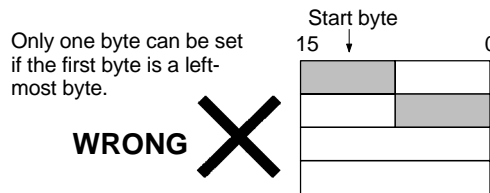
Note Using a Configurator, set the areas for each block, the start word, and the allocated words for each block.

Free Allocation Restrictions

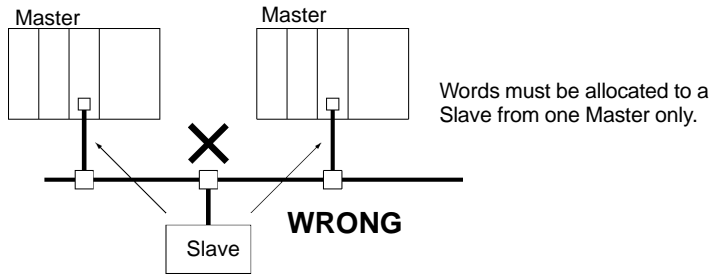
- Each node address can be set only once in the output blocks and once in the input blocks.



- If a Configurator is used to freely allocate words or bytes to each Slave, only a Slave using only one byte (8 bits) can be set in the leftmost byte of the allocated word. Slaves with more than 8 bits cannot be set for the leftmost bit of the allocated word.



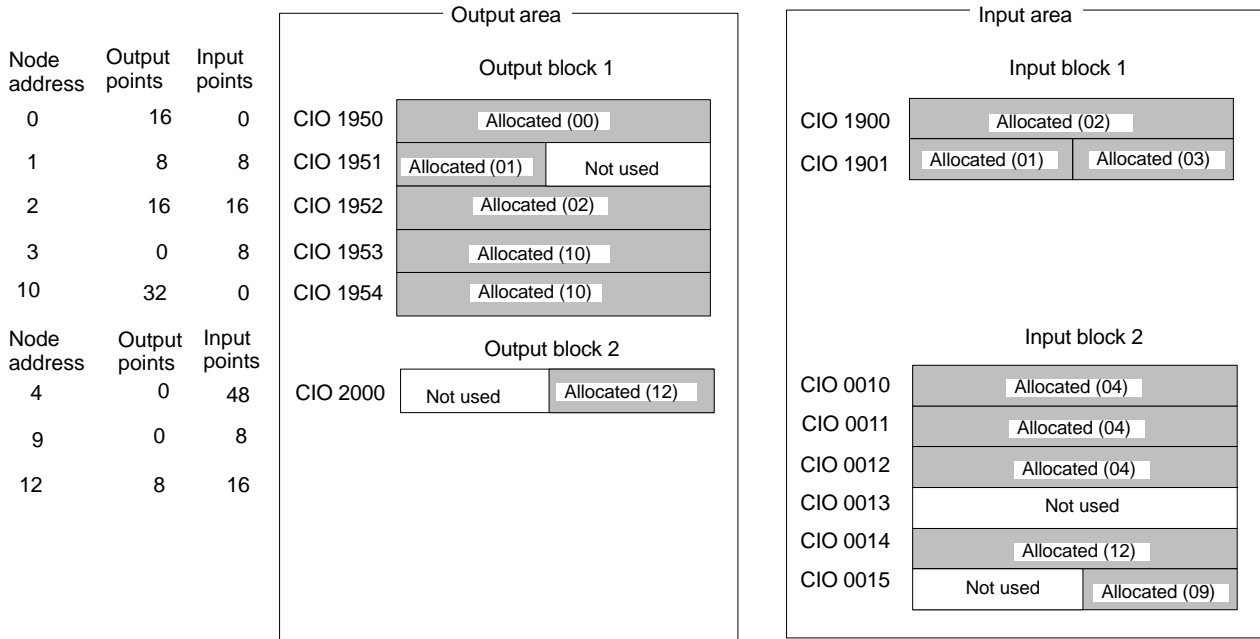
- The same Slave cannot be allocated words in more than one Master.



Note The master parameter file duplication check from the Configurator can be used to check for node addresses that have been set more than once in the scan list, which shows the I/O allocations that have been made.

- Always use the Configurator when there is more than one Master and enable the scan lists. A Bus OFF error can occur if there is more than one Master with the scan list disabled on the same Network.

■ Example of Free Allocations



Note The above example is for a CV-series PC.

■ Basic Application Procedure

1. Set the initial settings for the Master Unit:

- Unit number (“UNIT No.” or “MACHINE No.” on front panel switch)
- Node address (back panel DIP switch)
- Baud rate (front panel DIP switch)
- Communications continue/stop setting for communications error (front panel switch)

2. Set the initial settings for the Slaves:

- Node address (DIP switch)
- Baud rate (DIP switch)
- Etc.

3. Mount the Master Unit and wire the Network.

For CV-series PCs, Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack. Up to 16 Master Units can be mounted if a Configurator is used.

For CS1-series PCs or C200HX/HG/HE PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Up to 10 or 16 Master Units can be mounted if a Configurator is used.

For C200HS PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Up to 10 or 16 Master Units can be mounted if a Configurator is used.

4. Connect a Programming Device to the PC and turn ON the power supply to the PC.
5. Generate the I/O table.
6. Turn OFF the power to the PC.
7. Go to step 8. if only one Master Unit is being used and to step 15. if more than one Master Unit is being used in the same Network.

8. Connect a Configurator to the Network.
9. Turn ON the power supply to all nodes.
10. Switch the PC to PROGRAM mode.
11. Get the device list and create the master parameters with the Configurator.
12. If more than one Master Unit is mounted to the same PC, use the Configurator to check for duplication in the master parameter settings.
13. Register the master parameters in the Master Unit(s).
14. Go to step 28.
15. Connect a Configurator to the Network.
16. Turn ON the power supply to all the Slaves.
17. Read the Network configuration from the Configurator.
18. Turn OFF the power supply to all the Slaves.
19. Create the master parameters for each Master Unit and save the parameters in files.
20. Turn ON the power supply to one PC (i.e., to one of the Master Units).
21. Switch the PC to PROGRAM mode.
22. Read the Network configuration from the Configurator.
23. Read the master parameter file for the Master Unit that has been turned ON from the master parameter editing screen.
24. Write the master parameters created in the above step 19.
25. Turn OFF the power supply to the PC (i.e., the Master Unit) and the Slaves.
26. Repeat the above steps beginning at step 20. for all Master Units.
27. Turn ON the power supply to all Masters and Slaves.
28. Remote I/O communications will start with the scan list enabled. (Communications will not start if they have been set to be stopped at startup from the Configurator.) Use the software switches or Configurator to start and stop remote I/O communications.
29. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
30. Read the Network configuration from the Configurator.
31. Save the Network configuration in a file from the Configurator.
32. Switch the PC to RUN mode.

4-2 SYSDRIVE 3G3MV Settings

In order to perform CompoBus/D communications, it is necessary to make settings for the Inverter according to the application.

Note The parameters set here are applied to the CompoBus/D Communications Unit when the power is turned ON. Turn OFF the power after changing parameters and turn ON again to apply them.

4-2-1 Run Command Selection

Constant	Register number (Hex)	Name	Content	Setting range	Setting unit	Default setting	Write during operation
n003	0103	Run command source selection	<p>Selects the run/stop command input method for the Inverter. (Becomes valid when the Remote mode is selected from Local/Remote.)</p> <p>0: Run/stop commands from the Digital Operator are valid.</p> <p>1: Terminal block (multi-function input) run commands are valid.</p> <p>2: RS-422/485 communications run commands are valid.</p> <p>3. Run commands from the Optional Unit (CompoBus/D Communications Unit) are valid.</p> <p>Note In Local mode, run commands are restricted to those performed using the operation keys of the Digital Operator.</p>	0, 1, 2, 3	1	0	No

Perform the above setting according to the source of the run commands (forward operation, reverse operation, STOP) in the application. When run commands (forward operation, reverse operation, STOP) are always to be made from CompoBus/D communications, set to “3.”

● Switching of Run Commands from CompoBus/D Communications

There is a switching signal, “Net. Ctrl.,” for run commands from the standard remote I/O of the CompoBus/D Communications Unit. The input method for run commands can be changed in the following way using the “Net. Ctrl.” signal.

Net. Ctrl. = 1 (ON): Automatically sets the n003 constant to “3,” making run commands from CompoBus/D communications valid (remote I/O run commands become valid). If the bit turns OFF, n003 will return to its original value.

Net. Ctrl. = 0 (OFF): The run command input method specified by n003 becomes valid.

4-2-2 Frequency Reference Selection

Con-stant	Register number (Hex)	Name	Content	Setting range	Setting unit	Default setting	Write during operation
n004	0104	Fre- quency reference source selection	<p>Selects the frequency reference input method for the Inverter. (Becomes valid when the Remote mode is selected from Local/Remote.)</p> <p>0: Digital Operator frequency settings are valid.</p> <p>1: Frequency reference 1 (n024) is valid.</p> <p>2: Frequency reference control terminal (0 to 10-V voltage input) is valid.</p> <p>3: Frequency reference control terminal (4 to 20-mA current input) is valid. (Also, set SW2 on the control board from V to I.)</p> <p>4: Frequency reference control terminal (0 to 20-mA current input) is valid. (Also, set SW2 on the control board from V to I.)</p> <p>5: Pulse train reference control terminal is valid. (Pulse train input scale: n149 sets the highest pulse input.)</p> <p>6: Frequency reference from RS-422/485 communications (0002 Hex) is valid.</p> <p>7: Multi-function analog voltage input (0 to 10 V) is valid.</p> <p>8: Multi-function analog current input (4 to 20 mA) is valid.</p> <p>9: Frequency reference from the Optional Unit (CompoBus/D Communications Unit) is valid.</p>	0 to 9	1	0	No

Perform the above setting according to the source of the frequency reference in the application. When frequency references from the CompoBus/D communications are to be always used, set to "9." If this setting is performed, frequency reference 1 can only be set through CompoBus/D communications. However, frequency references 2 to 16 and the inching frequency can be set from CompoBus/D communications or the Digital Operator regardless of the setting of n004.

● **Switching of Frequency References from CompoBus/D Communications**

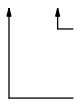
There is a switching signal, “Net. Ref.,” for frequency references (speed references) from the standard remote I/O of the CompoBus/D Communications Unit. The input method for frequency references can be changed in the following ways using the “Net. Ref.” signal.

Net. Ctrl. = 1 (ON): Automatically sets the n004 constant to “9,” making frequency references from CompoBus/D communications valid (remote I/O frequency references become valid). If the bit turns OFF, n004 will return to the original value.

Net. Ctrl. = 0 (OFF): The frequency reference specified by n004 becomes valid.

4-2-3 Frequency Reference Settings and Display Units

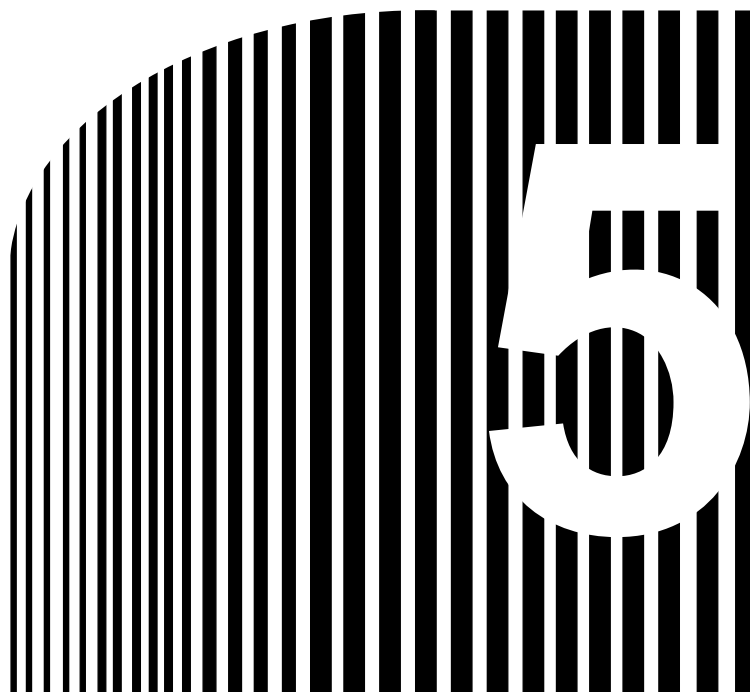
Perform the following settings to specify units for data related to frequencies (speeds) used in CompoBus/D communications. The standard unit used with DeviceNet is r/min, so always set the number of motor poles.

Con-stant	Register number (Hex)	Name	Content	Setting range	Setting unit	Default setting	Write during operation
n035	0123	Frequency reference setting and display units	<p>Sets the units for the frequency reference and frequency monitor that are set and referred to by the Digital Operator.</p> <p>0: 0.01-Hz units (0.1 Hz if more than 100 Hz)</p> <p>1: 0.1% units</p> <p>2 to 39: r/min units (Set the number of motor poles)</p> <p>40 to 3999: Optional Unit settings. (Specifies the value used to set and display the maximum frequency.</p> <p>□□□□</p>  <p>↑ ↑ Set a value without the decimal point. Set the position of the digit where the decimal point is to be displayed starting from the rightmost digit.</p> <p>Example: To display the maximum frequency as “50.0,” specify “1500.”</p> <p>Note 1. Only units for frequency reference and the frequency monitor will change.</p> <p>Note 2. The settings are valid in either Local or Remote mode.</p>	0 to 3999	1	0	No

4-3 Startup Procedure

The CompoBus/D communications system can be started from any of the nodes on the Network. The following procedure gives the startup process after turning ON the power to the Inverter's CompoBus/D Communications Unit. If the startup process shown below is interrupted or stops before being completed, an error will occur. Correct errors that occur, referring to *Chapter 6 Communications Errors*.


1. Turn ON the power.
2. The PWR indicator will turn ON: Power is being supplied.
3. The MS indicator will be lit red and then green: Confirming MS indicator status.
4. The NS indicator will be lit red and then green: Confirming MS indicator status.
5. The MS indicator will flash: Shows Optional Unit startup processing status.
6. The MS indicator will be lit: The Optional Unit is ready.
7. The NS indicator will flash: The Optional Unit is connected to the Network and startup processing is being performed.
8. The NS indicator will be lit: The Network is started.




Chapter 5

- **CompoBus/D
Communications Unit
Operations •**

- 5-1 Remote I/O
- 5-2 Message Communications
(DeviceNet Explicit Messages)
- 5-3 Switching Remote I/O Operation
- 5-4 Special Remote I/O Operation

 **Caution** Do not carelessly change Inverter's settings. Doing so may result in injury or damage to the product.

 **Caution** Be sure to perform the setting switch settings correctly and confirm the settings before starting operation. Not doing so may result in malfunction or damage to the product.

5-1 Remote I/O

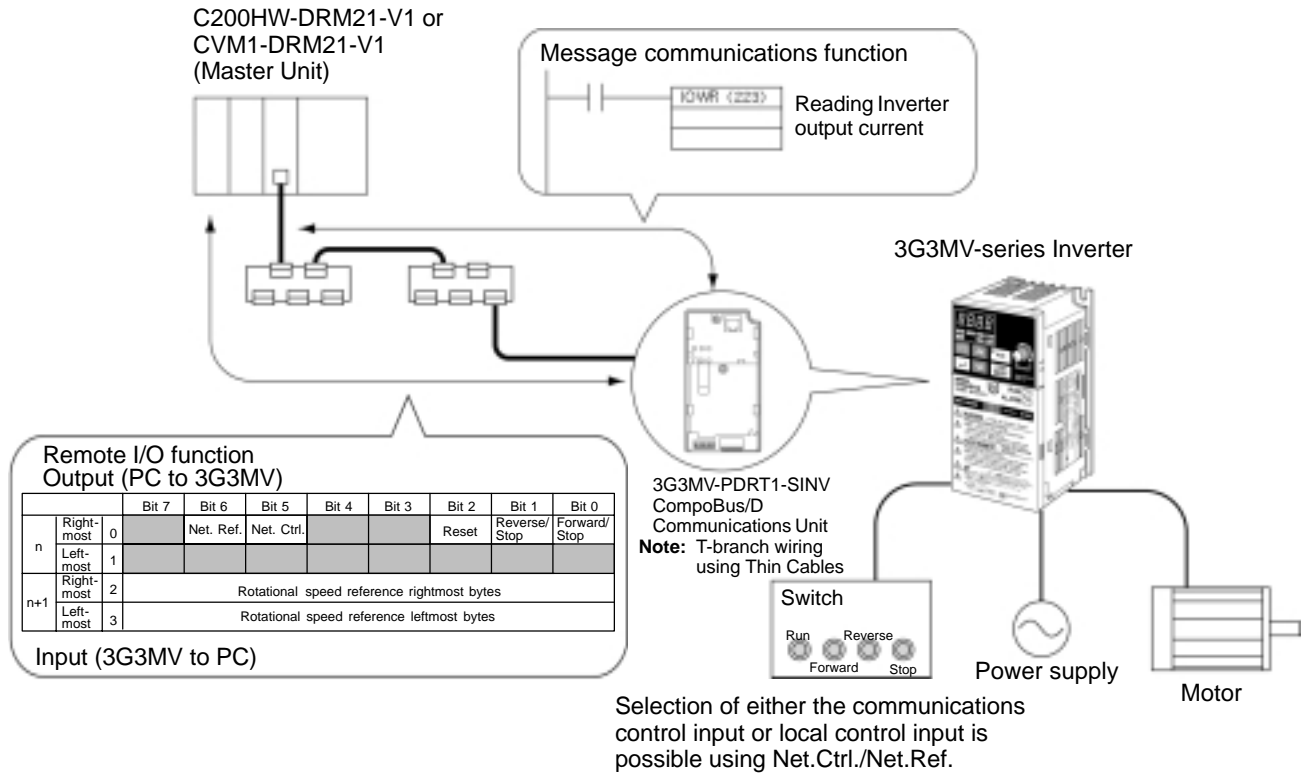
There are two types of CompoBus/D communications: Remote I/O and message communications. There are three types of remote I/O operation: Basic remote I/O, standard remote I/O, and special remote I/O. This section explains standard remote I/O operations and the types of remote I/O.

Note 1. To use special remote I/O, it is necessary to switch the remote I/O operation. Switching the remote I/O operation involves the use of message communications, so refer to *5-2 Message Communications* and *5-3 Switching Remote I/O Operations*. Also, for details regarding special remote I/O, refer to *5-4 Special Remote I/O*.

Note 2. When the CompoBus/D Communications Unit is used, the RS-422/485 of the Inverter cannot be used for communications.

5-1-1 Standard Remote I/O (Initial Setting)

The type of remote I/O operation pre-set as the initial setting for the Inverter’s CompoBus/D Communications Unit is standard remote I/O. This remote I/O can be used for general Inverter control.



Note When the CompoBus/D Communications Unit is used, the RS-422/485 of the Inverter cannot be used for communications.

■ Words Allocated to SYSDRIVE 3G3MV-series Inverters

A SYSDRIVE 3G3MV-series Inverter is allocated a total of four SYSMAC I/O words (two input and two output) via a CompoBus/D Communications Unit.

I/O classification	Word address	Bits	
		15 to 8	7 to 0
Output (SYSMAC PC to Inverter)	n	Not used.	Inverter run commands
	n+1	Rotational speed reference (leftmost bits)	Rotational speed reference (rightmost bits)
Input (Inverter to SYSMAC PC)	m	Not used.	Inverter status
	m+1	Rotational speed monitor (leftmost bits)	Rotational speed monitor (rightmost bits)

● Inverter Run Commands

Word	n							
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Signal name	Not used.	Net Reference	Net Control	Not used.	Not used.	Fault Reset	Reverse/stop	Forward/stop
Content	---	0: n004 1: CompoBus/D (See note 1.)	0: n003 1: CompoBus/D (See note 2.)	---	---	0: --- 1: Fault Reset	0: Stop 1: Reverse	0: Stop 1: Forward

Note 1. Net Reference is used to specify the frequency reference as follows (cannot be changed during running):

0: The frequency reference input method specified by the frequency reference source selection (n004) is used.

1: Set n004 to “9” and operate via CompoBus/D. (Operate with rotational speed reference in word n+1.)

Note 2. Net Control is used to change the run command as follows (cannot be changed during running):

0: The run command input method specified by the run command source selection (n003) is used.

1: Set n003 to “3” and operate via CompoBus/D. (Follow run command in word n, bits 0 and 1.)

● Inverter Status

Word	m							
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Signal name	At Reference	Reference From Net	Control From Net	Inverter Ready	During reverse run	During forward run	Alarm (Minor Fault)	Fault
Content	0: Accelerating or Decelerating 1: At reference	0: n004 1: CompoBus/D (See note 1.)	0: n003 1: CompoBus/D (See note 2.)	0: Preparing 1: Ready	0: Stop/forward 1: During reverse run (See note 4.)	0: Stop/reverse 1: During forward run (See note 5.)	0: Normal 1: Alarm (Minor Fault)	0: Normal 1: Fault

Note 1. Reference From Net shows the input status of word n, bit 6 (Net Reference) for CompoBus/D communications.

Note 2. Control From Net shows the input status of word n, bit 5 (Net Control) for CompoBus/D communications.

Note 3. Reverse Operation indicates reverse output status. This bit does not turn ON for DC braking (DC injection).

Note 4. Forward Operation indicates either forward run status or DC braking (DC injection) status. This bit turns ON even for DC braking (DC injection) during reverse run.

● **Rotational Speed Reference Data**

Word address	n+1															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Signal name	Rotational speed reference data															
Content	Communications data = Rotational speed reference x 2 ^a a: Speed scale value of Class 2A, Instance 01, Attribute 16 (Initial value: 0) <ul style="list-style-type: none"> • The speed scale is assigned to the message function. For instructions on how to change it, refer to 5-2 Message Communications. • The unit for the rotational speed reference is set in n035 (frequency reference setting and display units) • Setting example (providing reference of 1,800 r/min): When the speed scale value is "0" and the number of motor poles is set in n035 (so unit is r/min): 1,800 r/min → 1,800 x2⁰ → 1,800 → 0708 Hex 															

Note 1. Under the DeviceNet protocol, the unit for the speed reference is fixed as r/min. The number of motor poles (2 to 32) must be set in parameter n035 (frequency reference setting and display units) when using DeviceNet (open network).

Note 2. If the setting is not within the proper range, the previous data will be retained and the designated rotational speed will not be entered.

● **Rotational Speed Monitor Data**

Word address	m+1															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Signal name	Rotational speed monitor data															
Content	Communications data = Rotational speed monitor x 2 ^a a: Speed scale value of Class 2A, Instance 01, Attribute 16 (Initial value: 0) <ul style="list-style-type: none"> • The speed scale is assigned to the message function. For instructions on how to change it, refer to 5-2 Message Communications. • The unit for the rotational speed monitor is set in n035 (frequency reference setting and display units) • Data conversion example: When the speed scale value is "0" and the number of motor poles is set in n035, and the read data is 03E8 Hex: 03E8 Hex → 1,000 → 1,000/2⁰ → 1,000 r/min 															

Note Under the DeviceNet protocol, the unit for the speed reference is fixed as r/min. The number of motor poles (2 to 32) must be set in parameter n035 (frequency reference setting and display units) when using DeviceNet (open network).

5-1-2 Types of Remote I/O Operation

There are three types of CompoBus/D Communications Unit remote I/O operation:

- Basic remote I/O: Remote I/O operation for the standard DeviceNet configuration.
- Standard remote I/O: Remote I/O operation (DeviceNet-compatible) that is the default setting for the CompoBus/D Communications Unit.
- Special remote I/O: Remote I/O operations that enable using all the functions of 3G3MV-series Inverters, and accessing/setting for all parameters. (Special remote I/O operation is special for this product; they are not compatible with DeviceNet.)

The default setting is for standard remote I/O operation, so it will be necessary to switch to either of the other types of remote I/O operation if desired. Switching the remote I/O operation involves the use of message communications. Refer to 5-2 Message Communications and 5-3 Switching Remote I/O Operation.

■ Basic Remote I/O

Basic remote I/O is used for the standard DeviceNet configuration.

● Outputs (SYSMAC PC to 3G3MV) Instance ID: 20 Dec (14 Hex)

Byte number			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd n	Rightmost	0						Fault Reset		Forward/stop
	Leftmost	1								
Wd n+1	Rightmost	2	Rotational speed reference (rightmost data)							
	Leftmost	3	Rotational speed reference (leftmost data)							

● Inputs (3G3MV to SYSMAC PC) Instance ID: 70 Dec (46 Hex)

Byte number			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd m	Rightmost	0						During forward run		Fault
	Leftmost	1								
Wd m+1	Rightmost	2	Rotational speed reference (rightmost data)							
	Leftmost	3	Rotational speed reference (leftmost data)							

Note 1. A shaded box indicate that the bit is not used.

Note 2. The basic remote I/O operation is the same as those explained for standard remote I/O. (Basic remote I/O restricts the operation of standard remote I/O.)

■ Standard Remote I/O

Standard remote I/O is the default setting for the CompoBus/D Communications Unit.

● Outputs (SYSMAC PC to 3G3MV) Instance ID: 21 Dec (15 Hex)

Byte number			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd n	Rightmost	0		Net Reference	Net Control			Fault Reset	Reverse/stop	Forward/stop
	Leftmost	1								
Wd n+1	Rightmost	2	Rotational speed reference (rightmost data)							
	Leftmost	3	Rotational speed reference (leftmost data)							

● Inputs (3G3MV to SYSMAC PC) Instance ID: 71 Dec (47 Hex)

Byte number			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd m	Rightmost	0	At Reference	Reference From Net	Control From Net	Inverter Ready	During reverse run	During forward run	Alarm (minor fault)	Fault
	Leftmost	1								
Wd m+1	Rightmost	2	Rotational speed monitor (rightmost data)							
	Leftmost	3	Rotational speed monitor (leftmost data)							

Note A shaded box indicate that the bit is not used.

■ Special Remote I/O

Special remote I/O enables using all the functions of 3G3MV-series Inverters, and accessing/setting all parameters.

● Outputs (SYSMAC PC to 3G3MV)

Instance ID: 100 Dec (64 Hex)

Byte number		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd n	Rightmost	0	Function code (write/read code)						
	Leftmost	1	Register number, leftmost byte (register number assigned to various parameters, etc.)						
Wd n+1	Rightmost	2	Register number, rightmost byte (register number assigned to various parameters, etc.)						
	Leftmost	3	Register data, leftmost byte (data to write to specified register)						
Wd n+2	Rightmost	4	Register data, rightmost byte (data to write to specified register)						

● Inputs (3G3MV to SYSMAC PC)

Instance ID: 150 Dec (96 Hex)

Byte number		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd m	Rightmost	0	Function code (returns transmitted code)						
	Leftmost	1	Register number, leftmost byte (returns transmitted register number)						
Wd m+1	Rightmost	2	Register number, rightmost byte (returns transmitted register number)						
	Leftmost	3	Register data, leftmost byte (return transfer data amount or read data)						
Wd m+2	Rightmost	4	Register data, rightmost byte (return transfer data amount or read data)						

Note 1. Special remote I/O outputs and inputs are paired. When using special remote I/O, be sure to set them together.

Note 2. Special remote I/O objects do not conform to the AC/DC drive profile, but are specially set for this product.

Note 3. The 16-bit data (register number and register data) is set using two words for each setting.

Note 4. Be careful of the order of the leftmost and rightmost bytes of the 16-bit data. The order is reversed from that of basic and standard remote I/O.

Note 5. For details on special remote I/O operation, refer to 5-4 *Special Remote I/O*.

5-2 Message Communications (DeviceNet Explicit Messages)

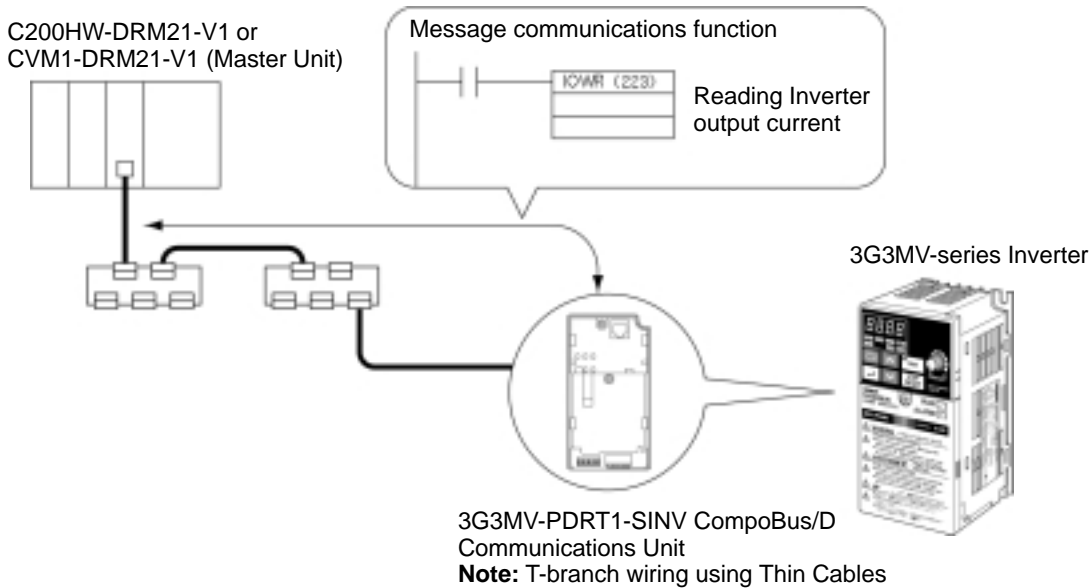
There are two types of CompoBus/D communications: Remote I/O and message communications. This sections explains CompoBus/D Communications Unit message communications. With message communications, specific instructions (SEND, RECV, CMND, and IOWR) are used for reading and writing data between Master and Slave Units.

5-2-1 Overview of Message Communications (Explicit Message Operations)

■ Message Communications Operations

Message communications enable data to be exchanged as required between nodes (i.e., between Masters or between Masters and Slaves) on a CompoBus/D Network. For example, the accumulated data from a given PC can be read from another PC, and constants from various Slaves can be changed from a PC. To use message communications, however, both nodes involved in the data exchange must support message communications.

Note When the CompoBus/D Communications Unit is used, the RS-422/485 of the Inverter cannot be used for communications.



Note When the CompoBus/D Communications Unit is used, the RS-422/485 of the Inverter cannot be used for communications.

■ **Types of Message Communications**

CompoBus/D message communications are broadly divided into the two categories described below. Of these two categories, the Inverter’s CompoBus/D Communications Unit supports explicit messages.

• **Explicit Messages**

Explicit messages are defined by DeviceNet. The class, instance, and attribute are specified for executing message communications. The messages are the same for all Inverter products, so messages can be exchanged in the same way with masters made by other manufacturers.

• **FINS Messages**

Messages can be exchanged using FINS commands between CompoBus/D nodes (Masters and Slaves) that support FINS messages. (FINS commands are actually sent and received using DeviceNet explicit messages.)

Note Message communications are supported by CV-series, CS1-series, and C200HX/HG/HE PCs, but not by C200HS PCs.

■ **Overview of Explicit Messages**

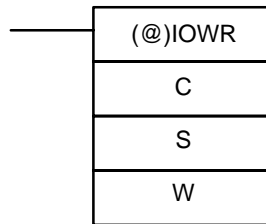
Explicit messages are sent and received as described below. Basically explicit message communications are executed in 1-byte (8-bit) units.

Header	Node address	Service code	Class	Instance	Attribute	Data	Footer
Item	Content						
Header	The header indicates the beginning of an explicit message and that the frame is an explicit message request/response. It is set automatically for CompoBus/D (DeviceNet), so there is no particular need to be concerned with it.						
Node address	Request: Set the node address of the Slave/Master to be requested. Response: The node address of the responding Slave/Master is set.						
Service code	Request: Set the code of the requested service (read/write, etc.). Response: The MSB (most significant bit) of the requested service code is changed to “1” and returned.						
Class	Function classification (major classification)	Indicates the classification of a function defined by DeviceNet. To specify a function, specify these three codes.					
Instance	Instance classification (minor classification)						
Attribute	Attribute (Set values are assigned for each function.)						
Data	Request: Set the data to be written. Response: Read-requested data or fault message are attached.						
Footer	This is the part that indicates the end of the explicit message and executes the CRC check. It is set automatically for CompoBus/D (DeviceNet), so there is no particular need to be concerned with it.						

5-2-2 Sending and Receiving Messages with SYSMAC CS1-series and C200HX/HG/HE PCs

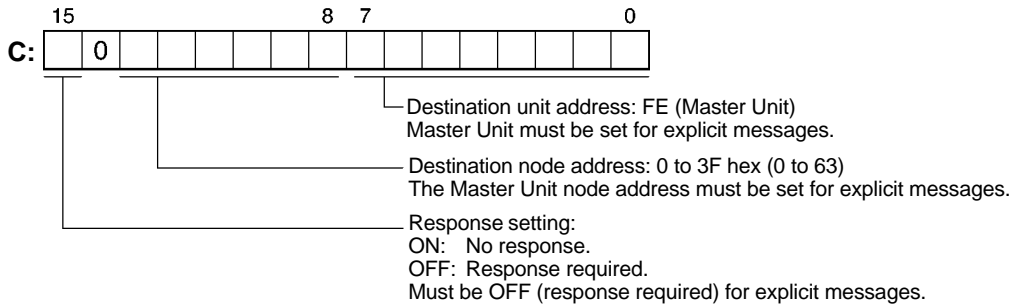
■ IOWR for CS1 Series

With CS1-series PCs, explicit messages are sent using IOWR. To send an explicit message, it is necessary to place FINS command “2801” in front and to send the command to the Master Unit. The Master Unit that receives the command converts the command data to an explicit message and transfers it to the destination node. (When sending an explicit message, it is not possible to directly specify the destination node with IOWR.)



● C: Control Code

The control code is set as shown below for CompoBus/D Master Units.

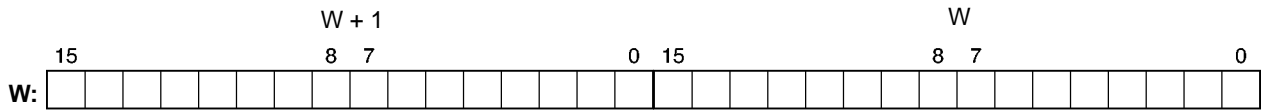


● **S: Beginning Source Word**

Specify the beginning word address for the command data transferred to the CompoBus/D Master Unit. Preset the data to be transferred in consecutive words as shown in the following table.

Word address	Bits	
	15 to 8	7 to 0
S	Beginning response storage word Set with the PC's variable area designation method.	
S+1	Example: DM 1000 82 (DM area) 03E8 (1000 in hexadecimal) 00 (fixed at 00 for DM area)	
S+2	Response monitor time: 0000 hex → 2 s 0001 to 028F hex → 0.1 to 65.5 s (unit: 0.1 s)	
S+3	Number of command data bytes (Set in hexadecimal.) Note: Command data is the data set in words S+4 onwards.	
S+4	Command data (Set explicit message FINS command "2801.")	
S+5	Node of Slave or Master for transmission Address: 0 to 3F hex (0 to 63)	Explicit message service code Write: 10 Read: 0E
S+6	Class ID code (Set DeviceNet class code for relevant function.) Set within 0001 to 002A (hex) with Inverter's CompoBus/D Communications Unit.	
S+7	Instance ID code (Set DeviceNet instance code for relevant function.) Set within 0001 to 0003 (hex) with Inverter's CompoBus/D Communications Unit.	
S+8	Attribute ID code (Set DeviceNet attribute code for relevant function.)	Attached data (for writing)
---	Attached data (for writing)	

● **W: Number of Words to Transfer/Destination Unit Number**



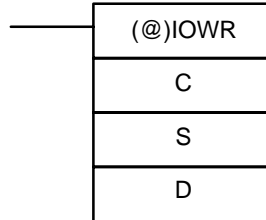
Destination unit number (00000 to 000F Hex, 0 to 15)
Set the unit number of the Master Unit.

Number of words to transfer (0001 to 0080 Hex, 1 to 128)
Set the total number of words to be transferred, including leading word S.

Example: 000A0001 (sends 10 words to Master Unit with unit number 1)

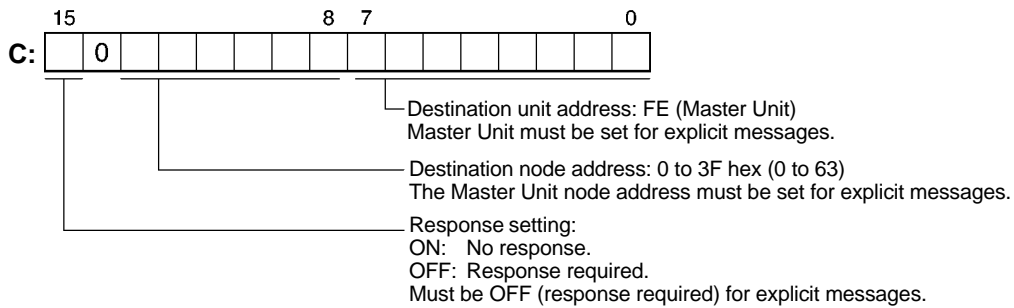
■ IOWR for C200HX/HG/HE

With C200HX/HG/HE PCs, explicit messages are sent using IOWR. To send an explicit message, it is necessary to place FINS command “2801” in front and to send the command to the Master Unit. The Master Unit that receives the command converts the command data to an explicit message and transfers it to the destination node. (When sending an explicit message, it is not possible to directly specify the destination node with IOWR.)



● C: Control Code

The control code is set as shown below for CompoBus/D Master Units.

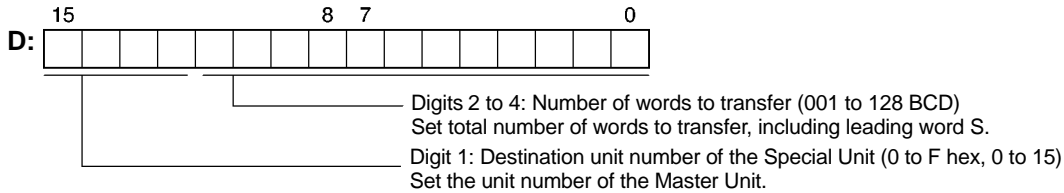


● **S: Beginning Source Word**

Specify the beginning word address for the command data transferred to the CompoBus/D Master Unit. Preset the data to be transferred in consecutive words as shown in the following table.

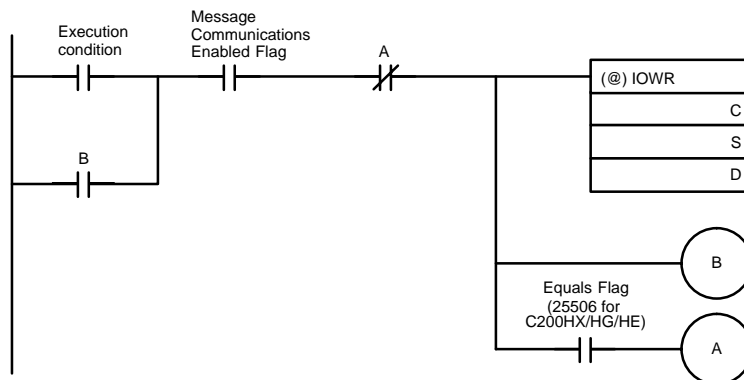
Word address	Bits	
	15 to 8	7 to 0
S	Beginning response storage word Set with the PC's variable area designation method.	
S+1	Example: DM 1000 82 (DM area) 03E8 (1000 in hexadecimal) 00 (fixed at 00 for DM area)	
S+2	Response monitor time: 0000 hex → 2 s 0001 to 028F hex → 0.1 to 65.5 s (unit: 0.1 s)	
S+3	Number of command data bytes (Set in hexadecimal.) Note: Command data is the data set in words S+4 onwards.	
S+4	Command data (Set explicit message FINS command "2801.")	
S+5	Node of Slave or Master for transmission Address: 0 to 3F hex (0 to 63)	Explicit message service code Write: 10 Read: 0E
S+6	Class ID code (Set DeviceNet class code for relevant function.) Set within 0001 to 002A (hex) with Inverter's CompoBus/D Communications Unit.	
S+7	Instance ID code (Set DeviceNet instance code for relevant function.) Set within 0001 to 0003 (hex) with Inverter's CompoBus/D Communications Unit.	
S+8	Attribute ID code (Set DeviceNet attribute code for relevant function.)	Attached data (for writing)
---	Attached data (for writing)	

● **D: Destination Information**



■ **Message Timing**

The Message Communications Enabled Flag must be used as an execution condition for the Master when IOWR is used. Be sure this flag is ON before executing IOWR. If IOWR is executed when this flag is OFF, a Special I/O Unit error may be generated for the Master.



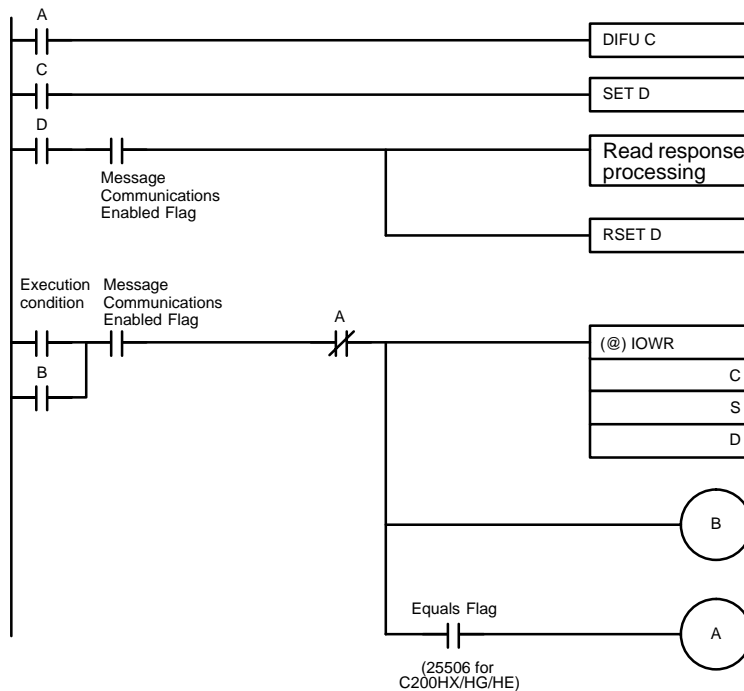
1. IOWR is executed when the execution condition is met and the Message Communications Enabled Flag is ON.
2. When IOWR is executed, it is self-held by bit B.
3. When IOWR is completed, the Equals Flag turns ON and the self-holding bit is cleared.

Note 1. If IOWR ends in an error, the Equals Flag will not turn ON, so the self-holding bit will remain ON.

Note 2. The Equals Flag is also affected by the execution of other instructions, so be careful not to use any other such instructions between IOWR and the Equals Flag.

■ Timing of Message Response Reading

Responses are read when the Message Communications Enabled Flag turns ON in the next cycle. The Message Communications Enabled Flag will turn OFF when a Master Unit is executing message communications. If the message response is faster than the PC ladder program cycle time, the Message Communications Enabled Flag will remain ON and response processing will not be possible. Execute the read response processing before IOWR, as shown in the following diagram, and produce a Message Communications Status Flag (d) using bit A.



Note If the read response processing is executed after IOWR, there can be no Message Communications Enabled Flag response by means of IOWR, so an attempt could be made to read the response even though the message communications have not been completed.

■ Communications Flags For CS1 Series

Flag	Functions
Equals Flag	The Equals Flag turns OFF when an error occurs in writing a command from the CPU Unit to the Master Unit. This Flag turns ON after a command has been written normally from the CPU Unit to the Master Unit.
Error Flag	The Error Flag is OFF when all operands and the control code are legal. This Flag turns ON when an illegal operand or control code is set or when there is an error in instruction execution.
Message Communications Enabled Flag in the Master Unit status area (bit 12 in IR 101 + 10 x unit number)	The Communications Enabled Flag turns OFF during messages communications or when message communications are not possible. This Flag is ON when message communications are possible.

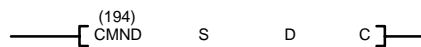
■ Communications Flags For C200HX/HG/HE

Flag	Functions
Equals Flag (SR 25506)	The Equals Flag turns OFF when an error occurs in writing a command from the CPU Unit to the Master Unit. This Flag turns ON after a command has been written normally from the CPU Unit to the Master Unit.
Error Flag (SR25503)	The Error Flag is OFF when all operands and the control code are legal. This Flag turns ON when an illegal operand or control code is set or when there is an error in instruction execution.
Message Communications Enabled Flag in the Master Unit status area (bit 12 in IR 101 + 10 x unit number)	The Communications Enabled Flag turns OFF during messages communications or when message communications are not possible. This Flag is ON when message communications are possible.

5-2-3 SYSMAC CV-series Message Transmission

■ Using CMND(194)

With CV-series PCs, CMND(194) is used to send explicit messages. To send an explicit message, it is necessary to place FINS command “2801” in front and to send the command to the Master Unit. The Master Unit that receives the command converts the command data to an explicit message and transfers it to the destination node. When sending an explicit message, it is not possible to directly specify the destination node with CMND(194).



● **S: Beginning Command Storage Word**

Specify the beginning word address for the command data transferred to the CompoBus/D Master Unit. Preset the data to be transferred in consecutive words as shown in the following table.

Word address	Bits	
	15 to 8	7 to 0
S	Command data (Set explicit message FINS command "2801.")	
S+1	Node of Slave or Master for transmission Address: 0 to 3F hex (0 to 63)	Explicit message service code Write: 10 Read: 0E
S+2	Class ID code (Set DeviceNet class code for relevant function.) Set within 0001 to 002A (hex) with Inverter's CompoBus/D Communications Unit.	
S+3	Instance ID code (Set DeviceNet instance code for relevant function.) Set within 0001 to 0003 (hex) with Inverter's CompoBus/D Communications Unit.	
S+4	Attribute ID code (Set DeviceNet attribute code for relevant function.)	Attached data (for writing)
---	Attached data (for writing)	

● **D: Beginning Response Storage Word**

Specify the beginning word address of the area for storing responses to messages.

● **C: Beginning Control Code Word**

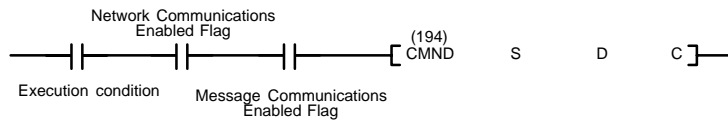
Specify the beginning word address of the area for storing the required control codes for message communications. The control codes shown in the following table are required by CompoBus/D Master Units. Preset the data in consecutive words.

Word address	Bits		
	15	14 to 8	7 to 0
C	Number of command data bytes: 0000 to 00A0 hex (0 to 160 bytes) Set the amount of data from the beginning S word.		
C+1	Number of response data bytes: 0001 to 00A0 hex (0 to 160 bytes) Set the size of the data storage area from the beginning D word.		
C+2	Network address: 0001 to 007F hex (1 to 127) When using CMND(194) with the CV Series, a network address must be set for each CompoBus/D Master Unit. The network address is edited using the routing table edit function of a Peripheral Device (except for the Programming Console).		
C+3	Command destination node address: 00 to 3F hex (0 to 63) Node address of the Master Unit	Command destination Unit address Set Master Unit (FE) or Master Unit's unit number, 10 to 1F hex (0 to 15).	
C+4	Response	Communications port number: 0 to 7	Number of retries: 00 to 0F hex (0 to 15) Set the number of times to resend for error response.
C+5	Response monitor time: 0000 hex → 2 s 0001 to 028F hex → 0.1 to 65.5 s (unit: 0.1 s) Set at least 2 seconds for explicit messages.		

Note Set "0" in word C+4 bit 15 to require a response or "1" to not require a response. Responses are required for explicit messages, so set "0."

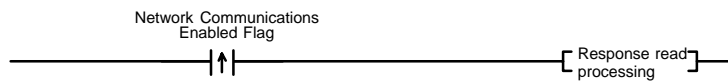
■ Message Timing

When executing CMND(194), an AND condition must be set that requires both the PC's Network Communications Enabled Flag and the Master Unit's Message Communications Enabled Flag to be ON.



■ Message Response Read Timing

Have messages read with the rising edge of the Network Communications Enabled Flag for each communications port.



■ Communications Flags

Type	Name	Address		Content
		Word	Bit	
SYSMAC PC flags	Network Communications Enabled Flag	A502	7: Port 7 6: Port 6 5: Port 5 4: Port 4 3: Port 3 2: Port 2 1: Port 1 0: Port 0	0: Execution disabled (executing) 1: Execution enabled (not executing)
	Network Communications Error Flag	A502	15: Port 7 14: Port 6 13: Port 5 12: Port 4 11: Port 3 10: Port 2 9: Port 1 8: Port 0	0: Normal end 1: Abnormal end
Master Unit status flag	Message Communications Enabled Flag	25 x Unit number + 1501	12	0: Communications error detected; Master Unit message communications not possible. 1: Master Unit communications possible.

5-2-4 Overview of Messages and Responses

When message communications are used, the Inverter’s CompoBus/D Communications Unit returns responses as explained below.

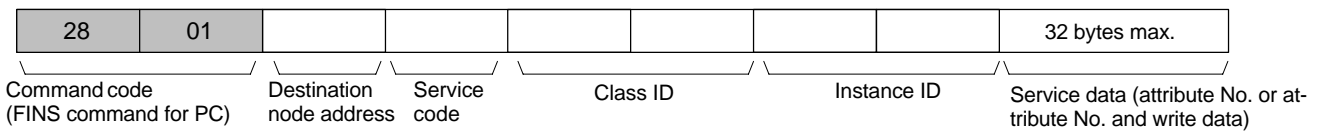
Basically, CompoBus/D (DeviceNet) communications are executed in 1-byte (8-bit) units. In the case of single-word data (16 bits), the rightmost bits (least significant) and the leftmost bits (most significant) are reversed in order due to the following reasons:

- Data on communications line is transmitted in the order of rightmost bits and leftmost bits.
- Data that is internally processed by PC for issuing commands is transmitted in the order of leftmost bits and rightmost bits.

Therefore, reverse the order for attributes where “Word” is written in the “Size” column in the tables on subsequent pages and create attached data or read response data.

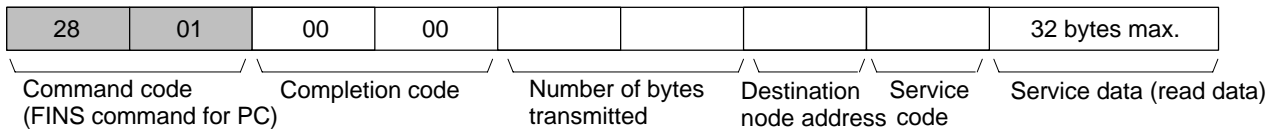
Note There is no need to take this into consideration for remote I/O because the rightmost bits and leftmost bits are automatically reversed.

■ Command Format

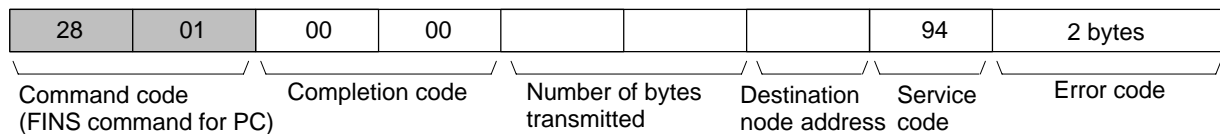


■ Response Format

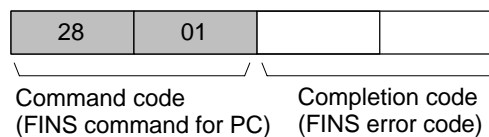
● Normal Response



● Error Response



● Failure or Timeout During Transmission



5-2-5 Motor Data Objects: Class 28 Hex

This and subsequent sections provide details on objects. There are eight types of :

- Identify objects (identification information): Class 01 hex
- Message router objects: Class 02 hex
- DeviceNet objects: Class 03 hex
- Assembly objects: Class 04 hex
- DeviceNet connection objects: Class 05 hex
- Motor data objects: Class 28
- Control supervisor objects: Class 29 hex
- AC/DC drive objects: Class 2A hex

The three types of objects related to Inverters are the motor data, control supervisor, and AC/DC drive objects. These are explained below and in subsequent sections. The other types of objects are used less frequently, and covered in *8-2 Objects*.

Motor data objects are data and functions related to motors connected to Inverters. The motors that can be connected to Inverters are squirrel-cage inductive motors, so the “Motor Type” is always “7.” The motor’s rated current and rated voltage can be set and read.

■ Support Service Code

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default	Read	Write	Size
00	01	Object Software Revision	Indicates class 28 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01	03	Motor Type	Indicates the type of motor to be used. The setting for a squirrel-cage inductive motor is 7.	---	07	Yes	No	Byte
	06	Motor Rated Current	The motor’s rated current can be set and read. The setting unit is 0.1 A. (The setting unit can be changed using the current scale in Class 2A, Instance 1, Attribute 17.)	Inverter rated output current 10% to 150%	See note 1.	Yes	Yes	Word
	07	Motor Rated Voltage	The motor’s rated voltage can be set and read. The setting unit is 1 V. (The setting unit can be changed using the voltage scale in Class 2A, Instance 1, Attribute 1B.)	0 to 255 V (0 to 510 V) See note 2.	00C8 (0190) See note 2.	Yes	Yes	Word

Note 1. The default setting for the motor’s rated current depends on the Inverter model.
Example: 1.90A (0013 hex) for 200-V class, 0.4 kW

Note 2. The figures enclosed in parentheses in the “Setting range” and “Default” columns are the values for 400-V class Inverters.

5-2-6 Control Supervisor Objects: Class 29 Hex

Control supervisor objects are objects that have Inverter control I/O-related functions. They are assigned according to their particular control I/O functions, such as forward operation, reverse operation, error detection, and so on. Be careful when setting up a remote I/O communications connection. These functions are shared with similar functions used for remote I/O, so even if they have been set for message operations they may get rewritten for remote I/O.

■ Support Service Codes

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single
05	Reset attribute Turns OFF the Forward Operation and Reverse Operation inputs and turns ON the Fault Reset. Then turns OFF the Fault Reset when Inverter Ready is output.

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default	Read	Write	Size
00	01	Object Software Revision	Indicates class 29 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01	03	Forward/Stop	00: Stop 01: Forward operation	00, 01	00	Yes	Yes	Byte
	04	Reverse/Stop	00: Stop 01: Reverse operation	00, 01	00	Yes	Yes	Byte
	05	Net Control Local/remote switch Set note 1.	00: Operate by n003 setting. 01: Operate by CompoBus/D with n003 set to "3."	00, 01	00	Yes	Yes	Byte
	06	State Inverter status	03 hex: Inverter ready	---	03	Yes	No	Byte
	07	During forward run	00: No Inverter output or operating in reverse. 01: Forward operation or DC braking Turns ON even for DC braking during reverse operation.	---	00	Yes	No	Byte
	08	During reverse run	00: No Inverter output or operating in forward. 01: Operating in reverse (reverse operation output status) Becomes "00" with DC braking.	---	00	Yes	No	Byte
	09	Inverter Ready	00: Preparing Initial processing/ not drive mode/ fault 01: Inverter ready Inverter can receive run command.	---	00	Yes	No	Byte
	0A	Fault	00: Normal 01: Fault	---	00	Yes	No	Byte
	0B	Alarm (minor fault)	00: Normal 01: Alarm (minor fault)	---	00	Yes	No	Byte
	0C	Fault Reset	00: Normal status 01: Fault reset	00, 01	00	Yes	Yes	Byte
	0D	Fault code	Indicates the contents of fault that occur. (See the fault code list on the following page.)	---	0000	Yes	No	Word
	0F	Control From Net Run signal input status See note 1.	00: Operating by n003 setting. 01: Operating by CompoBus/D.	---	00	Yes	No	Byte
	10	DeviceNet Fault mode See note 2.	02: Maker's specifications	---	02	Yes	No	Byte
	11	Force Fault/Trip Communications external fault input	00: Normal operation 01: Communications external fault input	00, 01	00	Yes	Yes	Byte
12	Force Status Communications external fault input status	00: Normal status 01: Communications external fault detected. (Inverter stopped with fault detection.)	---	00	Yes	No	Byte	

Note 1. The Net Control and Control From Net functions cannot be changed during running.

Note 2. A DeviceNet Fault mode cannot be set from communications. The Inverter will stop when a communications fault is detected.

● **Fault Codes**

DeviceNet error code	Operator display	Meaning
0000	---	Inverter normal
2200	OL2	Inverter overload
2220	OL1	Motor overload
2221	OL3	Overtorque detection 1
2300	OC	Overcurrent
3210	OV	Main circuit overvoltage
3220	UV1	Undervoltage (main)
4200	OH	Overheat
5110	UV2	Control power supply fault
5300	OPR	Operator disconnection
7500	BUS	Communications error
9000	EF3	External fault (Terminal 3)
	EF4	External fault (Terminal 4)
	EF5	External fault (Terminal 5)
	EF6	External fault (Terminal 6)
	EF7	External fault (Terminal 7)
	FF0	Communications external fault

5-2-7 AC/DC Drive Objects: Class 2A Hex

AC/DC drive objects are assigned to command-related functions for drive devices such as Inverters and Servomotors. Command-related data reading and writing, monitor data reading, set data scale changes, and so on, are all enabled. These functions are shared with similar functions used for remote I/O, so even if they have been set for message operations they may get rewritten for remote I/O.

■ Support Service Codes

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default	Read	Write	Size
00	01	Object Software Revision	Indicates class 2A software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01	03	At Reference	00: Stopped, accelerating or decelerating 01: At reference	---	00	Yes	No	Byte
	04	Net Reference (See note 1.)	00: Operate at n004 setting. 01: Set n004 to "3" and operate with CompoBus/D.	00, 01	00	Yes	Yes	Byte
	06	Drive Mode	00: Open loop vector (n002 = 1) 01: V/f control (n002 = 0)	00 to 03	01	Yes	Yes	Byte
	07	Speed Actual Rotational Speed Monitor (See note 1.)	Can be referenced in hexadecimal with the output frequency monitor (U-02) minimum unit as 1. The output frequency monitor minimum unit can be set by the frequency reference setting and display units (n035). n035= 0: 0.01 Hz n035= 1: 0.01% (100%: Max. frequency.) n035= 2 to 39: 1 r/min (Set number of poles.) n035= 40 to 39999: Follow individual set values. Setting the attribute 16 speed scale enables a further multiplication factor to be set for n035= 2 to 39: 1 r/min.	---	0000	Yes	No	Word
08	Speed Reference Rotational Speed Reference (See note 1.)	Can be set and read in hexadecimal with the frequency reference minimum unit as 1. The frequency reference minimum unit can be set by the frequency reference setting and display units (n035). n035= 0: 0.01 Hz n035= 1: 0.01% (100%: Max. frequency.) n035= 2 to 39: 1 r/min (Set number of poles.) n035 = 40 to 39999: Follow individual set values. Setting the attribute 16 speed scale enables a further multiplication factor to be set for n035= 2 to 39: 1 r/min.	0 to max. frequency	0000	Yes	Yes	Word	

Instance	Attribute	Name	Content	Setting range	Default	Read	Write	Size
01	09	Current Actual	Can be referenced in hexadecimal with the output current monitor (U-03) minimum unit as 0.1 A. Setting the attribute 17 current scale enables a multiplication factor to be set.	---	0000	Yes	No	Word
	0F	Power Actual	Can be referenced in hexadecimal with the output power monitor (U-11) minimum unit as 1 W. Setting the attribute 1A power scale enables a multiplication factor to be set.	---	0000	Yes	No	Word
	10	Input Voltage	Can be referenced in hexadecimal with the input voltage setting (200 or 400) minimum unit as 1 V. Setting the attribute 1B voltage scale enables a multiplication factor to be set.	---	0000	Yes	No	Word
	11	Output Voltage	Can be referenced in hexadecimal with the output voltage monitor (U-04) minimum unit as 1 V. Setting the attribute 1B voltage scale enables a multiplication factor to be set.	---	0000	Yes	No	Word
	12	Accel Time	Can be set and read in hexadecimal with the acceleration time 1 (n019) and deceleration time 1 (n020) minimum unit as 1 ms. Depending on the acceleration/ deceleration time unit (n018) setting, numbers below 100 ms or 10 ms are truncated.	0.0 to 6,000.0 × 10 ³ ms (0.00 to 600.00 × 10 ³ ms)	2710 Hex (10.0 s)	Yes	Yes	Word
	13	Decel Time	Setting the attribute 1C time scale enables a multiplication factor to be set.					
	14	Low Speed Limit (See note 1 and 3.)	Can be set and read in hexadecimal with the frequency reference lower limit (n034) and the frequency reference upper limit (n033) minimum unit as 1 ms. The minimum unit can be set by the frequency reference setting and display units (n035).	0 to 109% of maximum frequency	0000	Yes	Yes	Word
	15	High Speed Limit (See note 1 and 3.)	n035= 2 to 39: 1 r/min n035= Other than above: 0.1% (Maximum frequency: 100%) Setting the attribute 16 speed scale enables a multiplication factor to be set for n035= 2 to 39: 1 r/min.	0 to 110% of maximum frequency	0708 Hex (1,800 r/min)	Yes	Yes	Word
	16	Speed scale	Speed data unit selection can be set and read. The speed data unit value is calculated as follows: Unit = 1 [r/min] × 1/2 ^a a: Speed scale set value Set a negative value as its 2's complement.	-15 to 15 (F1 to 0F hex)	00	Yes	Yes	Byte
17	Current scale	Current data unit selection can be set and read. The current data unit value is calculated as follows: Unit = 0.1 [A] × 1/2 ^b b: Current scale set value Set a negative value as its 2's complement.	-15 to 15 (F1 to 0F hex)	00	Yes	Yes	Byte	

Instance	Attribute	Name	Content	Setting range	Default	Read	Write	Size
01	1A	Power scale	Power data unit selection can be set and read. The power data unit value is calculated as follows: Unit = 0.1 [W] x 1/2 ^c c: Power scale set value Set a negative value as its 2's complement.	-15 to 15 (F1 to 0F hex)	00	Yes	Yes	Byte
	1B	Voltage scale	Voltage data unit selection can be set and read. The voltage data unit value is calculated as follows: Unit = 0.1 [V] x 1/2 ^d d: Voltage scale set value Set a negative value as its 2's complement.	-15 to 15 (F1 to 0F hex)	00	Yes	Yes	Byte
	1C	Time scale	Time data unit selection can be set and read. The time data unit value is calculated as follows: Unit = 0.1 [V] x 1/2 ^e e: Voltage scale set value Set a negative value as its 2's complement.	-15 to 15 (F1 to 0F hex)	00	Yes	Yes	Byte
	1D	Reference From Net	00: Operate at n004 setting. 01: Set B1-01 to "3" and operate with CompoBus/D.	---	00	Yes	No	Byte

- Note 1.** The Net Reference and Reference From Net functions cannot be changed during running.
- Note 2.** Under the DeviceNet protocol, the unit for the speed reference is always r/min. The number of motor poles (2 to 32) must be set in parameter n035 (frequency reference setting and display units) when using DeviceNet (open network).
- Note 3.** Cannot be changed during running.

● **Communications Data Setting Examples**

Example 1: Finding the communications data for outputting a frequency of 60 Hz with the following conditions set.

Number of poles (o1-03): 4
Speed scale (attribute 16): 0

- Converting frequency to rotational speed:
Frequency x 120 / number of poles = 60 x 120/4 = 1,800 r/min
- Converting rotational speed to minimum unit:
Rotational speed / unit = 1,800 / (1 r/min x 1/2⁰) = 1,800
- Converting communications data to hexadecimal: 1,800 (dec) = 708 (hex)

Example 2: Finding the communications data for outputting a frequency of 60 Hz with the following condition set.

Frequency setting (o1-03): 0 (Cannot be set with DeviceNet protocol.)

- Converting frequency to minimum setting unit:
Frequency / minimum unit = 60 / 0.01 = 6,000
- Converting communications data to hexadecimal: 6,000 (dec) = 1,770 (hex)

Note With frequency, the speed scale has no effect.

Example 3: Finding the communications data for setting a one-minute acceleration time with the following condition set.

Time scale (attribute 1C): -3

- Matching the acceleration time unit: 1 minute = 60 seconds = 60,000 ms
- Converting acceleration time to minimum unit:
Acceleration time / unit = $60,000 / (1 \text{ ms} \times 1/2^{-3}) = 7,500$
- Converting communications data to hexadecimal: 7,500 (dec) = 1D4C (hex)

• Communications Data Reference Example

In this example, the hexadecimal value BB8 that has been read is converted to frequency with the following conditions set.

Number of poles (o1-03): 4

Speed scale (attribute 16): 1

- Converting communications data to decimal: BB8 (hex) = 3,000 (dec)
- Converting from minimum unit to r/min:
Communications data x unit = $3,000 \times (1 \text{ r/min} \times 1/2^1) = 1,500 \text{ (r/min)}$

5-3 Switching Remote I/O Operation

To use remote I/O operations other than the standard remote I/O operation it is necessary to switch the remote I/O operation. There are two ways to switch:

- Use the Configurator to set the remote I/O instance IDs for parameter objects.
- Set the remote I/O instance IDs for connection objects.

When an OMRON Master Unit is used, however, only the method utilizing the Configurator can be used to switch remote I/O operations.

Note OMRON Master Units assume that communications will use remote I/O, so remote I/O communications are executed when the power is turned ON. Remote I/O operations cannot be switched during operation under DeviceNet protocol. If remote I/O operations need to be switched, it must be done by using the Configurator with the Master Unit's power supply turned OFF.

■ Switching via Parameter Objects (Using the Configurator)

To switch remote I/O operations using parameter objects, the appropriate instance IDs must be set for the following parameter objects.

- Switching remote I/O inputs (3G3MV to SYSMAC PC):
Class 100 dec (64 hex), Instance 01 dec (01 hex), Attribute 202 dec (CA hex)
- Switching remote I/O outputs (SYSMAC PC to 3G3MV)
Class 100 dec (64 hex), Instance 01 dec (01 hex), Attribute 203 dec (CB hex)

The instances to be set are shown in the following table.

Remote I/O type	Instance ID	
	Inputs (3G3MV to PC)	Outputs (PC to 3G3MV)
Basic remote I/O	70 Dec (46 hex)	20 Dec (14 hex)
Standard remote I/O	71 Dec (47 hex)	21 Dec (15 hex)
Special remote I/O	150 Dec (96 hex)	100 Dec (64 hex)

The procedure for switching remote I/O operations by means of object parameters is as follows:

1. Connect the 3G3MV Inverter and a Configurator to the CompoBus/D communications network. At least a 3G3MV CompoBus/D Communications Unit and a Configurator must be connected.
2. Set up the explicit message connection with no remote communications.
 - Turn ON the power to the Configurator and the 3G3MV CompoBus/D Communications Unit and press the Configurator's online button. Do **not** turn ON the power to the Master Unit at this time. This will put the system into online status.
 - Click the *Device List* button at the upper left corner of the Configurator screen. With this, the explicit message connection will be set up.
3. Connect the remote I/O to be used for the parameter objects.
 - Select *Tool (T)* and then *Device Parameter Setting (P)* from the Configurator tool bar to display the parameter setting tool.
 - Set the node address, and then set the remote I/O instance IDs for the parameter objects described above (attributes CA and CB hex of class 64 hex, instance 01 hex).
4. Cut off the Configurator and explicit message connection by turning OFF the power to the Inverter.

5. Set up the Master Unit and 3G3MV Inverter connection by turning ON their power. The remote I/O connection will then start up with the specified remote I/O operation.

When creating scan lists, set the scan list to disable mode once and then create scan lists or change the settings as follows for the Inverter I/O allocation byte number from the Configurator.

- Basic/Standard remote I/O: 4 bytes (both for OUT and IN)
- Special remote I/O: 4 bytes (both for OUT and IN)

Switching via Connection Objects

This method is defined by OVDA AC/DC drive objects.

Connection Objects for Switching Remote I/O Operations

To switch remote I/O operations by this method, the appropriate instance IDs must be set for the following connection objects.

- Switching remote I/O inputs (3G3MV to SYSMAC PC):
Produced connection path (Class 05 hex, Instance 02 hex, Attribute 14 hex)
- Switching remote I/O outputs (SYSMAC PC to 3G3MV)
Consumed connection path (Class 05 hex, Instance 02 hex, Attribute 16 hex)

Remote I/O Instance ID

The instances to be set are shown in the following table.

Remote I/O type	Instance ID	
	Inputs (3G3MV to PC)	Outputs (PC to 3G3MV)
Basic remote I/O	70 Dec (46 hex)	20 Dec (14 hex)
Standard remote I/O	71 Dec (47 hex)	21 Dec (15 hex)
Special remote I/O	150 Dec (96 hex)	100 Dec (64 hex)

Restrictions on Switching Remote I/O

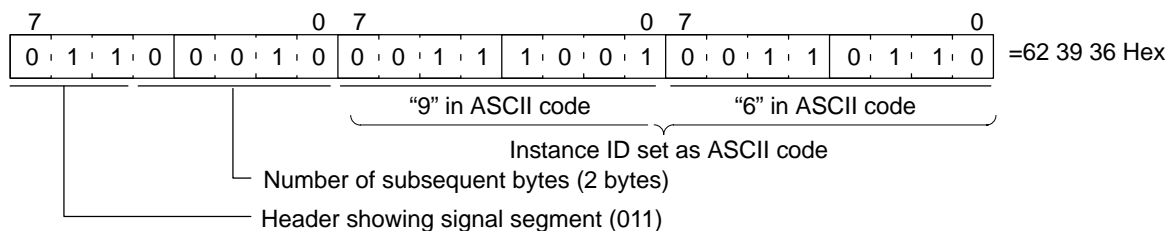
To switch remote I/O operations, maintain either of the following conditions and send an explicit message.

- Remote I/O communications stopped after the remote I/O connection and explicit message connection have been established.
- Remote I/O connection allocated after explicit message connection has been established.

Note The Configurator and OMRON Master Unit cannot create these conditions, so they cannot set connection objects.

Data Setting Example

The set data must be converted to signal segments as defined by DeviceNet and then transferred. For example, when remote I/O inputs are converted to special remote I/O inputs (instance ID: 96 hex), the set data is as follows:



Note For details on using message communications, refer to 5-2 Message Communications (DeviceNet Explicit Messages) and the operation manual for the Master Unit being used.

5-4 Special Remote I/O Operation

There are three kinds of CompoBus/D remote I/O operation: Basic remote I/O, standard remote I/O (the default setting), and special remote I/O. This section explains special remote I/O.

Special remote I/O operation enables using all the functions of 3G3MV-series Inverters, and setting and reading all parameters. These operations have been developed independently, and are not part of the DeviceNet standard.

5-4-1 Overview of Special Remote I/O

Special remote I/O operations utilize CompoBus/D (DeviceNet) remote I/O, and can directly write to and read from internal Inverter registers. Basically, the register numbers for the various functions shown on this and subsequent pages are specified for writing or reading. Once data has been written, it is retained until it is changed by the next write operation.

■ Words Used for Special Remote I/O

● Outputs (SYSMAC PC to 3G3MV) Instance ID: 100 Dec (64 Hex)

Byte number		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd n	Rightmost	0	Function code (write/read code)						
	Leftmost	1	Register number leftmost byte (register number allocated to each parameter, etc.)						
Wd n+1	Rightmost	2	Register number rightmost byte (register number allocated to each parameter, etc.)						
	Leftmost	3	Register data leftmost byte (data to write to specified register)						
Wd n+2	Rightmost	4	Register data rightmost byte (data to write to specified register)						

● Outputs (3G3MV to SYSMAC PC) Instance ID: 150 Dec (96 Hex)

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Wd m	Rightmost	0	Function code (returns transmitted code)						
	Leftmost	1	Register number leftmost byte (returns transmitted register number)						
Wd m+1	Rightmost	2	Register number rightmost byte (returns transmitted register number)						
	Leftmost	3	Register data leftmost byte (returns transmitted data amount or reads data)						
Wd m+2	Rightmost	4	Register data rightmost byte (returns transmitted data amount or reads data)						

Note 1. Special remote I/O outputs and inputs are paired. When using special remote I/O, be sure to set them together.

Note 2. Special remote I/O objects do not conform to the AC/DC drive profile, but are specially set for this product.

Note 3. The 16-bit data (register number and register data) is set in two words for each setting.

■ Function Codes

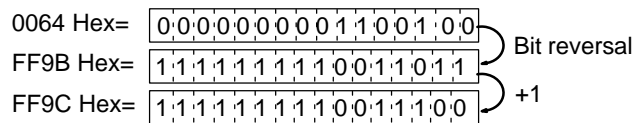
The special remote I/O function codes are shown in the following table. Note that they are different from the explicit message service codes.

Function code (hex)	Content
10	Data writing
03	Data reading
00	No execution (data wrapping only; no internal processing takes place.)

■ **Setting Data for Operations and Parameter Constants**

Read data and write data to be set for operations and parameters are calculated as shown below and then transmitted in hexadecimal.

- Convert to hexadecimal values with the operation/parameter minimum setting value as 1.
Example: To set a frequency reference of 60 Hz when the minimum setting unit is 0.01 Hz.
 $60/0.01 = 6000 \rightarrow 1770$ Hex
- Negative numbers are expressed as two's complements.
Example: To set a frequency reference bias (n061) of of -100% when the minimum setting unit is 1%:
 $100/1 = 100$ Dec = 0064 Hex, -100% \rightarrow FF9C Hex



- If the original data is already displayed in hexadecimal, it is transmitted as is.

Note There is nothing corresponding to the parameters for the 3G3MV Series.

- Set bits that are not used to "0."
- Do not perform data settings for unused registers.

■ **Storing Parameter Data by Enter Command**

Store the parameter setting data, sent in the way shown in *Setting Data for Operations and Parameter Constants*, in EEPROM by sending an enter command. To store a series of data in more than one parameter, send an enter command after completing all the settings.

Data type	Transmission	Inverter operation	Remarks
Enter command to write to EEPROM	Function code: 10 Hex Register number: FFFD Hex Send data: 0000 Hex	When the enter command is received, the series of parameter setting data will be stored in EEPROM. Note: The maximum number of write operations that can be performed to EEPROM is 100,000 operations.	Used to store data even after power interruption.
Not writing to EEPROM	Enter command not sent.	Previously received parameter setting data is already valid as operating data. If an enter command is not sent, data is not stored in EEPROM.	When there is frequent rewriting of data, do not send an enter command because of problems that arise when writing to EEPROM several times. Be sure to send an enter command once before the power supply is interrupted.

Note Register numbers 0000 to 000F are in RAM only. Even if an enter command is sent for these registers, the data will not be stored in EEPROM.

■ Special Remote I/O Responses

When data is written and read using special remote I/O, the responses shown in the following table are returned. Check that the input data and output data match when handling communications.

Error code	Name	Content	Countermeasure
---	---	Normal completion response The function code and register number at the time of transmission are placed at the beginning, and returned with the data amount (when data is written) or the read data (when data is read) attached.	---
01 Hex	Function code error	A code other than 03 Hex/08 Hex//10 Hex has been set as a function code.	Check and correct the function code.
02 Hex	Register number error	The set register number has not been registered.	Check and correct the register number.
		An attempt to read an enter command register was made.	
21 Hex	Data setting error	An upper or lower limit for the write data setting range was exceeded.	Check the display for the Digital Operator and correct the error data.
		Data that would give rise to an operation error (OPE1 to OPE9) has been erroneously set.	
22 Hex	Writing mode error	During Inverter operations, a write-requested message was received for a parameter that is read-only during operation.	Perform write operations after stopping the Inverter.
		An enter command was received during Inverter operations.	
		A read-requested message was received during UV.	Perform write operations after clearing the UV (main circuit undervoltage) error.
		An enter command was received during UV.	
		During F04 (initial memory error) detection, a write-requested message other than constant initialization (n001="8" or "9"), was received.	After constant initialization (n001 = "8" or "9") has been performed, turn the power supply OFF and ON again.
A write-requested message was received for a read-only register.	Check and correct the register number.		

Note 1. When a communications error occurs, the function code MSB will be returned as "1."

Note 2. A "constant restriction" is a restriction on OPE error detection.

5-4-2 Special Remote I/O Communications Timing

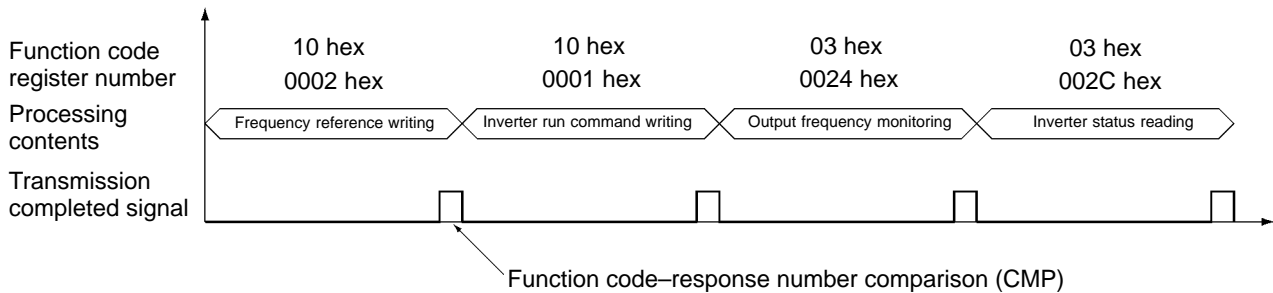
With special remote I/O communications, it is possible to use all of the SYSDRIVE 3G3MV functions, such as frequency setting, control input setting, error monitoring, output frequency monitoring, and so on. These functions are utilized by setting the register numbers and connecting to the various 3G3MV functions. To use these functions properly, be sure to use the following method to handle the data and provide a program for switching the communications processing.

■ **Matching Function Codes and Register Numbers**

- In the remote I/O outputs (SYSMAC PC to 3G3MV), set the function code, register number, and set data for the function to be executed.
- Compare (CMP) the function codes and register numbers of the set remote I/O outputs and the remote I/O inputs (3G3MV to SYSMAC PC). If they agree, proceed to the next process.

Note If data is repeatedly written to the same register number, it cannot be handled. Be sure to keep performing processes with different function codes or register numbers. If it is necessary to write repeatedly to the same register number, then alternately write to and read from that register. (Handling data is made possible by changing function codes.)

■ **Handling Illustration**



5-4-3 Inputting Control/Frequency

The Inverter’s various control inputs are allocated to the registers shown in the following table. For example, to set the frequency reference and begin operation, first set the reference value to the frequency reference register “0002,” and then write the run command to the Inverter’s run command register “0001.”

Note 1. Set values are retained until changed by the next writing operation.

Note 2. The following registers are in RAM, so they are all cleared to zero when the Inverter’s power supply is turned OFF.

Register number (Hex)	Function	Content
0000	Not used.	---
0001	Run command	Refer to the following <i>Run Commands</i> table.
0002	Frequency reference	Frequency reference value setting (units as specified in n035)
0003	V/f gain	Make settings with 1000 Dec as 100%. (see note 1) Setting range: 2.0 to 200.0% (20 to 2000 Dec)
0004 to 0008	Not used.	---
0009	Inverter output	Refer to following <i>Inverter Outputs</i> table.
000A to 000F	Not used.	---

Note 1. The V/f gain is the setting for the percentage of the V/f calculation result with respect to the output voltage. A setting of 1000 Dec (03E8 Hex) corresponds to a multiplication factor of 1.

Note 2. When these registers are read, the values set in communications will be read. For example, when an operation command (register number 0001) is read, the control input previously set in communications will be returned. It is not a monitor for the actual terminal block input signals.

● **Run Commands: Register Number 0001 Hex**

Bit	Content
0	Forward/stop (1: forward operation)
1	Reverse/stop (1: reverse operation)
2	Multi-function input 3 (set with n052)
3	Multi-function input 4 (set with n053)
4	Multi-function input 5 (set with n054)
5	Multi-function input 6 (set with n055)
6	Multi-function input 7 (set with n056)
7	Not used.
8	External fault input (1: EFO)
9	Fault reset (1: reset)
10 to 15	Not used.

Note Input from the control terminal block of the Inverter and input from communications have an OR relationship. For this reason, if multi-function input is set to Forward/Stop or Reverse/Stop, it is possible to give run commands by operating the multi-function input for these registers. However, this would create 2 systems of commands and is therefore not recommended.

● **Inverter Outputs: Register Number 0009 Hex**

Bit	Content
0	Multi-function contact output (1: ON)
1	Multi-function output 1 (1: ON)
2	Multi-function output 2 (1: ON)
3 to 15	Not used.

Note Valid when “18” (communications output) is set for multiple-function outputs 1 to 3 (n057 to n059). By performing this setting, the relevant output terminal can be turned ON and OFF through communications.

5-4-4 Inverter Monitoring Functions

All Inverter monitoring can be accessed. To read Inverter status, fault monitoring, alarm monitoring, I/O status monitoring, error log, etc., specify the register number from the following table and read the data.

Register number (Hex)	Function	Content
0020	Status signal	Refer to the following <i>Status Signals</i> table.
0021	Fault status	Refer to the following <i>Fault Status</i> table.
0022	Data link status	Refer to the following <i>Data Link Status</i> table.
0023	Frequency reference	Follows setting for n035.
0024	Output frequency	Follows setting for n035.
0025 to 0027	Not used.	---
0028	Output voltage	Read with 1 (V) = 1 Dec.
0029 to 002A	Not used.	---
002B	Input terminal status	Refer to the following <i>Input Terminal Status</i> table.
002C	Inverter status	Refer to the following <i>Inverter Status</i> table.
002D	Output terminal status	Refer to the following <i>Output Terminal Status</i> table.
002E to 0030	Not used.	---
0031	Main circuit DC voltage	Read with 1 (V) = 1 Dec.
0032	Torque reference	Read with 1 (%) = 1 Dec. Rated motor torque = 100%. Read with +/-.
0033 to 0036	Not used	---
0037	Output power	Read with 1 (W) = 100 Dec. Read with +/-.
0038	PID feedback	Read with 1 (%) = 1 Dec. Maximum frequency corresponds to 100%.
0039	PID input	Read with 1 (%) = 1 Dec. Maximum frequency corresponds to 100%. Read with +/-.
003A	PID output	Read with 1 (%) = 1 Dec. Maximum frequency corresponds to 100%. Read with +/-.
003B	Output current	Read with 1 (A) = 10 Dec.
003C	Not used.	---
003D	Communications error content	Refer to the following <i>Communications Error Content</i> table.
003E to 00FF	Not used.	---

● **Status Signals: Register Number 0020 Hex**

Bit	Function
0	During RUN (1: during RUN)
1	Forward/reverse operation (1: reverse operation)
2	Inverter ready (1: ready)
3	Fault (1: fault)
4	Data setting error (1: error)
5	Multi-function output 1 (1: ON)
6	Multi-function output 2 (1: ON)
7	Multi-function output 3 (1: ON)
8 to 15	Not used.

● **Fault Status: Register Number 0021 Hex**

Bit	Function
0	OC
1	OV
2	OL2
3	OH
4	Not used.
5	Not used.
6	FBL
7	EF□, STP
8	F□
9	OL1
10	OL3
11	Not used.
12	UV1
13	UV2
14	CE
15	OPR

Note If an error is generated, the relevant bit will become 1.

● **Data Link Status: Register Number 0022 Hex**

Bit	Function
0	During data write (1: during write)
1 to 2	Not used.
3	Upper/lower limit error (1: error): setting range exceeded
4	Integration error (1: error): same as OPE□
5 to 15	Not used.

● **Input Terminal Status: Register Number 002B Hex**

Bit	Function
0	Multi-function input 1 terminal S1 (1: ON)
1	Multi-function input 2 terminal S2 (1: ON)
2	Multi-function input 3 terminal S3 (1: ON)
3	Multi-function input 4 terminal S4 (1: ON)
4	Multi-function input 5 terminal S5 (1: ON)
5	Multi-function input 6 terminal S6 (1: ON)
6	Multi-function input 7 terminal S7 (1: ON)
7 to 15	Not used.

● **Inverter Status: Register Number 002C Hex**

Bit	Function
0	During RUN (1: during RUN)
1	Zero speed (1: zero speed)
2	Frequency agree (1: frequency agree)
3	Warning (minor fault) (1: alarm)
4	Frequency detection 1 (1: output frequency \leq n095)
5	Frequency detection 2 (1: output frequency \geq n095)
6	Inverter ready (1: ready)
7	UV (1: UV)
8	Baseblock (1: during baseblock)
9	Frequency reference mode (1: not communications)
10	RUN command mode (1: not communications)
11	Overtorque detection (1: over torque detection)
12	Not used.
13	Fault retry (1: fault retry)
14	Fault (1: fault)
15	Communications timeover: over 2 s without normal communications (1: communications timeover detected)

● **Output Terminal Status: Register Number 002D**

Bit	Function
0	Multi-function contact output terminal MA (1: ON)
1	Multi-function photocoupler output 1 terminal P1 (1: ON)
2	Multi-function photocoupler output 2 terminal P2 (1: ON)
3 to 15	Not used.

● **Communications Error Content: Register Number 003D Hex**

Bit	Function
0	CRC error (1: error)
1	Incorrect data length (1: error)
2	Not used.
3	Parity error (1: error)
4	Overrun error (1: error)
5	Framing error (1: error)
6	Communications timeout (1: error)
7 to 15	Not used.

5-4-5 Parameter Constant Reading and Writing

The following tables show the SYSDRIVE 3G3MV-series Inverter parameter constant numbers and the corresponding register numbers. Write and read the various parameter constants with “1” as the minimum setting unit. Negative numbers are expressed as two’s complements. When parameter constants are written, the settings for parameters that can be written during operation become valid after the being set in RAM, whereas the settings for parameters that cannot be written during operation, become valid from the next operation. Send an enter command to save the set data in EEPROM.

Note The 2 register numbers which are different from RS-422/485 communications are indicated with a “*.”)

■ Function Group 1

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n001	0101	Parameter write-prohibit selection/parameter initialization	1	0 to 9	1	No
n002	0102	Control mode selection	1	0, 1	0	No
n003	0103	Run command selection	1	0, 1, 2, 3	0	No
n004	0104	Frequency reference selection	1	0 to 9	0	No
n005	0105	Stopping method selection	1	0, 1	0	No
n006	0106	Reverse rotation-prohibit selection	1	0, 1	0	No
n007	0107	STOP Key function selection	1	0, 1	0	No
n008	0108	Frequency reference selection in local mode	1	0, 1	0	No
n009	0109	Operator frequency setting method selection	1	0, 1	0	No
n010	010A	Operation selection at Digital Operator interruption	1	0, 1	0	No
n011	010B	Maximum frequency (FMAX)	0.1 Hz	50.0 to 400.0	60.0	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n012	010C	Maximum voltage (VMAX)	0.1 V	0.1 to 255.0 [0.1 to 510.0]	200.0 (400.0)	No
n013	010D	Maximum voltage frequency (FA)	0.1 Hz	0.2 to 400.0	60.0	No
n014	010E	Middle output frequency (FB)	0.1 Hz	0.1 to 399.9	1.5	No
n015	010F	Middle output frequency voltage (VC)	0.1 V	0.1 to 255.0 [0.1 to 510.0]	12.0 (24.0)	No
n016	0110	Minimum output frequency (FMIN)	0.1 Hz	0.1 to 10.0	1.5	No
n017	0111	Minimum output frequency voltage (VMIN)	0.1 V	0.1 to 50.0 [0.1 to 100.0]	12.0 (24.0)	No
n018	0112	Acceleration/Deceleration time setting unit	1	0, 1	0	No
n019	0113	Acceleration time 1	0.1 s (set with n018)	0.0 to 6000	10.0	Yes
n020	0114	Deceleration time 1			10.0	Yes
n021	0115	Acceleration time 2			10.0	Yes
n022	0116	Deceleration time 2			10.0	Yes
n023	0117	S-shape acceleration/deceleration characteristic	1	0 to 3	0	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n024	0118	Frequency reference 1	0.01 Hz (set with n035)	0.00 to maximum frequency	6.00	Yes
n025	0119	Frequency reference 2			0.00	Yes
n026	011A	Frequency reference 3			0.00	Yes
n027	011B	Frequency reference 4			0.00	Yes
n028	011C	Frequency reference 5			0.00	Yes
n029	011D	Frequency reference 6			0.00	Yes
n030	011E	Frequency reference 7			0.00	Yes
n031	011F	Frequency reference 8			0.00	Yes
n032	0120	Inching frequency command			6.00	Yes
n033	0121	Upper frequency reference limit	1%	0 to 110	100	No
n034	0122	Lower frequency reference limit	1%	0 to 110	0	No
n035	0123	Frequency reference setting/display unit selection	1	0 to 3999	0	No
n036	0124	Rated motor current	0.1 A	0 to 150% of the rated output current	Differs with capacity	No
n037	0125	Motor protection characteristics	1	0, 1, 2	0	No
n038	0126	Motor protective time setting	1 min	1 to 60	8	No
n039	0127	Cooling fan operation	1	0, 1	0	No
n040 to n049	---	Not used.	---	---	---	---

■ Function Group 2

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n050	0132	Multi-function input 1 (terminal S1)	1	1 to 25	1	No
n051	0133	Multi-function input 2 (terminal S2)	1	1 to 25	2	No
n052	0134	Multi-function input 3 (terminal S3)	1	0 to 25	3	No
n053	0135	Multi-function input 4 (terminal S5)	1	1 to 25	5	No
n054	0136	Multi-function input 5 (terminal S5)	1	1 to 25	6	No
n055	0137	Multi-function input 6 (terminal S6)	1	1 to 25	7	No
n056	0138	Multi-function input 7 (terminal S7)	1	1 to 25, 34, 35	10	No
n057	0139	Multi-function input 1 (MA/MB-MC)	1	0 to 7, 10 to 19	0	No
n058	013A	Multi-function input 2 (P1-PC)	1	0 to 7, 10 to 19	1	No
n059	013B	Multi-function input 3 (P2-PC)	1	0 to 7, 10 to 19	2	No
n060	013C	Frequency reference gain	1%	0 to 255	100	Yes
n061	013D	Frequency reference bias	1%	-100 to 100	0	Yes
n062	013E	Analog frequency reference filter time constant	0.01 s	0.00 to 2.00	0.10	Yes
n063 to n64	---	Not used.	---	---	---	---
n065	0141	Multi-function analog output type selection	1	0, 1	0	No
n066	0142	Multi-function analog output	1	0 to 5	0	No
n067	0143	Multi-function analog output gain	0.01	0.00 to 2.00	1.00	Yes

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n068	0144	Multi-function analog voltage input gain	1%	-255 to 255	100	Yes
n069	0145	Multi-function analog voltage input bias	1%	-100 to 100	0	Yes
n070	0146	Multi-function analog voltage input filter constant	0.01 s	0.00 to 2.00	0.10	Yes
n071	0147	Multi-function analog current input gain	1%	-255 to 255	100	Yes
n072	0148	Multi-function analog current input bias	1%	-100 to 100	0	Yes
n073	0149	Multi-function analog current input filter constant	0.01 s	0.00 to 2.00	0.10	Yes
n074	014A	Pulse train frequency reference gain	1%	-255 to 255	100	Yes
n075	014B	Pulse train frequency reference bias	1%	-100 to 100	0	Yes
n076	---	Not used.	---	---	---	---
n077	---	Do not set. (Factory use.)	---	---	0	---
n078	---		---	---	0	---
n079	---		---	---	10	---

■ Function Group 3

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n080	0150	Carrier frequency selection	1	1 to 4, 7 to 9	Differs with capacity.	No
n081	0151	Momentary power interruption compensation	1	0,1,2	0	No
n082	0152	Number of fault retries	1	0 to 10	0	No
n083	0153	Jump frequency 1	0.01 Hz	0.00 to 400.00	0.00	No
n084	0154	Jump frequency 2		0.00 to 400.00	0.00	No
n085	0155	Jump frequency 3		0.00 to 400.00	0.00	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n086	0156	Jump width	0.01 Hz	0.00 to 25.50	0.00	No
n087 n088	---	Not used.	---	---	---	---
n089	0159	DC injection braking current	1%	0 to 100	50	No
n090	015A	DC injection braking-to-stop time	0.1 s	0.0 to 25.5	0.5	No
n091	015B	Startup DC injection braking time	0.1 s	0.0 to 25.5	0.0	No
n092	015C	Stall prevention during deceleration	1	0, 1	0	No
n093	015D	Stall prevention level during acceleration	1%	30 to 200	170	No
n094	015E	Stall prevention level during operation	1%	30 to 200	160	No
n095	015F	Frequency detection level	0.01 Hz	0.00 to 400.0	0.00	No
n096	0160	Overtorque detection function selection 1	1	0 to 4	0	No
n097	0161	Overtorque detection function selection 2	1	0, 1	0	No
n098	0162	Overtorque detection level	1%	30 to 200	160	No
n099	0163	Overtorque detection time	0.1 s	0.1 to 10.0	0.1	No
n100	0164	UP/DOWN frequency selection	1	0, 1	0	No
n101 to n102	---	Not used.	---	---	---	---
n103	0167	Torque compensation gain	0.1	0.0 to 2.5	1.0	Yes
n104	0168	Torque compensation primary delay time constant	0.1 s	0.0 to 25.5	0.3 (0.2)	No
n105	0169	Torque compensation core loss	0.1 W	0.0 to 6550	Differs with capacity.	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n106	016A	Rated motor slip	0.1 Hz	0.0 to 20.0	Differs with capacity.	Yes
n107	016B	Motor phase-to-neutral resistance	0.001 Ω	0.000 to 65.50	Differs with capacity.	No
n108	016C	Motor leakage inductance	0.01 mH	0.00 to 655.0	Differs with capacity.	No
n109	016D	Torque compensation limit	1%	0 to 250	150	No
n110	016E	Motor no-load current	1%	0 to 99	Differs with capacity.	No
n111	016F	Slip compensation gain	0.1	0.0 to 2.5	0.0 (1.0)	Yes
n112	0170	Slip compensation primary delay time	0.1 s	0.0 to 25.5	2.0 (0.2)	No
n113	0171	Slip compensation during regeneration	1	0, 1	0	No
n114	---	---	---	---	---	---
n115	0173	Stall prevention level automatic suppression selection	0, 1	1	0	No
n116	0174	Stall prevention acceleration/deceleration time setting	0, 1	1	0	No
n117 to n119	---	---	---	---	---	---

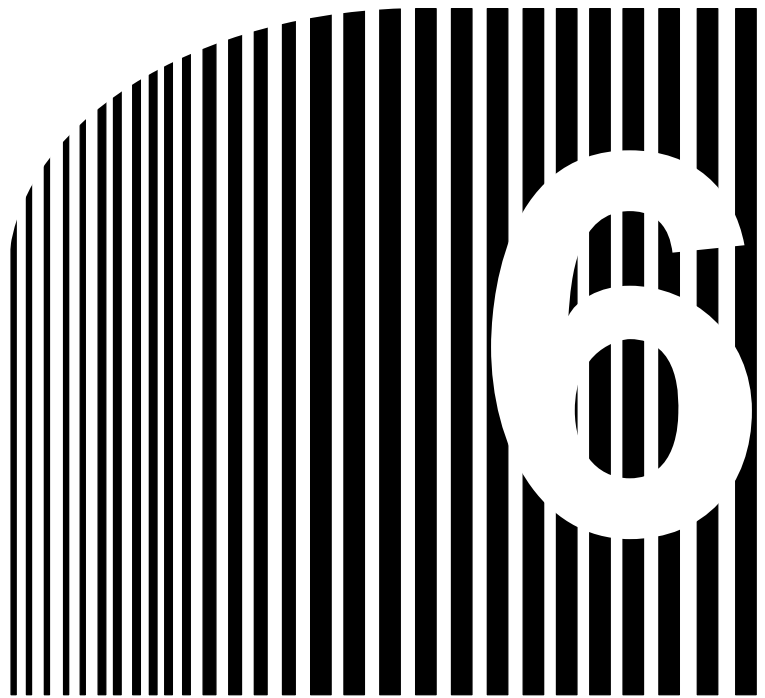
■ Function Group 4

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n120	0178	Frequency reference 9	0.01 Hz (set with n035)	0.00 to maximum frequency	0.00	Yes
n121	0179	Frequency reference 10			0.00	Yes
n122	017A	Frequency reference 11			0.00	Yes
n123	017B	Frequency reference 12			0.00	Yes
n124	017C	Frequency reference 13			0.00	Yes
n125	017D	Frequency reference 14			0.00	Yes
n126	017E	Frequency reference 15			0.00	Yes
n127	017F	Frequency reference 16			0.00	Yes
n128	01D3*	PID control selection	1	0 to 8	0	No
n129	01D4*	Feedback value adjustment gain	0.01	0.00 to 10.00	1.00	Yes
n130	0182	Proportional gain (P)	0.1	0.0 to 25.0	1.0	Yes
n131	0183	Integral time (I)	0.1 s	0.0 to 360.0	1.0	Yes
n132	0184	Derivative time (D)	0.01 s	0.00 to 2.50	0.00	Yes
n133	0185	PID offset adjustment	1%	-100 to 100	0	Yes
n134	0186	Integral (I) upper limit	1%	0 to 100	100	Yes
n135	0187	PID primary delay time	0.1 s	0.0 to 10.0	0.0	Yes
n136	0188	Feedback loss detection selection	1	0, 1, 2	0	No
n137	0189	Feedback loss detection level	1%	0 to 100	0	No
n138	018A	Feedback loss detection time	0.1 s	0.0 to 25.5	1.0	No
n139	018B	Energy-saving control selection	1	0, 1	0	No
n140	018C	Energy-saving control coefficient K2	0.1	0.0 to 6550	Differs with capacity.	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n141	018D	Energy-saving voltage lower limit at 60-Hz output	1%	0 to 120	50%	No
n142	018E	Energy-saving voltage lower limit at 6-Hz output	1%	0 to 25	12%	No
n143	018F	Power averaging time	1 (24 ms)	1 to 200	1	No
n144	0190	Probe operation voltage limit	1%	0 to 100	0%	No
n145	0191	Probe operation control voltage step at 100%	0.1%	0.1 to 10.0	0.5%	No
n146	0192	Probe operation control voltage step at 5%	0.1%	0.1 to 10.0	0.2%	No
n147 n148	---	Not used	---	---	---	---
n149	0195	Pulse train input scale	1 (10 Hz)	100 to 3300	2500	No
n150	0196	Multi-function analog output, pulse train frequency selection	1	0, 1, 6, 12, 24, 36	0	No
n151	0197	RS-422/485 communications time-over detection selection	1	0 to 4	0	No
n152	0198	RS-422/485 communications frequency reference/monitor unit selection	1	0 to 3	0	No
n153	0199	RS-422/485 communications slave address	1	0 to 32	0	No
n154	019A	RS-422/485 baud rate selection	1	0 to 3	2	No
n155	019B	RS-422/485 parity selection	1	0, 1, 2	0	No

Constant	Register number (Hex)	Name	Setting unit	Setting range	Default setting	Write during operation
n156	019C	RS-422/485 send wait time	1 ms	10 to 65	10	No
n157	019D	RS-422/485 RTS control selection	1	0, 1	0	No
n158	019E	Motor code	1	0 to 70	Differs with capacity.	No
n159	019F	Energy-saving voltage upper limit at 60-Hz output	1%	0 to 120	120	No
n160	01A0	Energy-saving upper limit voltage at 6-Hz output	1%	0 to 25	16	No
n161	01A1	Power detection width for probe operation switching	1%	0 to 100	10%	No
n162	01A2	Power detection filter constant	1 (4 ms)	0 to 255	5	No
n163	01A3	PID output gain	0.1	0.0 to 25.0	1.0	No
n164	01A4	PID feedback input block selection	1	0 to 5	0	No
n165 to n174	---	Not used	---	---	---	---
n175	01AF	Low carrier frequency at low speed	0, 1	1	0	No
n176	01B0	Parameter copy and verify function selection	1	0 to 5	0	No
n177	01B1	Parameter read prohibit selection	1	0, 1	0	No
n178	01B2	Fault log (read only)	---	---	---	---
n179	01B3	Software number (read only)	---	---	---	---

Note [] values indicate those for 400-V-class Inverters.



Chapter 6

• Communications Errors •

- 6-1 Communications Line Errors
- 6-2 Message Communications Errors
- 6-3 Special Remote I/O Errors
- 6-4 Inverter Faults

6-1 Communications Line Errors

Malfunctions in CompoBus/D communications that are a result of broken wires, short circuits, reversed wiring, duplicate node address assignments, or noise interference are detected as transmission (BUS) errors. When a transmission error is detected, the Inverter’s Fault Bit will turn ON and the motor will coast to a stop.

When an error is detected, perform error processing according to the indicator display of the CompoBus/D Communications Unit with the terminal cover and Digital Operator removed.

■ Operation Indicators

The CompoBus/D Communications Unit has 4 operation indicators that show the status of the power and communications.

Indicator	Display		Meaning	Countermeasures
	Color	Status		
PWR	Green	Lit	Power is being supplied from the Inverter to the Unit.	---
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being supplied to it.	Check the Option Unit connector and turn ON the Inverter power supply. Replace the Option Unit.
MS	Green	Lit	The Unit is operating normally.	---
		Flashing	Initial settings or necessary preparations for communications are incomplete.	Turn ON the Inverter power supply again. Replace the Option Unit.
	Red	Lit	A fatal error (hardware error) has occurred in the Unit.	Turn ON the Inverter power supply again. Replace the Option Unit.
		Flashing	A non-fatal error, such as a switch setting error, has occurred.	Check the baud rate setting. Turn ON the Inverter power supply again. Replace the Option Unit.
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being to supplied to it.	Check the Option Unit connector and turn ON the Inverter power supply. Replace the Option Unit.

Indicator	Display		Meaning	Countermeasures
	Color	Status		
NS	Green	Lit	The CompoBus/D Network (DeviceNet) is operating normally. (Communications connections established.)	---
		Flashing	The Network is normal, but the communications connection with the Master Unit is not established.	Turn ON the power supply again after the following steps. <ul style="list-style-type: none"> • Register in the scan list. • Turn ON the power supply to the Master Unit.
	Red	Lit	A fatal communications error has occurred. A CompoBus/D communications error was detected caused by node address duplication or Bus OFF. (These errors make communications impossible.)	Turn ON the power supply again after the following steps. <ul style="list-style-type: none"> • Correct node address duplication. • Connect termination resistance to both ends of the communications line. • Correct the Master Unit errors that occur when the Master Unit stops after communications is once established. • Correct environmental conditions such as noise.
		Flashing	A non-fatal communications error has occurred due to communications timeout.	Turn ON the power supply again after the following processing. <ul style="list-style-type: none"> • Connect termination resistance to both ends of the communications line. • Correct defective connections in the communications line. • Correct environmental conditions such as noise.
		---	Not lit	A CompoBus/D Network error has occurred. For example, the Network does not exist, power is not supplied to the Unit, or the baud rates do not match.

Indicator	Display		Meaning	Countermeasures
	Color	Status		
WD	Green	Flashing	The CPU Unit of the Unit is operating normally.	---
	Red	Lit	The CPU Unit of the Unit is not ready or the CPU Unit has malfunctioned.	Check the Option Unit connector and turn ON the Inverter power supply. Replace the Option Unit.
	---	Not lit	Power is not being supplied from the Inverter. The Unit is not connected properly and power is not being to supplied to it.	Check the Option Unit connector and turn ON the Inverter power supply. Replace the Option Unit.

Note 1. When both of the baud rate setting pins DR0 and DR1 are set to ON, both the MS and NS will be lit in red.

Note 2. For communications line problems, detailed error codes will be displayed on the indicators of the Master Unit. Check the error code and take appropriate countermeasures according to the descriptions in *Chapter 15 Troubleshooting and Maintenance of CompoBus/D (Device-Net) Operation Manual (W267)*.

6-2 Message Communications Errors

■ **Explicit Message Errors**

If an explicit message is sent, but communications do not end normally, one of the following error codes will be returned with service code 94. Check the meaning of the error message, and either correct the message or adjust the timing of the message.

Error Code	Meaning	Countermeasures
0000	Normal end response.	---
08FF	The requested service does not exist.	Correct the service code and send the data again.
09FF	An invalid attribute was detected.	Check and correct the attribute values, and send the data again.
0CFF	The requested service cannot be executed in the current object mode or status.	Stop the Inverter and send the data again.
0EFF	A request has been sent to change an attribute that cannot be changed.	Check and correct the service code and attribute values, and send the data again.
13FF	There is insufficient data to execute the service.	Correct the data size and send the data again.
14FF	The attribute for the service does not exist.	Check and correct the service code and attribute values, and send the data again.
15FF	There is too much data to execute the service.	Correct the data size and send the data again.
16FF	The specified object does not exist.	Check and correct the class and instance values, and send the data again.
20FF	The parameters are invalid or the data is outside the range for the requested service.	Check and correct the data setting range, send the data again.
1FFF	Manufacturer fault code.	Stop the Inverter and send the data again. Check and correct the data setting range, send the data again.

6-3 Special Remote I/O Errors

■ Special Remote I/O Errors

If each function is not set properly using the special remote I/O, the MSB of the function code will be changed to 1 and one of the following error codes will be returned. Check the meaning of the error message, and either correct the message or adjust the timing of the message.

Error code	Name	Content	Countermeasure
---	---	Normal completion response The function code and register number at the time of transmission are placed at the beginning, and returned with the data amount (when data is written) or the read data (when data is read) attached.	---
01 Hex	Function code error	A code other than 03 Hex/08 Hex//10 Hex has been set as a function code.	Check and correct the function code.
02 Hex	Register number error	The set register number has not been registered.	Check and correct the register number.
		An attempt to read an enter command register was made.	
21 Hex	Data setting error	An upper or lower limit for the write data setting range was exceeded.	Check the display for the Digital Operator and correct the error data.
		Data that would give rise to an operation error (OPE1 to OPE9) has been erroneously set.	
22 Hex	Writing mode error	During Inverter operations, a write-requested message was received for a parameter that is read-only during operation.	Perform write operations after stopping the Inverter.
		An enter command was received during Inverter operations.	
		A read-requested message was received during UV.	Perform write operations after clearing the UV (main circuit undervoltage) error.
		An enter command was received during UV.	
		During F04 (initial memory error) detection, a write-requested message other than constant initialization (n001="8" or "9"), was received.	After constant initialization (n001 = "8" or "9") has been performed, turn the power supply OFF and ON again.
A write-requested message was received for a read-only register.	Check and correct the register number.		

Note The MSB of the function code will be returned as 1 when there is a communications failure.

6-4 Inverter Faults

■ Detecting Inverter Faults

When a fault is detected in the Inverter itself, the status will change as shown in the following table.

Function	Inverter Fault Status
Remote I/O	The fault output allocated in the remote I/O will turn ON. If the fault output is ON, turn OFF all related inputs controlling the Inverter, and program a sequence to stop the program.
Explicit messages	Read the fault output for Class 29, Instance 1, Attribute 0A using message communications. If there is a fault in the Inverter, the fault output will be ON, so turn OFF all related inputs controlling the Inverter, and program a sequence to stop the program.
Special remote I/O	Read register 002C, and check whether bit 14 (fault output) is ON (serious fault). If bit 14 is ON, turn OFF all related inputs controlling the Inverter, and program a sequence to stop the program.

■ Confirming Inverter Fault Status

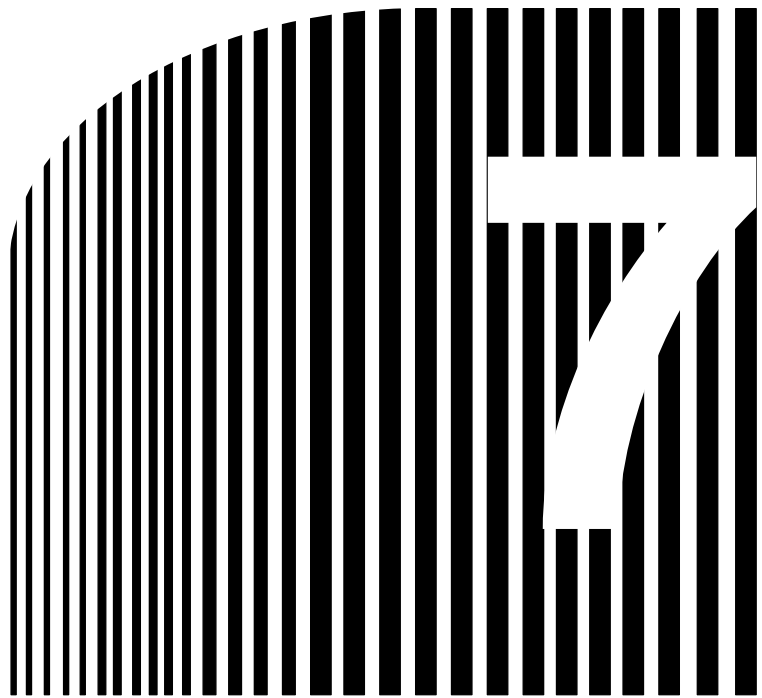
The fault information for the Inverter can be checked by using the following methods. Perform troubleshooting based on the information corresponding to the fault and refer to maintenance information in the *SYSDRIVE 3G3MV Multi-function General-purpose Inverter User's Manual (I516)*.

Function	Inverter Error Status
Operation indicators on Inverter	When there is an Inverter fault, the details will be displayed on the Digital Operator of the Inverter. The fault log can be checked using the monitor function (U-09).
Explicit messages	Read the fault code for Class 29, Instance 1, Attribute 0D using message communications. The code corresponding to the Inverter fault is specified.
Special remote I/O	Read registers 0021. Check the fault status from the bit signals that are output for an Inverter fault.

■ Memory Data Backup (F04)

The SYSDRIVE 3G3MV Inverter uses EEPROM for the data backup. Data is written to EEPROM when the parameters change or the power is turned OFF.

- Data can be written to EEPROM up to 100,000 times.
- Parameters are always written to EEPROM when they are changed using CompoBus/D communications, so limit the times that parameters are written to EEPROM as much as possible. (With the special I/O, data will be written to EEPROM when an enter command is received.)
- Frequency reference and control command (register numbers 0000 to 000F for the special I/O) and the Net Control Bit and Net Reference Bit are not written to RAM or EEPROM. When the power is turned OFF, any specified values are cleared.



Chapter 7

• **Communications Programs** (SYSMAC C200HX/HG/HE PCs) •

- 7-1 Standard Remote I/O Programming
- 7-2 Message Communications Programming
- 7-3 Special Remote I/O Programs

Note In this chapter, the bits, words, and data memory used in the ladder programs are selected at random. When creating actual programs, modify the contents so that they do not overlap with other areas.

7-1 Standard Remote I/O Programming

When the following standard remote I/O programming is executed, the rotational speed reference data specified in the DM (Data Memory) Area of the PC is written to the 3G3MV Inverter and forward or reverse operation is performed at the specified frequency when the Frequency Reference Input Bit is turned ON and the Forward Input Bit or Reverse Input Bit is turned ON.

■ Allocations

Bit	00000	← Frequency Reference Input Bit
Bit	00001	← Forward Input Bit
Bit	00002	← Reverse Input Bit
Bit	00003	← Fault Reset Input Bit
Bit	00004	← Local/Network selection Bit
Bit	03000	← Fault Flag
	DM0000	← Rotational speed reference data

● Remote I/O: Outputs from PC to 3G3MV Inverter

Words n and n + 1

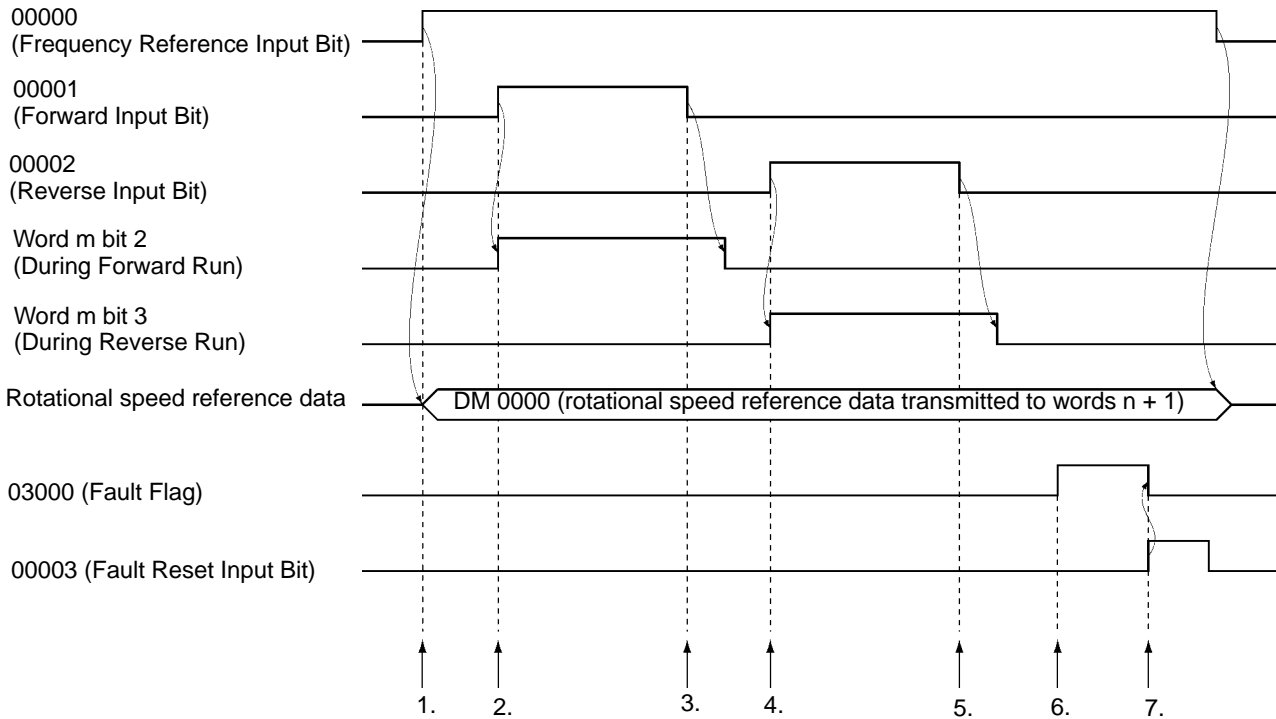
Byte		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	Rightmost	0	---	Net Reference	Net Control	---	---	Fault Reset	Reverse/ Stop
	Leftmost	1	---	---	---	---	---	---	---
n+1	Rightmost	2	Rotational speed reference data						
	Leftmost	3	Rotational speed reference data						

● Remote I/O: Inputs from 3G3MV Inverter to PC

Words m and m + 1

Byte		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
m	Rightmost	0	At Frequency	Reference From Net	Control From Net	Inverter Ready	During Reverse Run	During Forward Run	Alarm
	Leftmost	1	---	---	---	---	---	---	---
m+1	Rightmost	2	Rotational speed reference data						
	Leftmost	3	Rotational speed reference data						

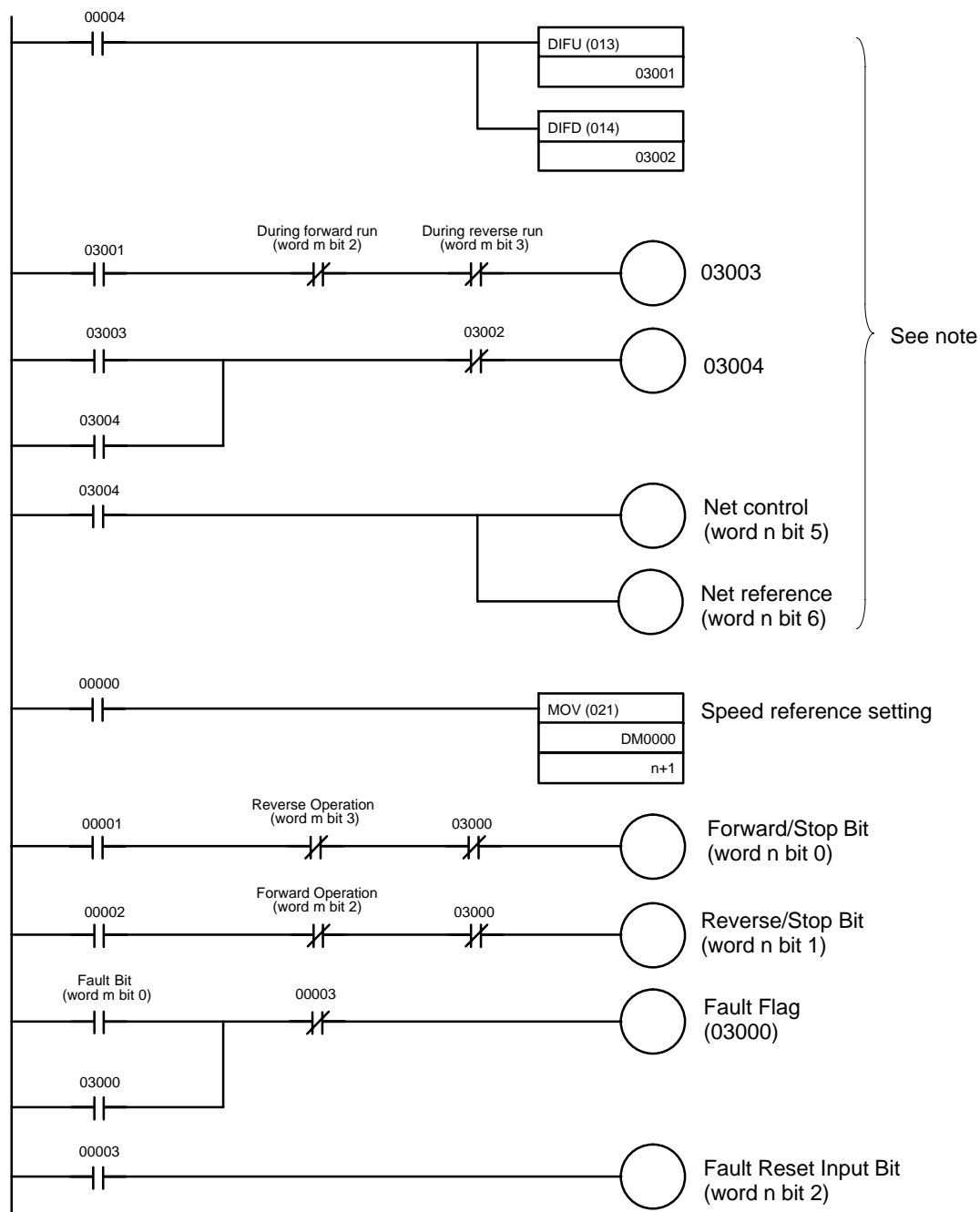
■ Timing Chart



■ Operation

1. When the Frequency Reference Input Bit turns ON, the rotational speed reference data specified in DM 0000 is moved to remote I/O output word n + 1.
2. When the Forward Input Bit turns ON, remote I/O word n bit 0 (Forward/Stop) will turn ON, and forward operation will start. During forward operation, remote I/O word m bit 2 (During Forward Run) will be ON.
3. When the Forward Input Bit turns OFF, remote I/O word m bit 2 (During Forward Run) will turn OFF after operation will decelerate to a stop.
4. When the Reverse Input Bit turns ON, remote I/O word n bit 1 (Reverse/Stop) will turn ON, and reverse operation will start. During reverse operation, remote I/O word m bit 3 (During Reverse Run) will be ON.
5. When the Reverse Input Bit turns OFF, remote I/O word m bit 3 (During Reverse Run) will turn OFF after operation decelerates to a stop.
6. When the remote I/O Fault Bit (word m bit 0) turns ON, the Fault Flag will turn ON.
7. When the Fault Reset Input Bit turns ON, remote I/O word n bit 2 (Fault Reset Input Bit) will turn ON, and the fault will be cleared. When the fault is reset, the Fault Flag will turn OFF simultaneously.

■ Ladder Program



Note This program is not required if the n004 (Frequency Reference Selection) is set to "9" and n003 (Inverter Run Command Selection) is set to "3."

7-2 Message Communications Programming

7-2-1 Inverter Fault Processing

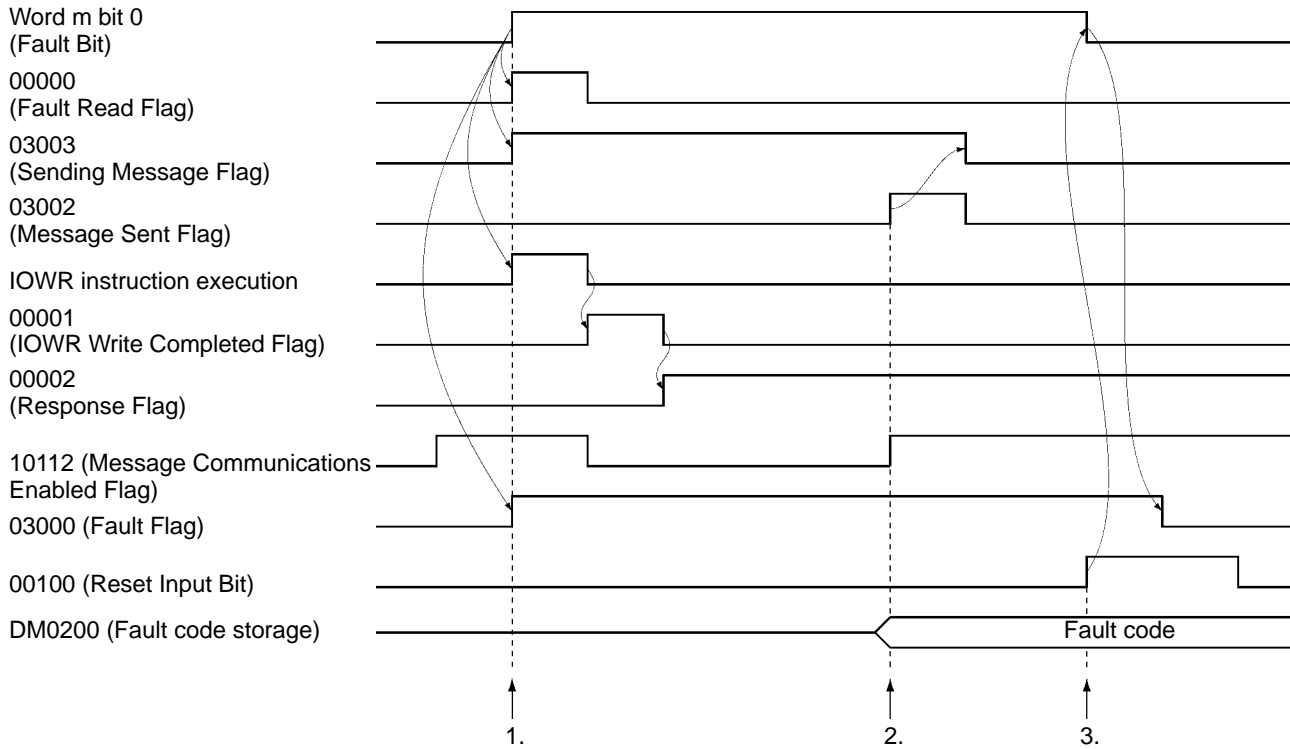
The message communications programming example given here reads and stores the fault data using explicit messages for fault outputs from the Inverter. If the Inverter has a fault, the remote I/O input's Fault Bit (word m bit 0) will turn ON. Be sure to turn OFF the Run Command Bits (word n bits 0 and 1). In this program example, the fault code is stored in DM 0200.

If commands are interrupted by faults, store the completion code in the DM Area and re-execute the command. When a fault occurs, check the contents of the fault and take countermeasures referring to information provided in the *SYS DRIVE 3G3MV Multi-function Compact Inverter User's Manual (I527)*.

■ Allocations

Bit	03000	← Fault Flag
Bit	00000	← Fault Code Read Flag
Bit	00001	← IOWR Write Completed Flag
Bit	00002	← Response Flag
Bit	03003	← Sending Message Flag
Bit	03002	← Message Sent Flag
Bit	00100	← Reset Input Bit
	DM0000	← Slave node address (3G3MV Inverter)
Response data storage area		
	DM 2000	← Command code 2801
	DM 2001	← Completion code
	DM 2002	← Received bytes
	DM 2003	← Node address, service code; 8E: Read normal, 94: Error
	DM 2004	← Read data or error code
	DM 0100	← Completion code storage for communications errors
	DM 0200	← Fault code storage for Inverter fault

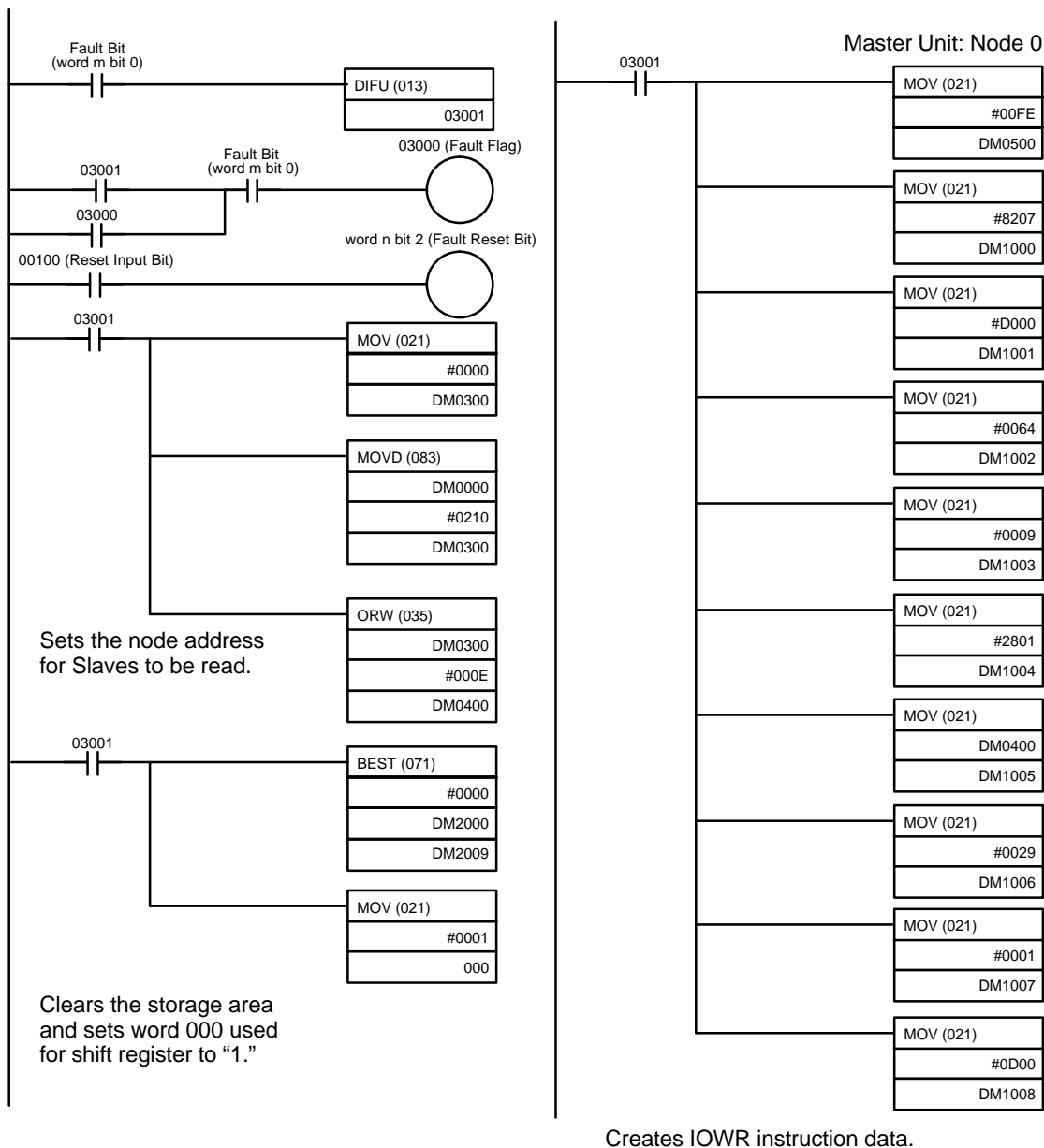
■ Timing Chart

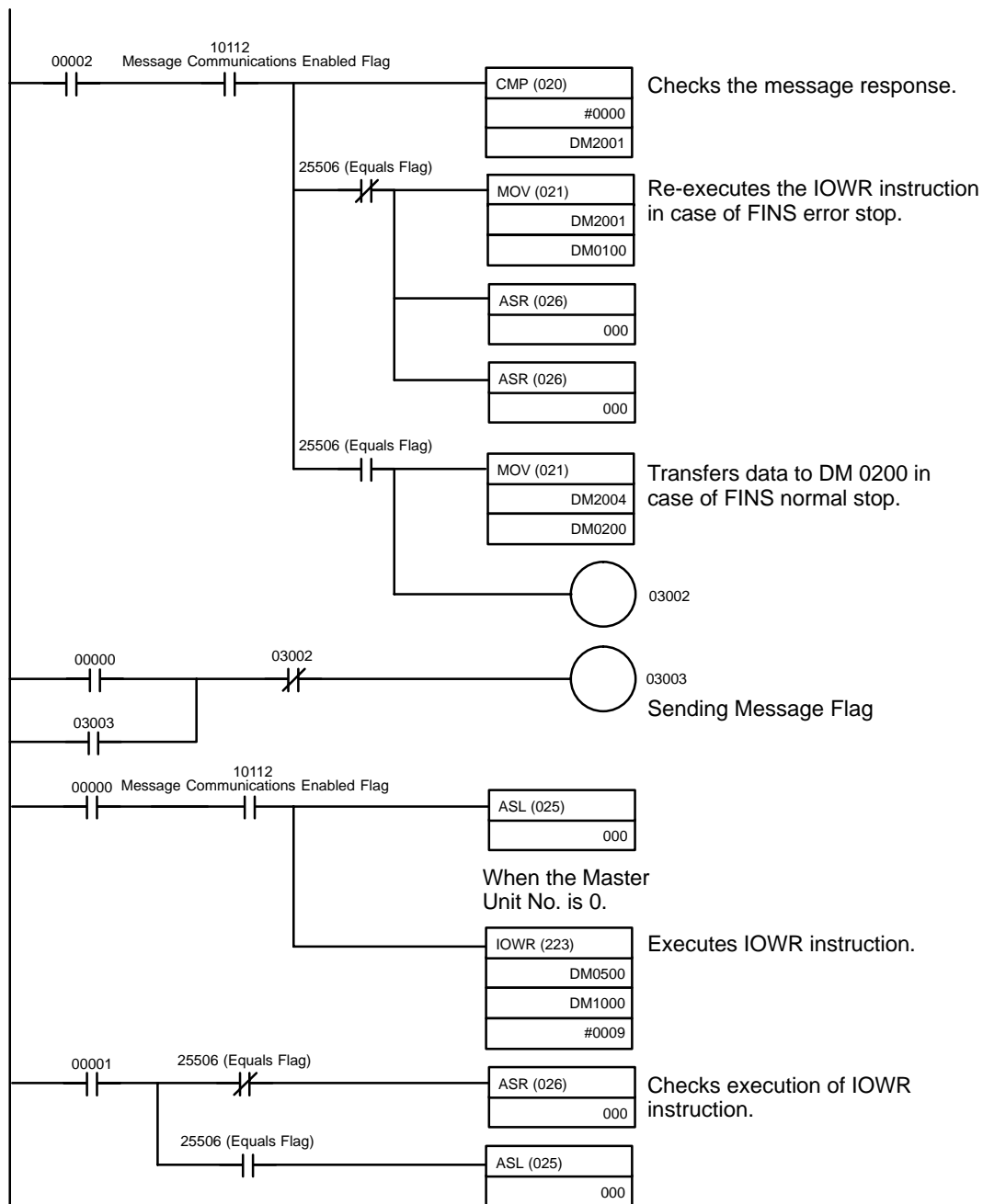


■ Operation

1. When the Inverter has a fault, bit 0 of word m (Fault Bit) will be turned ON. Until the fault is cleared, the Fault Flag will be turn ON, and this will cause the Fault Read Flag to be turned ON, and the command specified in the DM Area will be sent using the IOWR instruction.
2. When the Message Communications Enabled Flag is turned ON, the completion code (DM 2001) will be examined. If an error is found, the error code will be stored in DM 0100 and re-send message. If normally completed, the fault code will be stored in DM 0200 and the Message Sent Flag will be turned ON, and the Sending Message Flag will be turned OFF.
3. When the Reset Input Bit is turned ON, bit 2 of word n (Fault Reset Input Bit) will turn ON. When the fault is cleared, the Fault Flag will turn OFF.

■ Ladder Program





7-2-2 Reading/Writing Data

This programming example writes and reads data using explicit messages. Explicit messages can be executed by specifying FINS commands in the DM Area allocated to the PC, and sending them using the CMND or IOWR instructions.

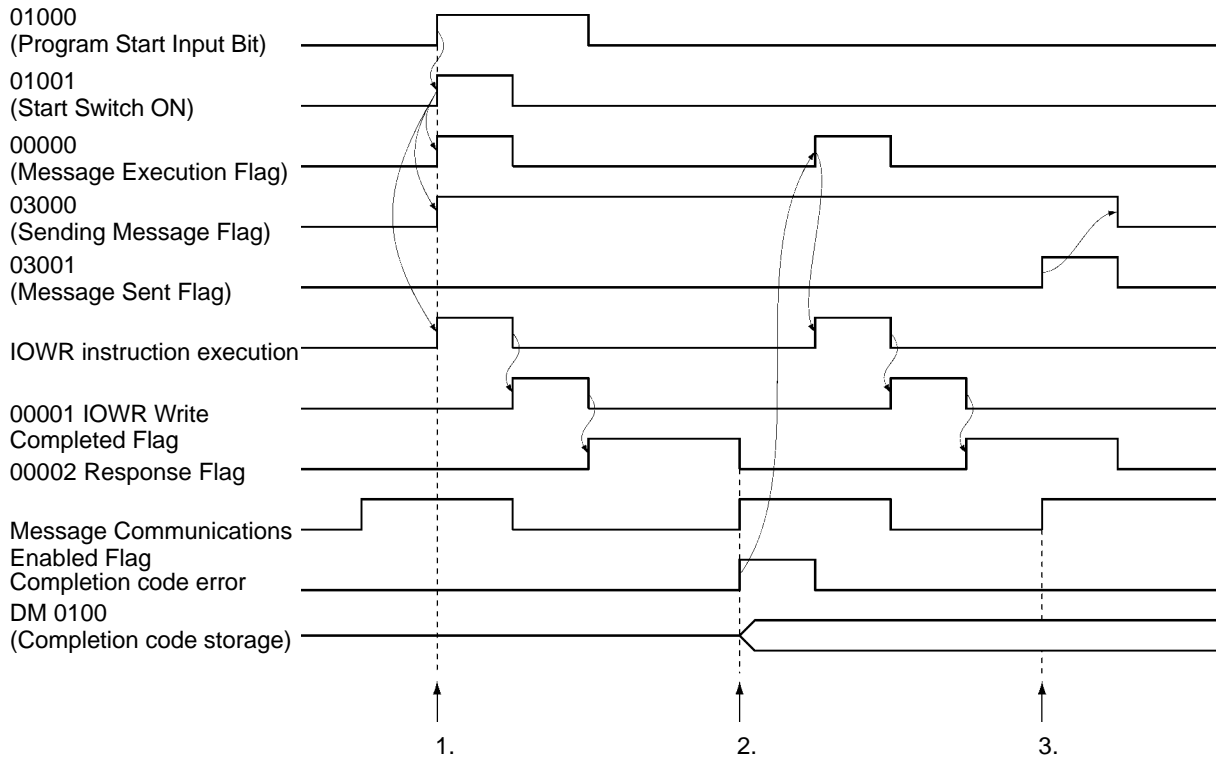
If there is an error in the command, the completion code is stored in the DM Area and the command is re-executed.

■ Allocations

Bit	01000	← Program Start Input Bit
Bit	00000	← Message Execution Flag
Bit	00001	← Command Write Flag
Bit	00002	← Response Flag
Bit	03000	← Sending Message Flag
Bit	03001	← Message Sent Flag
	DM 0000	← Slave node address (3G3MV Inverter)
	DM 0001	← Service code; 0E: Read, 10: Write
	DM 0002	← Number of command data bytes (hex)
	DM 0003	← Class ID (hex)
	DM 0004	← Instance ID (hex)
	DM 0005	← Attribute ID (hex)
	DM 0006	to DM 0009 Write data (hex) (See note)
Response data storage area		
	DM 2000	← Command code
	DM 2001	← Completion code
	DM 2002	← Number of bytes received
	DM 2003	← Node address, service code; 8E Read normal, 90: Write normal, 94: Error
	DM 2004	to DM 0009 ← Read data or error code
	DM 0100	← Completion code storage area for communications errors

Note If the written data size is “Word,” set in the order of the rightmost bits and leftmost bits.

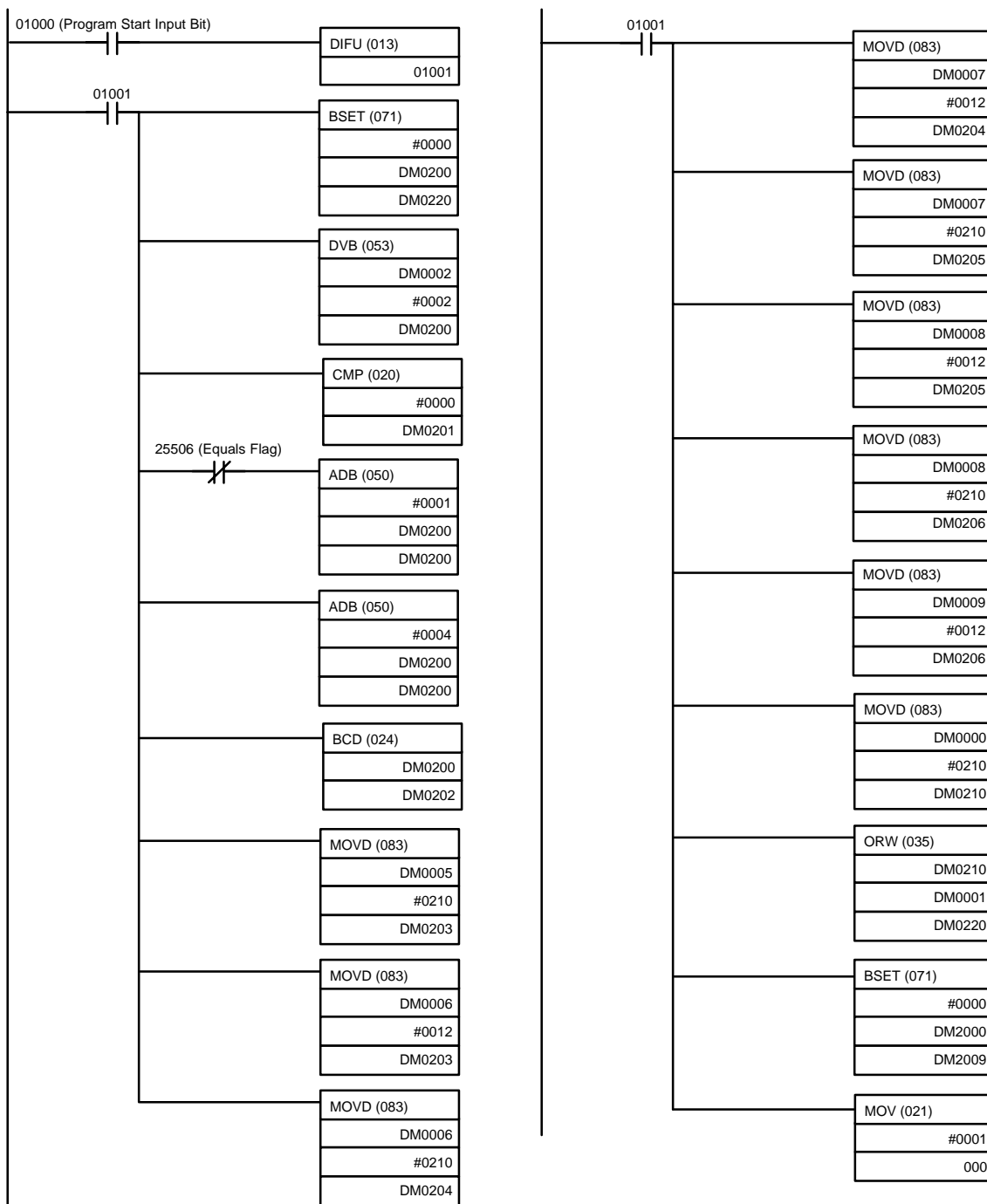
■ Timing Chart



■ Operation

1. When the Program Start Input Bit is turned ON, the Message Execution Flag will turn ON, and the command specified in the DM Area will be sent using the IOWR instruction.
2. When the Message Communications Enabled Flag is turned ON, the completion code (DM 2001) is examined. If an error is found, the completion code is stored in DM 0100, and the command is re-executed.
3. If the completion code of the response is normal, the Message Sent Flag will be turned ON, and the Sending Message Flag will be turned OFF.

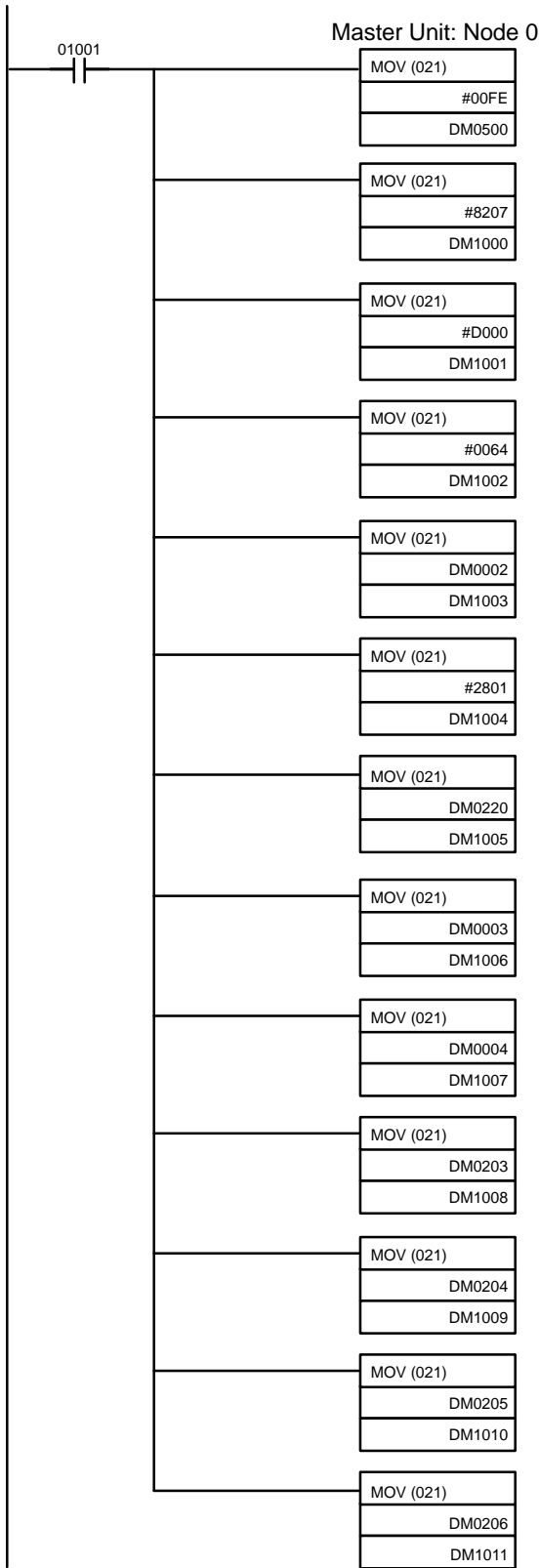
■ Ladder Program



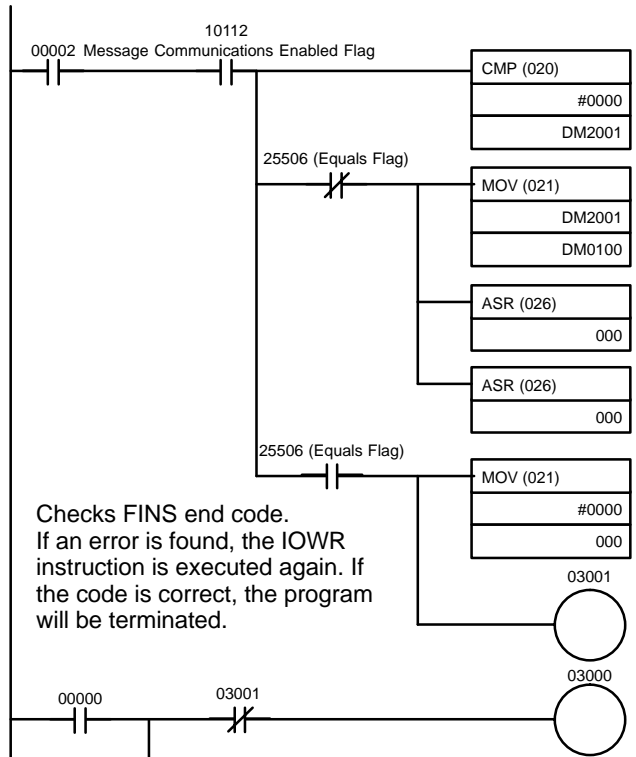
Converts to IOWR instruction data from the specified DM areas (DM 0000 to DM 0009).

Clears the data storage area.

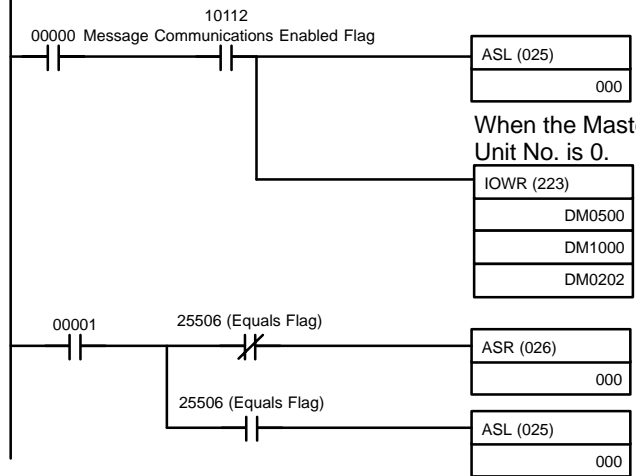
Sets the 000 word used for shift register to "1."



Sets IOWR instruction.



Checks FINS end code.
If an error is found, the IOWR instruction is executed again. If the code is correct, the program will be terminated.



When the Master Unit No. is 0.

Executes and checks the execution of IOWR instruction.

7-3 Special Remote I/O Programs

7-3-1 Simple Operation Programs

This section describes examples of simple operation programming using special remote I/O. To use special remote I/O, it is necessary to switch the remote I/O operation. Refer to 5-3 *Switching Remote I/O Operation* and change to the special remote I/O operation.

Once the Program Start Input Bit is turned ON, Inverter operations will continue until the Program End Input is turned ON. The frequency (speed) reference specified in the DM Area (DM1000) of the PC is repeatedly set in the Inverter. The output frequency value will be repeatedly read and stored in the DM Area (DM 2000). The Inverter status will also be read repeatedly and stored in words (020**) allocated in the PC.

If any communications error occurs, the program will stop and a stop command will be sent to the Inverter. This state will continue until the Communications Fault Reset Input Bit is turned ON.

Note Write the program so that the Inverter operation commands (01000 and 01001) will be turned OFF when the Fault Bit (02014) of the Inverter status turns ON, and also take appropriate countermeasures according to maintenance information in the *SYSDRIVE 3G3MV Multi-function General-purpose Inverter User's Manual*.

■ Allocations

● Inverter Control Input Word Allocation

Word	Function
01000	Forward/Stop (1: forward) Bit
01001	Reverse/Stop (1: reverse) Bit
01002	Multi-function Input 3 (set with n052) Bit
01003	Multi-function Input 4 (set with n053) Bit
01004	Multi-function Input 5 (set with n054) Bit
01005	Multi-function Input 6 (set with n055) Bit
01006	Multi-function Input 7 (set with n056) Bit
01007	Not used.
01008	External Fault Input (1: EFO) Bit
01009	Fault Reset (1: reset) Bit

● **Inverter Status Word Allocation**

Word	Function
02000	During Run (1: during run) Bit
02001	Zero Speed (1: zero speed) Bit
02002	Frequency Agree (1: frequency agree) Bit
02003	Warning (minor fault) (1: alarm) Bit
02004	Frequency Detect 1 (1: output frequency ≤ n095) Bit
02005	Frequency Detect 2 (1: output frequency ≥ n095) Bit
02006	Inverter Ready (1: Inverter ready) Bit
02007	UV (1: UV) Bit
02008	Baseblock (1: baseblock) Bit
02009	Frequency Reference Mode (1: not communications) Bit
02010	Run Command Mode (1: not communications) Bit
02011	Overtorque Detection (1: overtorque detected) Bit
02012	Not used.
02013	During Fault Retry (1: during fault retry) Bit
02014	Fault (1: during fault) Bit
02015	Communications Timeover CE (1: communications timeover detected) Bit

● **Program-related Bits Used**

Word	Function
00000	Program Start Input Bit
00001	Program End Input Bit
00002	Program Execution Flag
00003	Communications Error Reset Input Bit
00004	Inverter Stop Command Flag
01000	Frequency Reference Write Flag
00101	Control Input Write Flag
00102	Output Frequency Read Flag
00103	Inverter Status Read Flag
00300	Frequency Reference Write Completed Flag
00301	Control Input Write Completed Flag
00302	Output Frequency Read Completed Flag
00303	Inverter Status Read Completed Flag
03110	Communications Error Flag

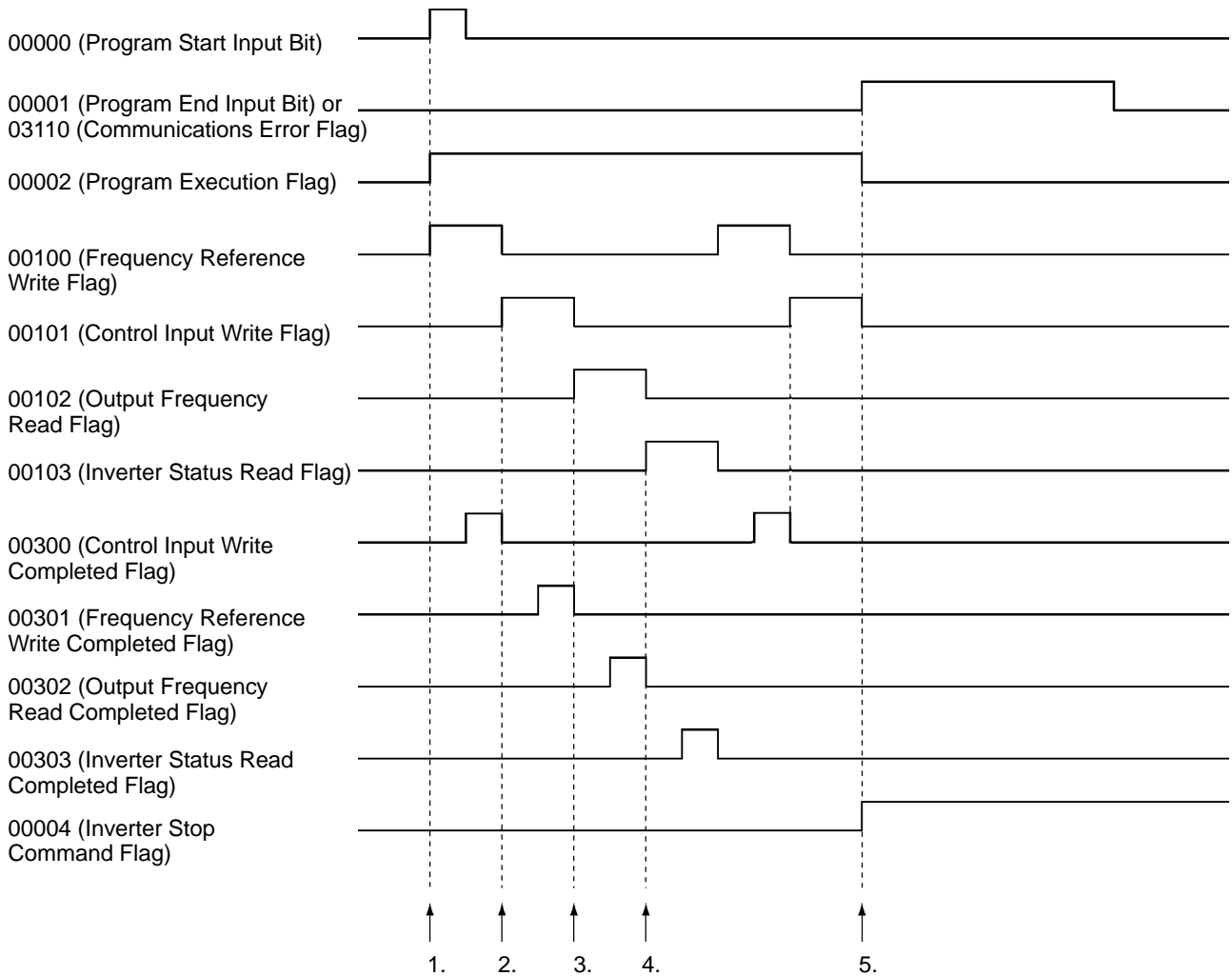
● **Inverter Control Input**

Word	Function
DM1000	Reference frequency setting
DM2000	Output frequency monitor

● Remote I/O Allocation Areas

I/O classification	Word address	15 to 8	7 to 0
Output (PC to 3G3MV Inverter)	n	Register number (leftmost bits)	Function code (10: Write, 03: Read)
	n+1	Register data (leftmost bits)	Register number (rightmost bits)
	n+2	Not used	Register data (rightmost bits)
Input (3G3MV Inverter to PC)	m	Register number (leftmost bits)	Function code (10: Write, 03: Read)
	m+1	Register data (leftmost bits)	Register number (rightmost bits)
	m+2	Not used	Register data (rightmost bits)

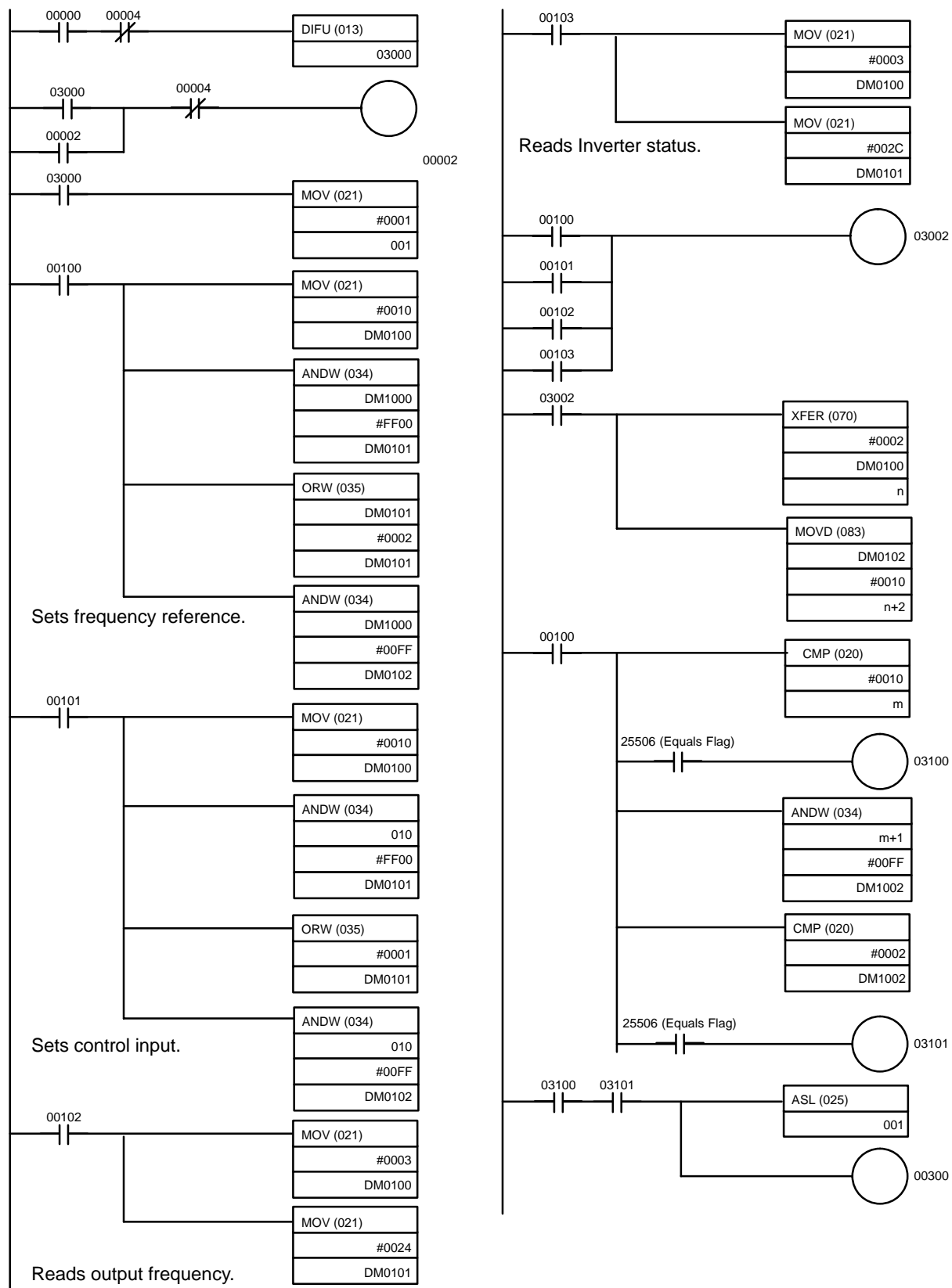
■ Timing Chart

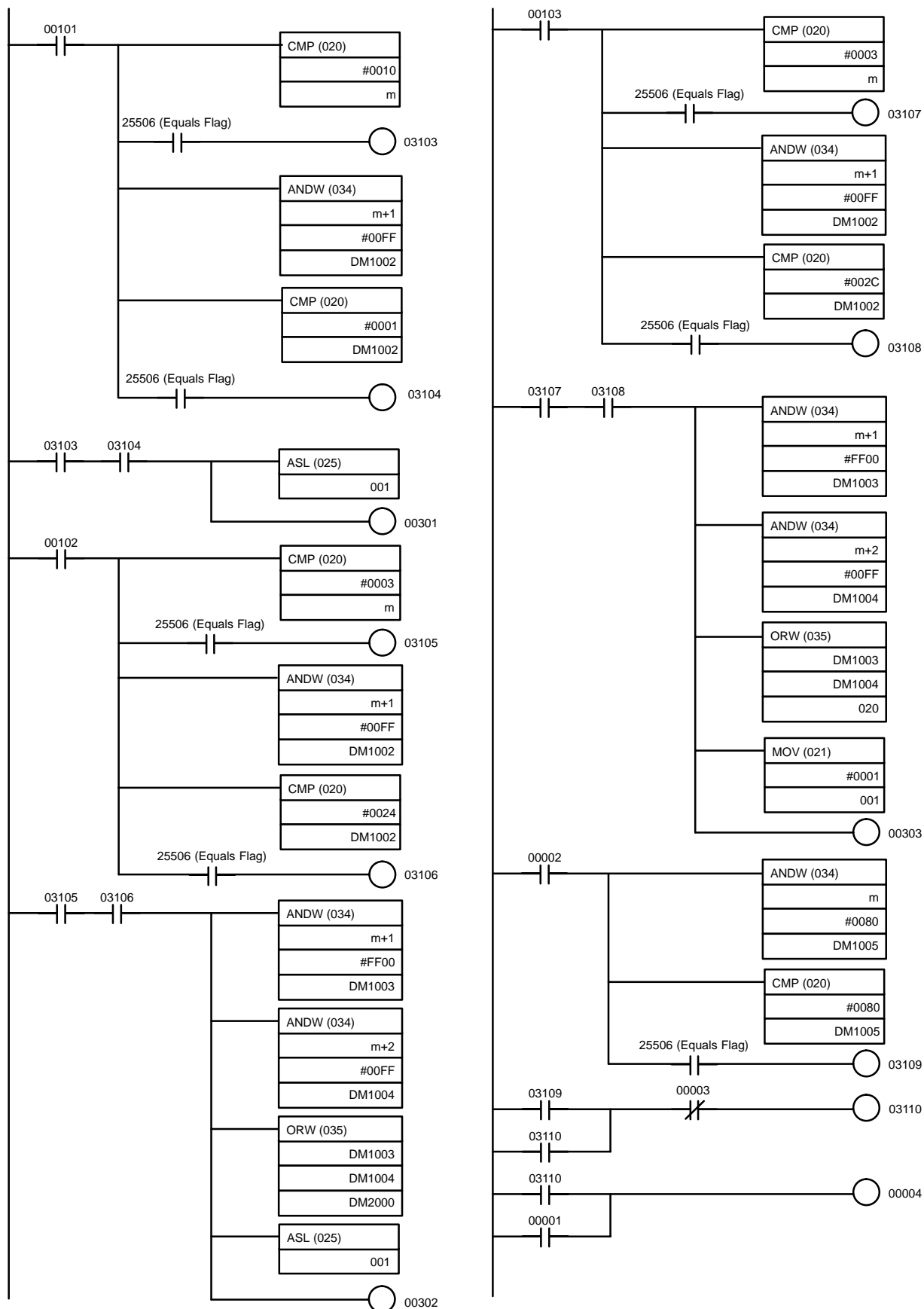


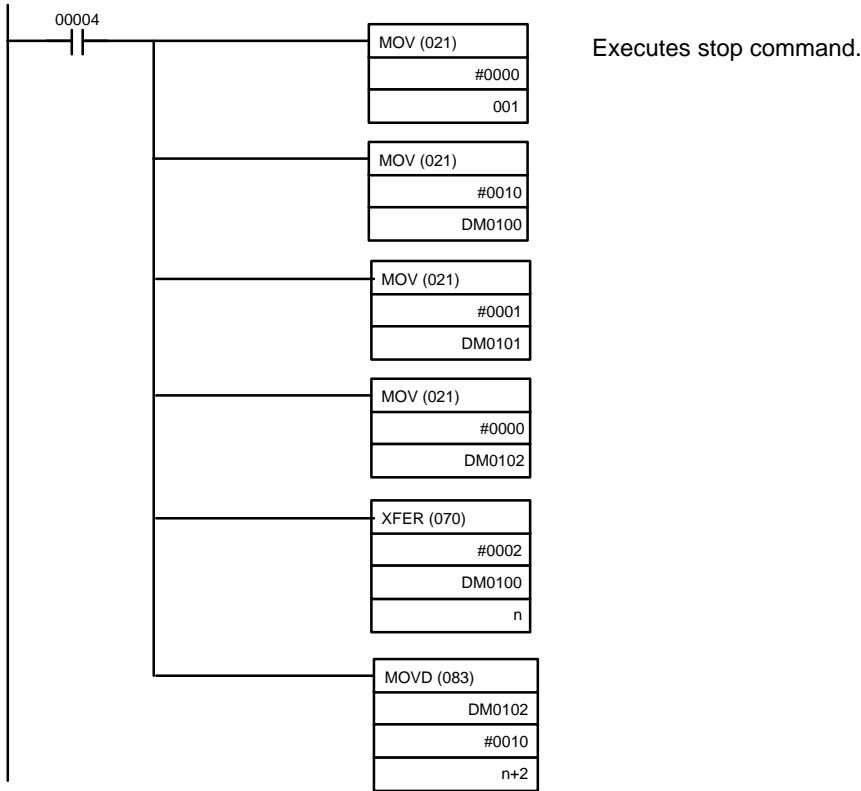
■ Operation

1. When the Program Start Input Bit is turned ON, the Program Execution Input Bit will be set to self-holding and the Frequency Reference Write Flag will be turned ON. When the Frequency Reference Write Flag is ON, the frequency reference data in DM1000 will be transferred to the Inverter. When the Frequency Reference Write Completed Flag is turned ON, the Frequency Reference Write Flag will be turned OFF and the Control Input Write Flag will be turned ON. (Bits are shifted to achieve this.)
2. When the Control Input Write Flag is turned ON, the Inverter control input specified in word 010 will be transferred to the Inverter. When the Control Input Write Completed Flag is turned ON, the Control Input Write Flag will be turned OFF and the Output Frequency Reference Read Flag will be turned ON. (Bits are shifted to achieve this.)
3. When the Output Frequency Read Flag is turned ON, the output frequency of the Inverter will be read. When the Output Frequency Read Completed Flag is turned ON, the read output frequency will be stored in DM 2000, the Output Frequency Read Flag will be turned OFF, and the Inverter Status Read Flag will be turned ON. (Bits are shifted to achieve this.)
4. When the Inverter Status Read Flag is turned ON, the Inverter status will be read. When the Inverter Status Read Completed Flag is turned ON, the read Inverter status will be transferred to word 020, the Inverter Status Read Flag will be turned OFF, and the Frequency Reference Write Flag will be turned ON. Setting the Frequency Reference Write Flag to ON will repeat the above steps 1 to 4.
5. When the Program End Input Bit is turned ON, the Inverter stop command will be written in the Inverter. (When word m bit 7 turns ON, communications errors will be detected and the Communications Error Flag will be turned ON and will be self-holding. While this flag remains ON, the system will perform the same processing as when the Program End Input Bit is turned ON. When the Communications Error Reset Input Bit is turned ON, the self-holding state will be cleared.)

■ Ladder Program







7-3-2 Reading Parameter Data

This programming example is designed to read the parameter data specified in the 3G3MV Inverter. To use special remote I/O, it is necessary to switch the remote I/O operation. Refer to 5-3 *Switching Remote I/O Operation* and change to the special remote I/O operation.

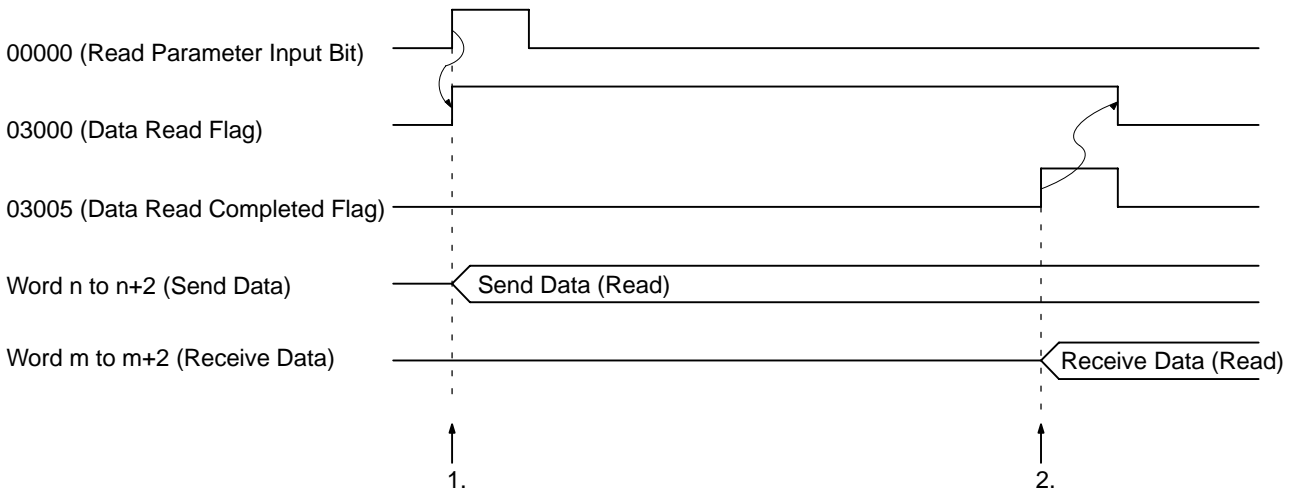
Allocation

Bit	00000	← Read Parameter Input Bit
Bit	00002	← Faulty Data Reset Input Bit
Bit	03000	← Data Read Flag
Bit	03001	← Faulty Data Flag
Bit	03005	← Data Read Completed Flag
	DM 0000	← Register number of the parameter to be read
	DM 0001	← Read data

● Remote I/O Allocation Areas

I/O classification	Word	15 to 8	7 to 0
Output (PC to 3G3MV Inverter)	n	Register number (leftmost byte)	Function code (10: Write, 03: Read)
	n+1	Register data (leftmost byte)	Register number (rightmost byte)
	n+2	Not used.	Register data (rightmost byte)
Input (3G3MV Inverter to PC)	m	Register number (leftmost byte)	Function code (10: Write, 03: Read)
	m+1	Register data (leftmost byte)	Register number (rightmost byte)
	m+2	Not used.	Register data (rightmost byte)

■ Timing Chart

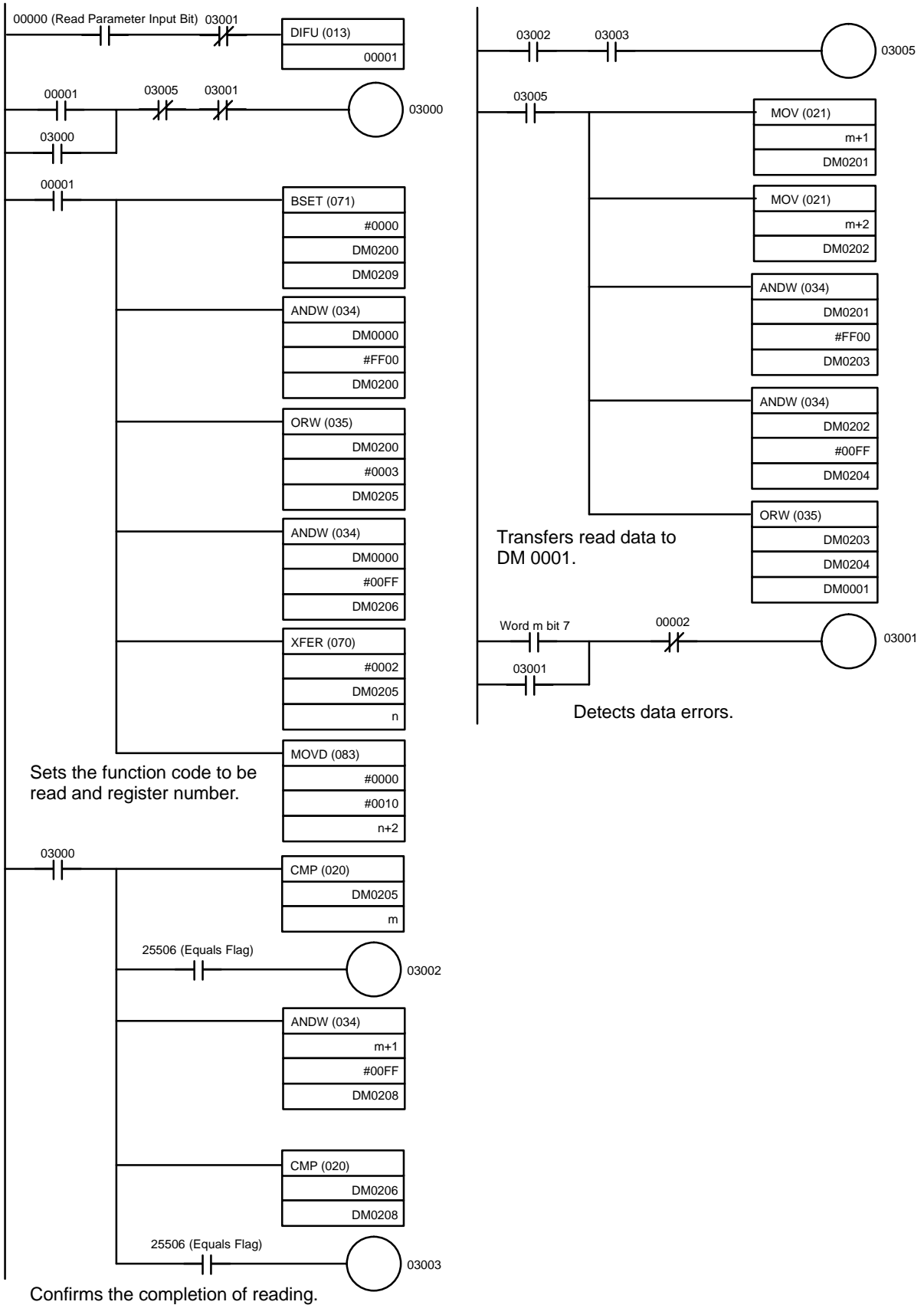


■ Operation

1. Set the register number of the parameter to be read in DM 0000. When the Read Parameter Input Bit is turned ON, the Data Read Flag will be turned ON and parameter reading processing will be executed.
2. If the data is normally read, the read parameter register number and data will be returned by the Inverter. When the register number that was sent agrees with the received register number, the parameter data will be stored in DM 0001, the Data Read Completed Flag will be turned ON and the Data Read Flag will be turned OFF.

Note If the send data is faulty, word m bit 7 will be turned ON, which will turn ON the Faulty Data Flag and the program will be stopped until the Faulty Data Reset Input Bit (00002) is turned ON.

■ Ladder Program



7-3-3 Writing Parameter Data

This programming example is designed to write the parameter data in the 3G3MV Inverter. After writing has been completed, be sure to send an enter command to enable the written data as the Inverter operation data.

To use special remote I/O, it will be necessary to switch the remote I/O operation. Refer to 5-3 *Switching Remote I/O Operation* and change to the special remote I/O operation.

■ Allocations

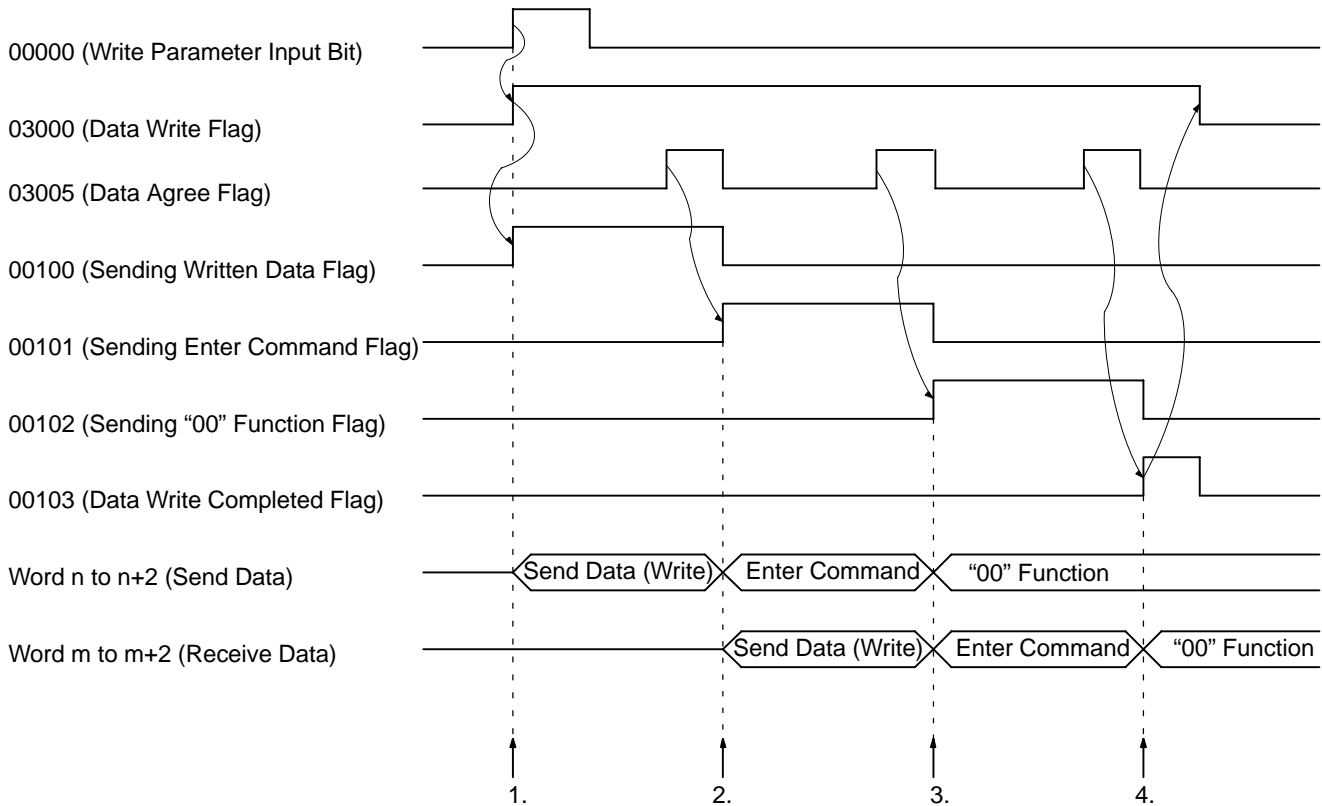
Bit	00000	← Write Parameter Input Bit
Bit	00002	← Faulty Data Reset Input Bit
Bit	03000	← Data Write Flag
Bit	03005	← Data Agree Flag (Function Code and Register No.)
Bit	00100	← Sending Written Data Flag
Bit	00101	← Sending Enter Command Flag
Bit	00102	← Setting "00" Function Code Flag
Bit	00103	← Data Write Completed Flag
Bit	03010	← Faulty Data Flag

DM 0000	← Register number of the parameter to be written
DM 0001	← Written data

● Remote I/O Allocation Areas

I/O classification	Word	15 to 8	7 to 0
Output (PC to 3G3MV Inverter)	n	Register number (leftmost byte)	Function code (10: Write, 03: Read)
	n+1	Register data (leftmost byte)	Register number (rightmost byte)
	n+2	Not used	Register data (rightmost byte)
Input (3G3MV Inverter to PC)	m	Register number (leftmost byte)	Function code (10: Write, 03: Read)
	m+1	Register data (leftmost byte)	Register number (rightmost byte)
	m+2	Not used	Register data (rightmost byte)

■ Timing Chart



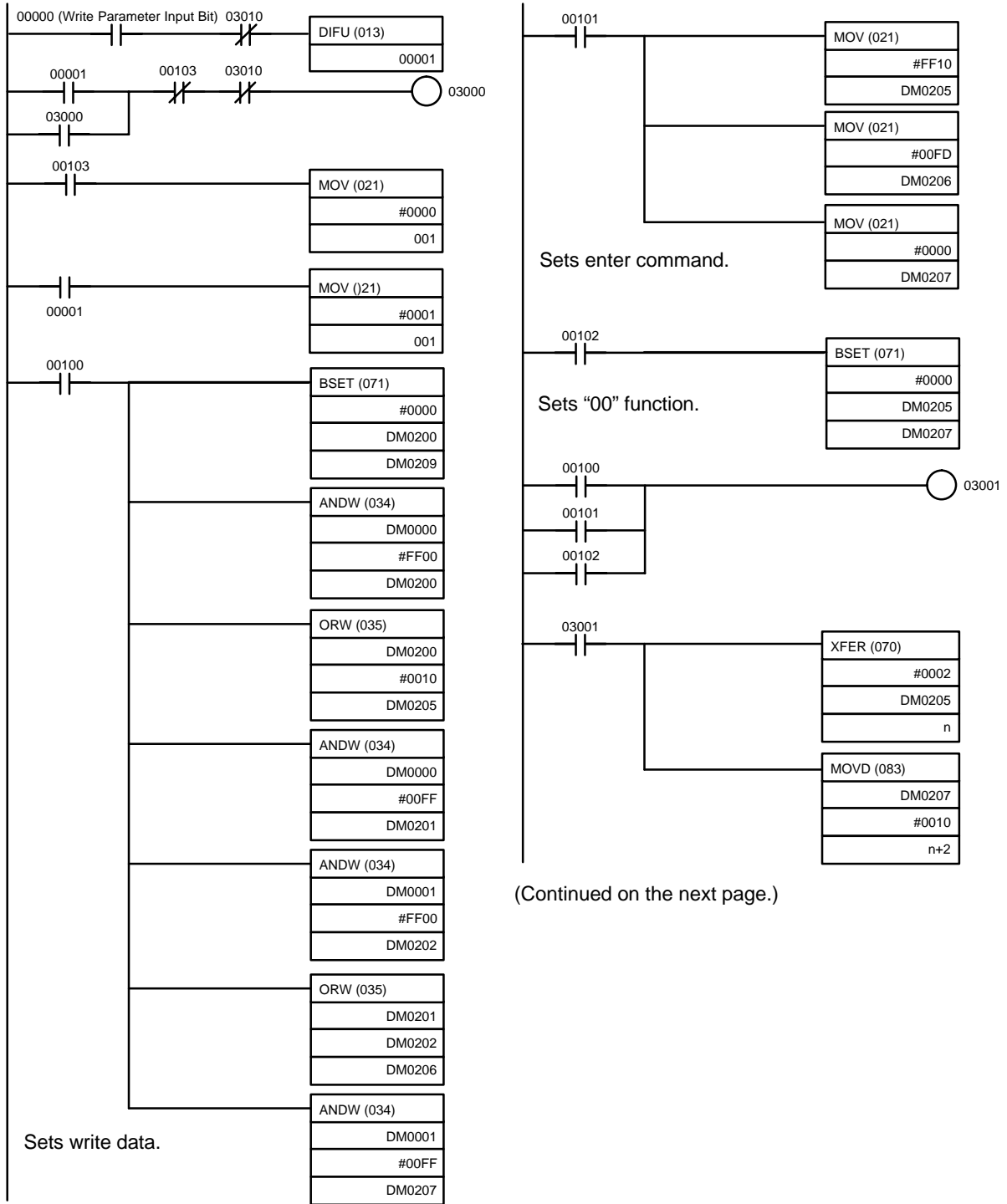
■ Operation

1. Set the register number of the parameter and the data to be written in DM 0000 and DM 0001 respectively. When the Write Parameter Input Bit is turned ON, the Data Write Flag will be turned ON and parameter writing processing will be executed.
2. If the data is properly written, the written parameter register number and the function code will be returned from the Inverter. When the sent register number and the function code agree with the received data contents, the Data Agree Flag will be turned ON to send the enter command.
3. If the enter command is normally received, the register number and function code that agree with the enter command will be returned from the Inverter. When the sent register number and function code agree with the received contents, the Data Agree Flag will be turned ON to send the function code "00" (both the register number and function code are 0000).
4. In the same manner, if the function code "00" is normally received, the Data Agree Flag will be turned ON and the Data Write Completed Flag will be turned ON. When the Data Write Completed Flag turns ON, the Data Write Flag will turn OFF and the program will stop.

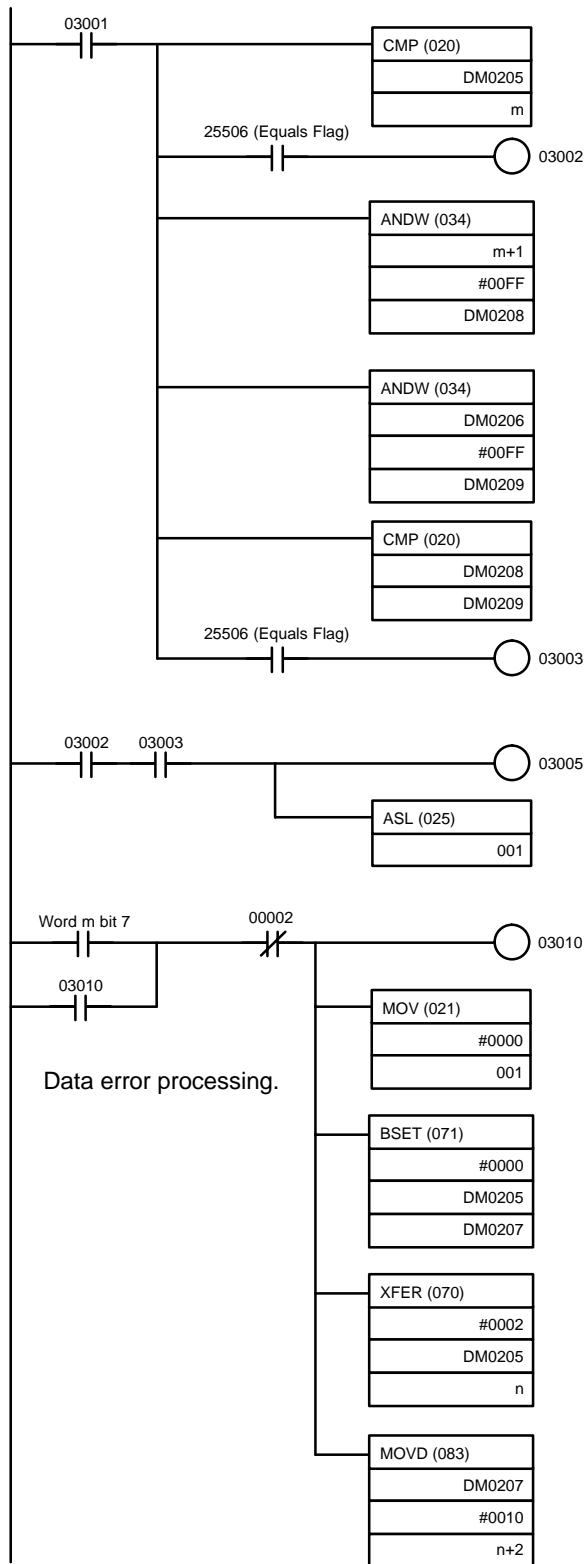
Note 1. If the enter command remains set, data will be repeatedly written to EEPROM. Therefore, set the function code to "00" (both the register number and function code are 0000), which performs no processing, to disable the enter command.

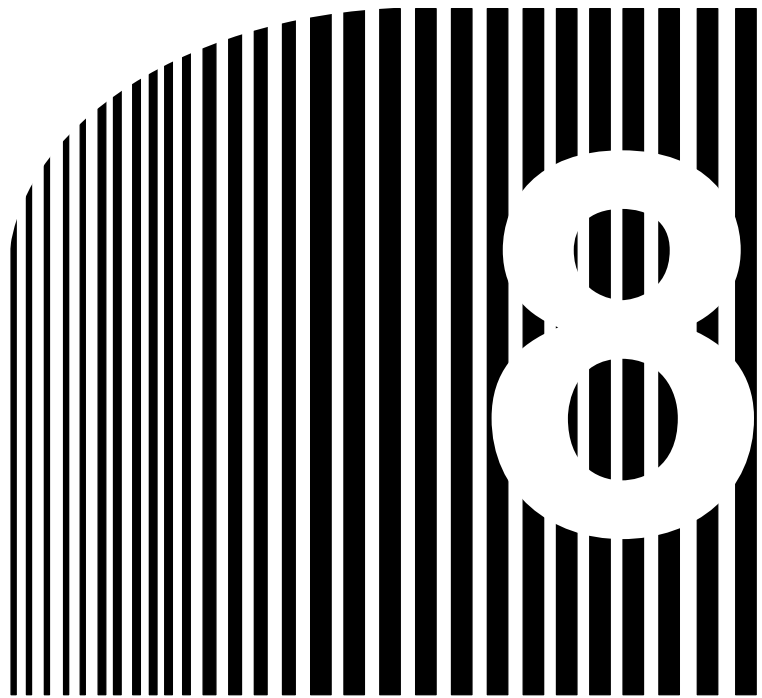
Note 2. If the sent data is faulty, word m bit 7 will be turned ON, which will turn ON the Faulty Data Flag and the program will be stopped until the Faulty Data Reset Input Bit (00002) is turned ON.

■ Ladder Program



(From previous page.)





Chapter 8

• Appendices •

8-1 Specifications

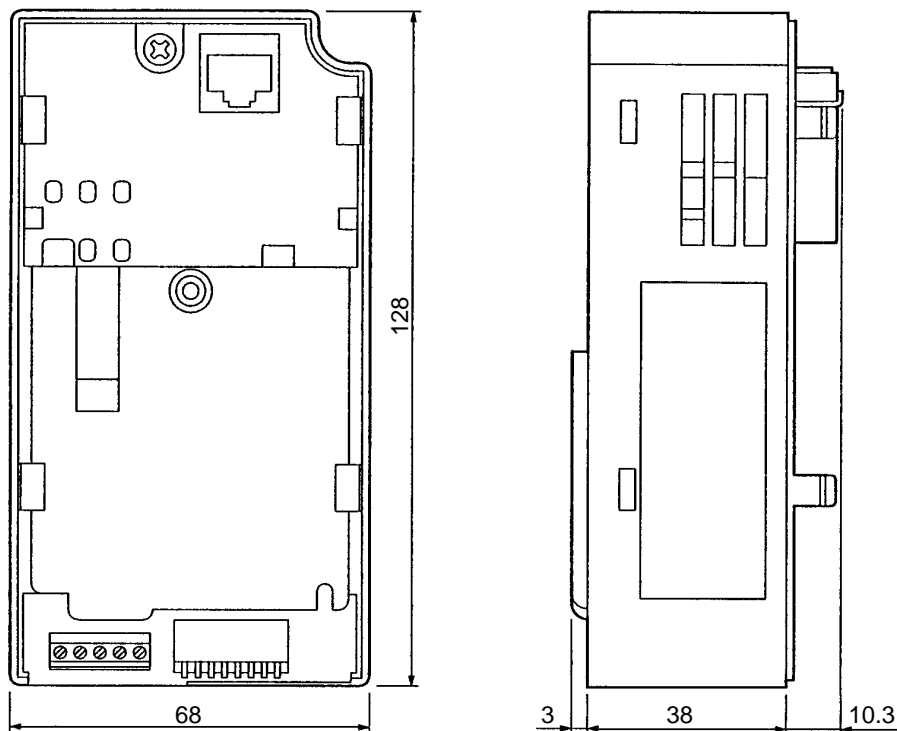
8-2 Objects

8-3 CompoBus/D Communications Response Time

8-1 Specifications

Item	Specifications
Model	3G3MV-PDRT1-SINV
Remote I/O	<ul style="list-style-type: none"> • Basic remote I/O: Allocated 2 input and 2 output words. • Standard remote I/O (default setting): Allocated 2 input and 2 output words. • Special remote I/O: Allocated 3 input and 3 output words. <p>Note 1. The user can select from among these three types of remote I/O.</p> <p>Note 2. Basic and standard remote I/O are compatible with DeviceNet. Special remote I/O is applicable only to this product and is not compatible with DeviceNet.</p>
Explicit messages	<p>A maximum of 32 bytes of data can be sent or received.</p> <p>Note Explicit messages are applicable to the AC/DC drive profile.</p>
Communications power supply specifications	11 to 25 V DC (20 mA max.)
Internal circuit power supply	Provided from 3G3MV Inverter.
Operating location	Indoors (with no corrosive gases, oil mist, metallic particles, etc.)
Operating ambient temperature	-10 to 45°C
Operating ambient humidity	90% RH max. (with no condensation)
Storage temperature	-20 to 60°C
Area	1,000 m max.
Weight	200 g max.

■ Dimensions



8-2 Objects

There are eight types of object:

- Identify objects (identification information): Class 01 hex
- Message router objects: Class 02 hex
- DeviceNet objects: Class 03 hex
- Assembly objects: Class 04 hex
- DeviceNet connection objects: Class 05 hex
- Motor data objects: Class 28
- Control supervisor objects: Class 29 hex
- AC/DC drive objects: Class 2A hex

For details on motor data objects, control supervisor objects, and AC/DC drive objects, refer to 5-2-5 *Motor Data Objects: Class 28 Hex* through 5-2-7 *AC/DC Drive Objects: Class 2A Hex*.

8-2-1 Identify Objects (Identification Information): Class 01 Hex

Identify objects are objects that provide CompoBus/D product information. All of this information is read-only.

■ Support Service Codes

Service code number (Hex)	Service
0E	Get attribute single
05	Reset (return to initial status)

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
00	01	Object Software Revision	Indicates class 01 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01	01	Vender ID	Indicates the maker's code. OMRON: 47 (2F hex)	---	002F	Yes	No	Word
	02	Device Type	Indicates the DeviceNet profile classification. The Inverter corresponds to the AC/DC Drive. <ul style="list-style-type: none">• Master Unit: 0• AC/DC Drive: 2	---	0002	Yes	No	Word
	03	Product Code	Assigned to each series by each maker. CompoBus/D Communications Unit: 53 (35 hex)	---	0035	Yes	No	Word
	04	Revision	Indicates overall software revisions for the CompoBus/D Communications Unit.	---	01.00	Yes	No	Byte × 2
	05	Status	Indicates the communications status of the CompoBus/D Communications Unit. (See details below.)	---	0000	Yes	No	Word
	06	Serial Number	Indicates the product serial number of the CompoBus/D Communications Unit. (60000000 hex onwards)	---	Depends on product.	Yes	No	Long
	07	Product Number	Indicates product model number. 3G3MV-PDRT1-SIN	---	Number shown at left.	Yes	No	String
	08	State	Indicates Inverter status. <ul style="list-style-type: none">• 3 hex: Inverter ready	---	03	Yes	No	Byte

● Status Details

Bit	Item	Content
0	Connection	0: Not connected. 1: Master/Slave connected.
1	Not used.	---
2	Configuration	0: Data never changed. 1: Data other than default.
3 to 15	Not used.	---

Note Bits that are not used are all zeros.

8-2-2 Message Router Objects: Class 02 Hex

Message router objects have the function of distributing CompoBus/D (DeviceNet) communications data. Message and remote I/O operations, and so on, must pass through these objects to be distributed. Message router objects themselves are involved in internal processing only and do not have data to be exchanged externally.

■ Support Service Code

Service code number (Hex)	Service
0E	Get attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
00	01	Object Software Revision	Indicates class 02 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word

8-2-3 DeviceNet Objects: Class 03 Hex

DeviceNet objects are objects related to CompoBus/D (DeviceNet) communications information and operations.

■ Support Service Code

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
00	01	Object Software Revision	Indicates class 03 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01	01	MAC ID	Indicates the set value of the communications node address. It is read-only because the setting is made by the external setting switch.	---	00	Yes	No	Byte
	02	Baud Rate	Indicates the baud rate. It is write-protected because the setting is made by the external setting switch. 00: 125 Kbps 01: 250 Kbps 02: 500 Kbps	---	00	Yes	No	Byte
	05	Allocation Information	Indicates DeviceNet communications connection information. Used to check whether connection is already made. • See details below. • Cannot be written for explicit messages. (Error is returned.)	---	0000	Yes	No	Byte × 2

● Allocation Information Details

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0	0	1: Remote I/O connection status	1: Explicit message connection status
1	0	0	Node address (MAC ID) of Master connected for DeviceNet communications.					

Note The Master Unit automatically writes allocation information when the communications connection is completed. After the Master Unit has written the information, writing is prohibited.

8-2-4 Assembly Objects: Class 04 Hex

Assembly objects are objects related to remote I/O operations. Remote I/O operations are configured with these objects for communications.

■ Support Service Codes

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
00	01	Object Software Revision	Indicates class 04 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
14	03	Remote I/O data	Operation is the same as for basic remote I/O (output).	See note 1.	00. 00. 00. 00	Yes	Yes	Byte × 4
15	03	Remote I/O data	Operation is the same as for standard remote I/O (output).	See note 1.	00. 00. 00. 00	Yes	Yes	Byte × 4
46	03	Remote I/O data	Operation is the same as for basic remote I/O (input).	---	00. 00. 00. 00	Yes	No	Byte × 4
47	03	Remote I/O data	Operation is the same as for standard remote I/O (input).	---	00. 00. 00. 00	Yes	No	Byte × 4
64	03	Remote I/O data	Operation is the same as for special remote I/O (output).	See note 1.	00. 00. 00. 00. 00	Yes	Yes	Byte × 5
96	03	Remote I/O data	Operation is the same as for special remote I/O (input).	---	00. 00. 00. 00. 00	Yes	No	Byte × 5

Note 1. The setting ranges are the same as the respective remote I/O setting ranges.

Note 2. The remote I/O operations are the same as those explained in 5-1 Remote I/O and 5-3 Special Remote I/O Operation.

Note 3. Remote I/O can be performed by means of message communications. When a normal remote I/O communications connection is established, however, the message communications cannot be used for that purpose. Even if an attempt is made to use message communications, they will be overwritten by remote I/O inputs.

8-2-5 DeviceNet Connection Objects: Class 05 Hex

DeviceNet connection objects are objects related to information and operations involving CompoBus/D (DeviceNet) communications connections. The Master Unit uses the information and operations of these objects to execute the initial processing for communications.

■ Support Service Codes

Service code number (Hex)	Service
0E	Get attribute single
10	Set attribute single

■ Object Details

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
00	01	Object Software Revision	Indicates class 05 software revisions. The revision value is advanced whenever there is a change.	---	0001	Yes	No	Word
01 Explicit message	01	State	Indicates the status of this object (instance). 00: Does not exist in network, or is not ready. 01: In network state, waiting for connection event from Master Unit. 02: Waiting for connection ID (attribute) writing. 03: Connection completed. 04: Timeout	---	Must be "03" when communications are established.	Yes	No	Byte
	02	Instance type	Indicates the type of object (instance). 00: Explicit message 01: Remote I/O	---	00	Yes	No	Byte
	03	Transport class trigger	Indicates the communications configuration for the CompoBus/D Communications Unit.	---	83	Yes	No	Byte
	04	Produced connection ID	Indicates the label used for the communications header for the CompoBus/D Communications Unit.	---	---	Yes	No	Word
	05	Consumed connection ID	Note: These are set when the communications connection is made.	---	---	Yes	No	Word
	06	Initial comm characteristics	Indicates the communications configuration for the CompoBus/D Communications Unit.	---	21	Yes	No	Byte
	07	Produced connection size	Indicates the maximum number of bytes for transmission.	---	0020	Yes	No	Word
	08	Consumed connection size	Indicates the maximum number of bytes for reception.	---	0020	Yes	No	Word

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
01 Explicit message	09	Expected packet rate	Indicates the length of the internal processing timeout when a communications request is received. Incremented by 10-ms units.	0 to 65,535 (ms)	09C4 (2,500 ms)	Yes	Yes	Word
	0C	Watchdog time-out action	Indicates the action for internal processing timeout related to communications. 00: Retain timeout status (until reset or cleared). 01: Cut connection automatically. 02: Operate again with same connection as is.	---	01	Yes	No	Byte
	0D	Produced connection path length	Indicates number of bytes of data for produced connection path. (No data for explicit messages.)	---	0000	Yes	No	Word
	0E	Produced connection path	Indicates the data for defining the application object for sending this object (instance). (No data for explicit messages.)	---	---	Yes	No	Array
	0F	Consumed connection path length	Indicates the number of bytes of data for the consumed connection path. (No data for explicit messages.)	---	0000	Yes	No	Word
	10	Consumed connection path	Indicates the data for defining the application object for receiving this object (instance). (No data for explicit messages.)	---	---	Yes	No	Array

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
02 Remote I/O	01	State	Indicates the status of this object (instance). 00: Does not exist in network, or is not ready. 01: In network state, waiting for connection event from Master Unit. 02: Waiting for connection ID (attribute) writing. 03: Connection completed. 04: Timeout	---	Must be "03" when communications are established.	Yes	No	Byte
	02	Instance type	Indicates the type of object (instance). 00: Explicit message 01: Remote I/O	---	01	Yes	No	Byte
	03	Transport class trigger	Indicates the communications configuration for the CompoBus/D Communications Unit.	---	82	Yes	No	Byte
	04	Produced connection ID	Indicates the label used for the communications header for the CompoBus/D Communications Unit.	---	---	Yes	No	Word
	05	Consumed connection ID	Note: These are set when the communications connection is made.	---	---	Yes	No	Word
	06	Initial comm characteristics	Indicates the communications configuration for the CompoBus/D Communications Unit.	---	01	Yes	No	Byte

Instance	Attribute	Name	Content	Setting range	Default (Hex)	Read	Write	Size
02 Remote I/O	07	Produced connection size	Indicates the maximum number of bytes for transmission.	---	0004	Yes	No	Word
	08	Consumed connection size	Indicates the maximum number of bytes for reception.	---	0004	Yes	No	Word
	09	Expected packet rate	Indicates the length of the internal processing timeout when a communications request is received.	0 to 65,535 (ms)	0000 (0 ms)	Yes	Yes	Word
	0C	Watchdog time-out action	Indicates the action for internal processing timeout related to communications. 00: Retain timeout status (until reset or cleared). 01: Cut connection automatically. 02: Operate again with same connection as is.	---	01	Yes	No	Byte
	0D	Produced connection path length	Indicates number of bytes of data for produced connection path.	---	0003	Yes	No	Word
	0E	Produced connection path	Indicates the data for defining the application object for sending this object (instance). Note: Has a function for switching the CompoBus/D Communication Unit's remote I/O operation.	---	62 34 37	Yes	No	Array
	0F	Consumed connection path length	Indicates the number of bytes of data for the consumed connection path.	---	0003	Yes	No	Word
	10	Consumed connection path	Indicates the data for defining the application object for receiving this object (instance). Note: Has a function for switching the CompoBus/D Communication Unit's remote I/O operation.	---	62 31 35	Yes	No	Array

Note "Reception" means output (3G3MV to SYSMAC PC), and "transmission" means input (SYSMAC PC to 3G3MV).

8-3 CompoBus/D Communications Response Time

This section describes communications response time when OMRON Master and Slave Units are being used. Use this section for reference when planning I/O timing. The equations provided here are valid under the following conditions:

- The Master Unit is operating with the scan list enabled.
- All of the required Slaves are participating in communications.
- No errors are being indicated at the Master Unit
- Messages are not being produced in the network (from another company's configurator, for example).

■ Communications Cycle Time

● One Master in Network

The following equations show the communications cycle time (T_{RM}) when there is only one Master in the network. If the calculation result is less than 2 ms, the communications cycle time (T_{RM}) will be considered as 2 ms.

$$\begin{aligned}
 T_{RM} = & \Sigma (0.016 \times T_B \times S_{OUT1} + 0.11 \times T_B + 0.07) \\
 & + \Sigma (0.016 \times T_B \times S_{IN1} + 0.06 \times T_B + 0.05) \\
 & + \Sigma \{0.016 \times T_B \times (S_{OUT2} + S_{IN2}) + 0.11 \times T_B + 0.07\} \\
 & + 0.11 \times T_B + 0.65 \\
 & + 0.22 \times T_B \text{ (number of message nodes)}
 \end{aligned}$$

S_{OUT1} : The number of Output Slave output words

S_{IN1} : The number of Input Slave input words

S_{OUT2} : The number of Mixed I/O Slave output words

S_{IN2} : The number of Mixed I/O Slave input words

T_B : The baud rate factor

(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

(Varies depending on the baud rate)

● More than One Master in Network

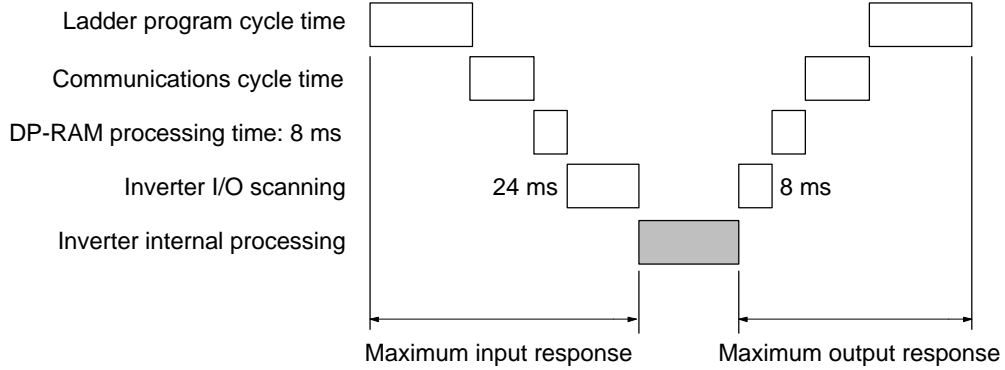
Calculate the communications cycle time according to the above equation for the Slaves of each Master Unit. The communications cycle time for the entire network is the sum of communications cycle times for each Master Unit.

I/O Response Time of Inverter

The following shows processing time between the Inverter and the CompoBus/D Communications Unit.

- DP-RAM processing time between the Inverter and CompoBus/D Communications Unit: 8 ms
- Inverter input scanning: 8 ms (read twice)
- Inverter output scanning: 8 ms
- Inverter parameters scanning: 20 ms

Inverter I/O response time



Note 1. The internal processing time varies depending on the controls to be executed.

Note 2. Input scanning for parameter reading or writing requires 20 ms.

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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. I529-E1-1
↑
Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	May 1999	Original production