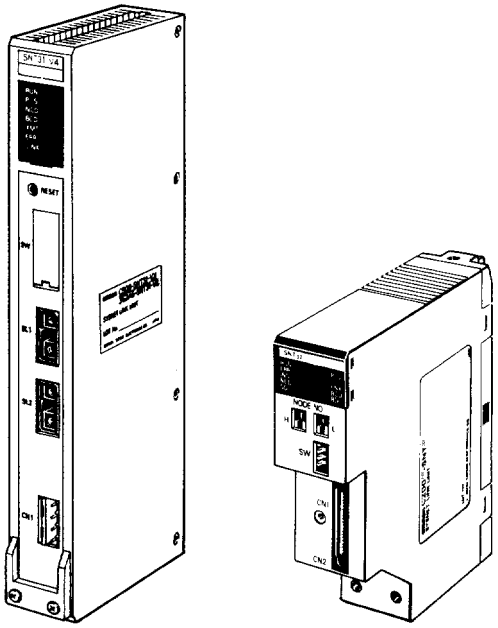
C500-SNT31-V4/C200HS-SNT32
SYSMAC NET Link Module

Operation Manual

Revised January 1996



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 the product.

DANGER! Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

Caution Indicates information that, if not heeded, could result in relative serious or minor injury, damage to the product, or faulty operation.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Module” 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 “PLC” 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.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

TABLE OF CONTENTS

About this Manual:

This manual describes the operation of the SYSMAC NET Link Module. The SYSMAC NET Link Module is used to connect the C200H, C200HS, C500, C1000H and C2000H series PLCs to the SYSMAC NET optical fiber local area network. Using the SYSMAC NET Link Module, data can be transferred between PLCs and other network devices via either datagrams or data links.

Section 1 Introduction introduces the SYSMAC NET Link Module's switches and indicators. Possible system configurations are also discussed.

Section 2 Pre-Operation discusses cabling, data transfer times, word allocation, and what is required to transfer information between nodes.

Section 3 Commands and Responses describes what constitutes a datagram and how the datagrams are transferred between the memory areas of the PLCs.

Section 4 Data Links discusses how to construct data links between PLCs.

Section 5 Troubleshooting tells how to identify and correct errors occurring on the network. Thoroughly familiarize yourself with this manual before using the SYSMAC NET Link Module in any system configuration.

Appendixes, a ***Glossary***, and an ***Index*** are also included.

WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

SECTION 1
Introduction

Introduction

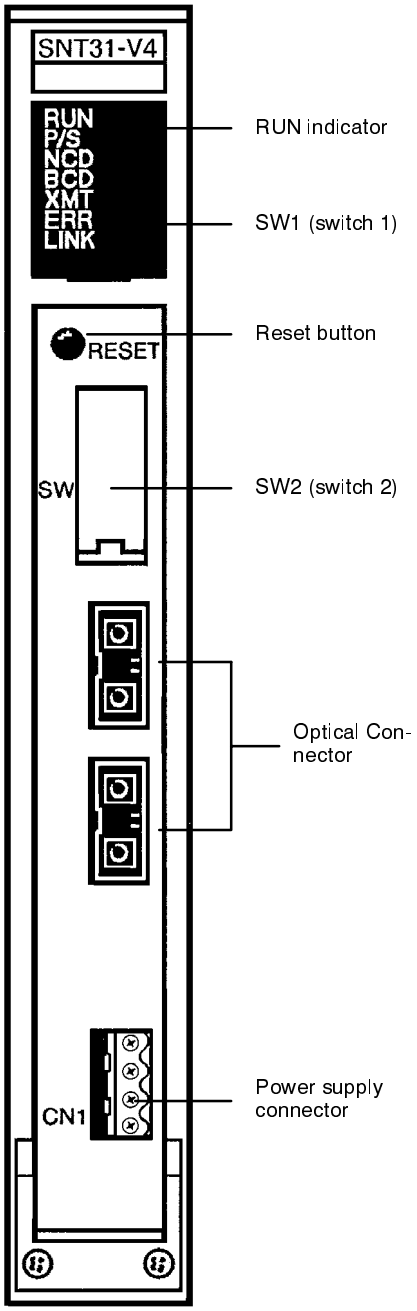
The C500-SNT31-V4 and C200HS-SNT32 NET Link Modules are use to connect C-series PLCs to a SYSMAC NET local area network.

The C500-SNT31-V4 includes the functions of the C500-SNT31-V3, with the added feature that 2 C500-SNT31-V4's can be connected to the C1000H and C2000H (Simplex CPU) PLCs creating a two-loop SYSMAC NET network.

The C200HS-SNT32 enables the connection of a single C200H/C200HS PLC to a SYSMAC NET.

1-1 C500-SNT31-V4

The C500-SNT31-V4 SYSMAC NET Module is compatible with the C500, C1000H and C2000H PLCs, mounting directly to the respective backplanes. An examination of the SYSMAC NET Module's front panel reveals the following components. The LED indicators are explained on the right.



Indicators

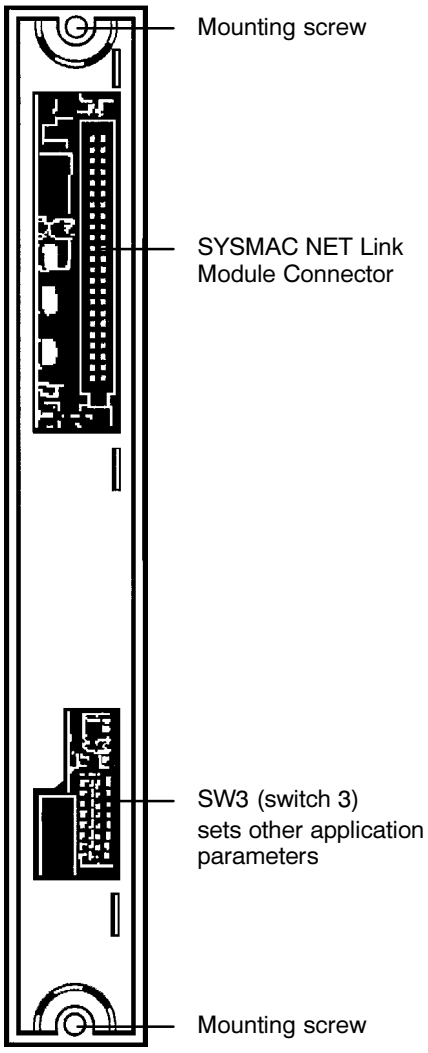
Lit ☼ Blinking ◑ Unlit ●

Indicator		Function
RUN	☼	The SYSMAC NET Link Module is running
	●	An error has occurred in the SYSMAC NET Link Module
P/S	☼	Power is supplied properly to CN 1
	●	Power is not supplied to CN 1
NCD	☼	Receiving normal loop signal
	●	Not receiving normal loop signal
BCD	☼	Receiving back loop signal
	●	Not receiving back loop signal
XMT	☼	Transmitting data
	●	Not transmitting data
ERR	☼	An error has occurred in the test or in the node address*
	●	No error in the test or the node address
LINK	☼	Data link operating
	◑	Data link error
	●	Data link stopped

*When the node address is set to other than #1 to #126, the ERR indicator lights.

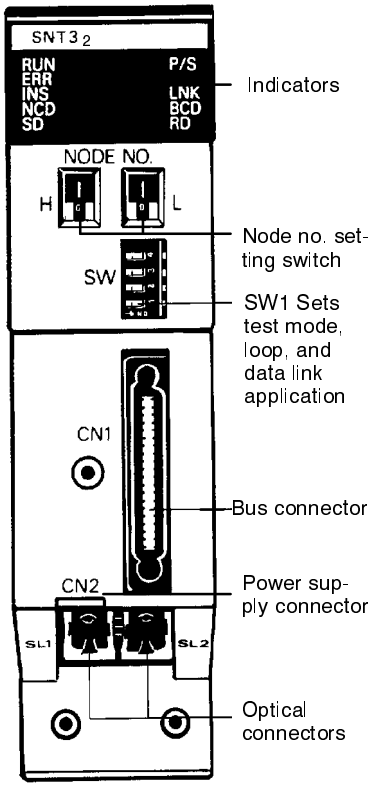
Back Panel

Examination of the Module's back panel reveals the components shown in the following figure.



1-2 C200HS-SNT32

The C200HS-SNT32 SYSMAC NET Link Module mounts onto the backplane of the C200H/C200HS PLC. Examination of the SYSMAC NET Link Module's front panel reveals the following components. The LED indicators are explained on the right.



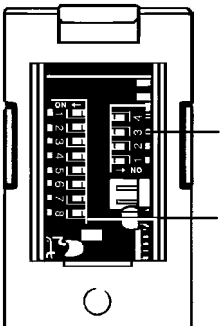
Indicators
Lit ☼ Blinking ◑ Unlit ●

Indicator		Function
RUN	☼	The SYSMAC NET Link Module is running
	●	An error has occurred in the SYSMAC NET Link Module
ERR	☼	An error has occurred in the test or in the node address*
	●	No error in the test or the node address
INS	☼	Ready to receive data
	●	Cannot receive data
NCD	☼	Receiving normal loop signal
	●	Not receiving normal loop signal
SD	☼	Sending data
	●	Not sending data
P/S	☼	Power is supplied properly to CN 2
	●	Power is not supplied to CN 2
LINK	☼	Data link operating
	◑	Data link error
	●	Data link stopped
BCD	☼	Receiving back loop signal
	●	Not receiving back loop signal
RD	☼	Receiving data
	●	Not receiving data

*When the node address is set to other than #1 to #126, the ERR indicator lights.

Back Panel

Examination of the Module's back panel reveals the components shown in the following figure.



SW 2 (Switch 2) - For setting of data link application

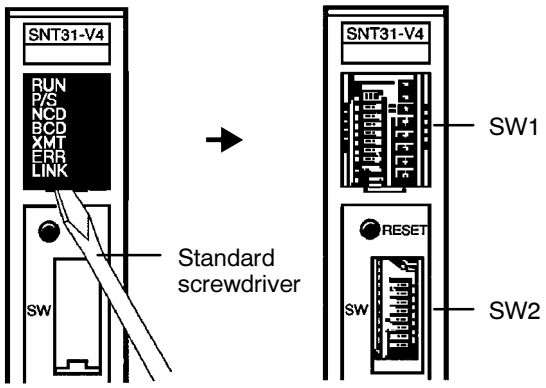
SW 3 (switch 3) - For setting of data link application, communication function between networks and application data

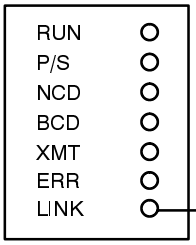
1-3 DIP Switch Settings

The SYSMAC NET Link Module uses DIP switches to determine parameter settings for the data link. Set these DIP switches before operation ensuring that the power to the PLC is turned OFF. Use a standard screwdriver to remove the plastic indicator window and expose the SW1 DIP switch. This DIP switch is responsible for data link settings.

1-3-1 C500-SNT31-V4

Front Panel DIP Switches



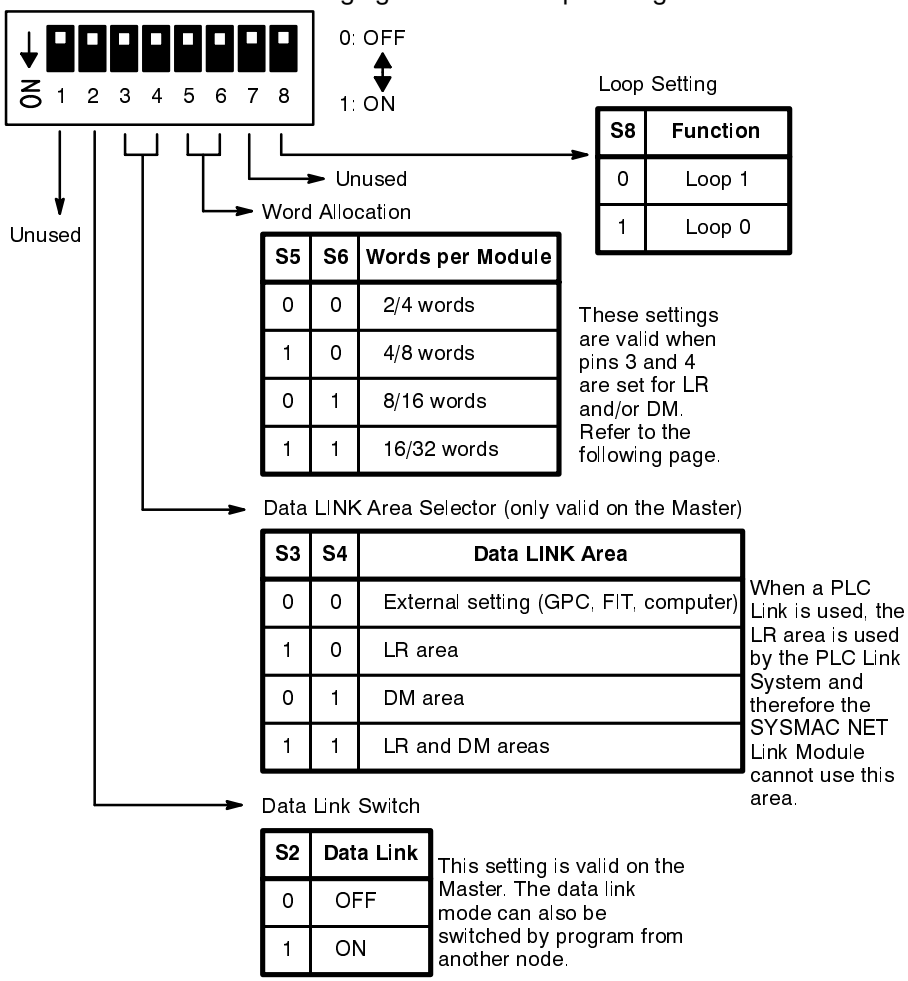


Lit when the Data Link is operating.

Blinks when an error occurs in the Data Link.

SW 1 Settings

The following figure shows the pin assignments for SW1.



S8	Function
0	Loop 1
1	Loop 0

S5	S6	Words per Module
0	0	2/4 words
1	0	4/8 words
0	1	8/16 words
1	1	16/32 words

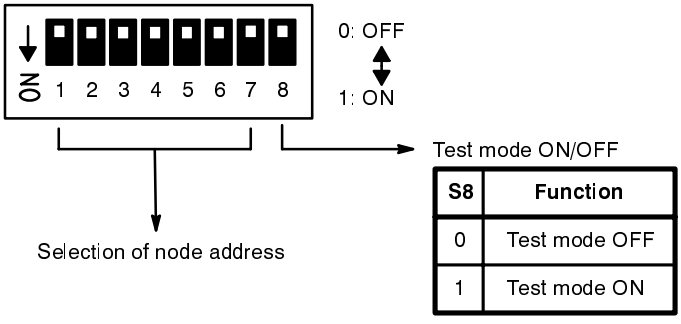
S3	S4	Data LINK Area
0	0	External setting (GPC, FIT, computer)
1	0	LR area
0	1	DM area
1	1	LR and DM areas

S2	Data Link
0	OFF
1	ON

When a PLC Link Module is used, the LR area is used by the PLC Link System; the SYSMAC NET Link Module cannot use this area. If the data link area is allocated automatically to the two-loop system together with loop 0 and loop 1, duplication of the word allocation will occur.

DIP switch 2 is responsible for setting the node address and test mode status.

SW 2 Settings



S8	Function
0	Test mode OFF
1	Test mode ON

Use the following table and formula to set the node address of the SYSMAC NET Link Module, then record this address for later use. Each node of a network loop must have a unique address.

Switch No.	1	2	3	4	5	6	7
Node Address	2^0	2^1	2^2	2^3	2^4	2^5	2^6
	1	2	4	8	16	32	64
1	1	0	0	0	0	0	0
2	0	1	0	0	0	0	0
3	1	1	0	0	0	0	0
125	1	0	1	1	1	1	1
126	0	1	1	1	1	1	1

Node addresses 0 and 127 cannot be selected. Do not make multiple settings in the same network.

The node address is set with pins 1 through 7 to an address between 1 and 126. Use this formula to calculate a node address n, where ON = 1 and 0 = OFF:

Node Address Calculation

Node address: n

$n = S1 \times 2^0 + S2 \times 2^1 + S3 \times 2^2 + S4 \times 2^3 + S5 \times 2^4 + S6 \times 2^5 + S7 \times 2^6$

Example:

When pin 3 is “ON” and the others are “OFF.”

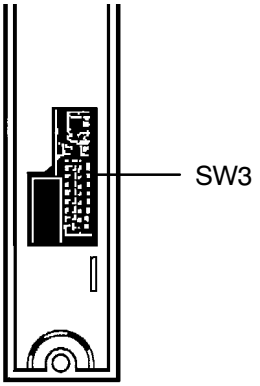
$n = 0 \times 2^0 + 0 \times 2^1 + 1 \times 2^2 + 0 \times 2^3 + 0 \times 2^4 + 0 \times 2^5 + 0 \times 2^6$

Notes 1. The node address is set to 0 before shipment from the factory.

2. Do not change the node address during operation. If the address is changed when power to the PLC is ON or after resetting the Module, communication will halt. If this occurs, restart using the reset switch.

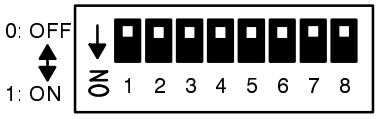
Pin 8 of SW2 sets the test mode status. Set this pin to OFF for normal operation. For information concerning the test mode, refer to *Section 5 Troubleshooting*.

Back Panel DIP Switch Settings



SW 3 Settings

The pin assignments for SW3 are shown in the following diagram.



S8	Application data code selector
0	Binary code
1	JIS* 8 (Used in Japan only)

*JIS stands for Japan Industrial Standard.

Data transmission time delay

This sets the time delay for data transmission between the slaves of a single group.
The delay is selected according to the system size.
A large system, or a system that may have a lot of down time (such as from errors) should be set for a greater delay time.
The delay time can also be set directly at the Master with the software (such as the diagnostic service), as shown.
This time delay is valid any time power is applied to the SYSMAC NET Link Module. These values will be effective when the next data link operation is executed.

S6	S7	Time	Note
0	0	5 ms	1 Master
1	0	10 ms	2 Masters
0	1	20 ms	3 Masters
1	1	30 ms	4 Masters

SEND/RECV Response Watchdog Timer

Set only when using SEND/RECV.

S5	Function
0	Default = 1 second.
1	Specified by the watchdog timer.

SR area selector

Set pin 4 of this switch to ON when the SYSMAC NET Link Module is mounted on C500, C1000H, or C2000H with a PLC Link Module.

S4	Model	SR area
0	C500	Wd 56 to 62
	C1000H C2000H Simplex	Wd 247 to 250
	C2000H Duplex	Wd 247 to 250
1	C500	Wd 52 to 55
	C1000H C2000H Simplex	Wd 242 to 245
	C2000H Duplex	Wd 247 to 250

Data Link Slave/Master selector

S3	Function
0	Slave
1	Master

2 bytes

$0000:0100 | Delay timer value (L) | Not used (H) |

Module 2 ms510 ms max.

Transmission between networks

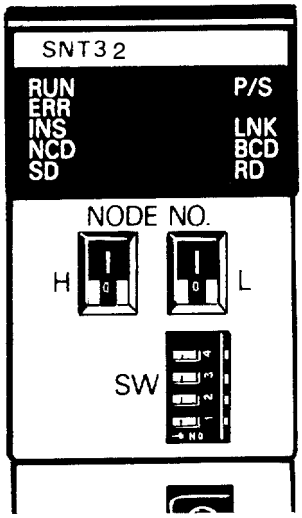
S2	Function
0	Transfer function invalid between networks
1	Transfer function valid between networks

PLC initial mode selector

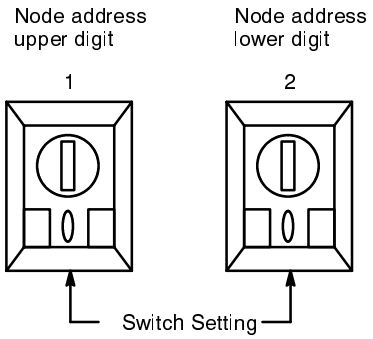
S1	Function
0	When the PLC is initialized, the PLC is in normal mode.
1	When the PLC is initialized, the mode is changed to MONITOR.

1-3-2 C200HS-SNT32

Front Panel DIP Switch Settings



The node address is set with the Node No. switches to an address between 1 and 126. Do not set the same address more than once in a network. Use the following formula to calculate a node address "n."



1	2	Switch No.
16^1	16^0	Node address
16	1	
0	1	1
0	2	2
0	3	3
7	D	125
7	E	126

Node Address Calculation

Node address: n
Switch status: n_1, n_2

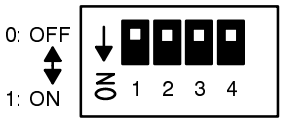
$n = n_1 \times 16^1 + n_2 \times 16^0$

Example
$n_1 = 3$, $n_2 = E$ (14)
$n = 3 \times 16^1 + 14 \times 16^0 = 62$

Notes 1. The node address is set to 0 before shipment from the factory.

2. Do not change node address during operation. If the address is changed when power to the PLC is ON or after resetting the Module, communication will halt. If this occurs, restart using the reset switch.

SW1 Settings



Loop Setting

S4	Function
0	Loop 1
1	Loop 0

When two Modules are used, do not set both Modules to the same loop number

Test mode ON/OFF

S3	Function
0	Test mode: OFF
1	Test mode: ON

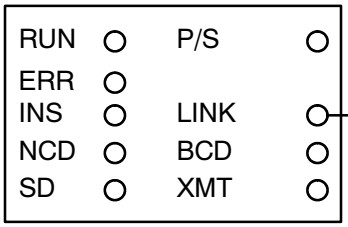
Data Link Slave/Master selector

S2	Function
0	Slave
1	Master

Data Link Switch

S1	Data Link
0	OFF
1	ON

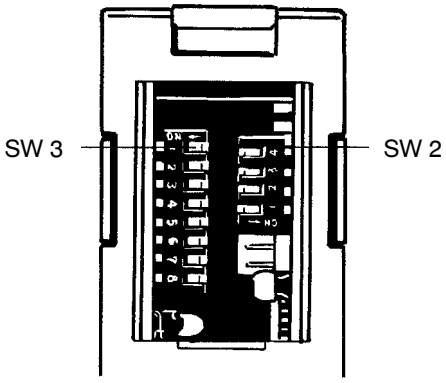
Valid on master only. The Data Link mode can also be selected by the program from another node



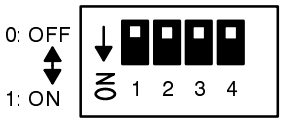
Lit when the Data Link is operating.

Blinks when an error occurs in the Data Link.

Back Panel DIP Switch Settings



SW 2 Settings



Word Allocation

S3	S4	Words per Module
0	0	2/4 words
1	0	4/8 words
0	1	8/16 words
1	1	16/32 words

These settings are valid when pins 1 and 2 are set for LR and/or DM.

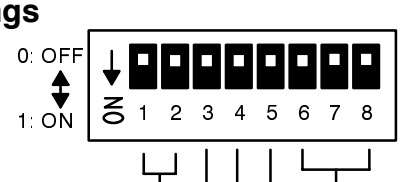
Data LINK Area Selector (See note)

S1	S2	Data LINK Area
0	0	External setting (GPC, FIT, computer)
1	0	LR area
0	1	DM area
1	1	LR and DM areas

Only valid on the Master

Note When a PLC Link Module is used, the LR area is used by the PLC Link System; the SYSMAC NET Link Module cannot use this area. If the data link area is allocated automatically to the two-loop system together with loop 0 and loop 1, duplication of the word allocation will occur.

SW 3 Settings



Be sure to set to OFF.

Application data code selector

S5	Function
0	Binary
1	JIS 8

SEND/RECV response monitoring timer switchover. Set this switch when using SEND/RECV command.

Transmission between networks

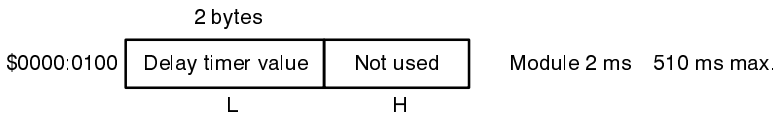
S3	Function
0	Transfer function invalid between networks
1	Transfer function valid between networks

Data transmission time delay (setting at Master)

S1	S2	Time	Standard setting Master Nos.
0	0	5 ms	1 Master
1	0	10 ms	2 Masters
0	1	20 ms	3 Masters
1	1	30 ms	4 Masters

Data Transfer Delay Time

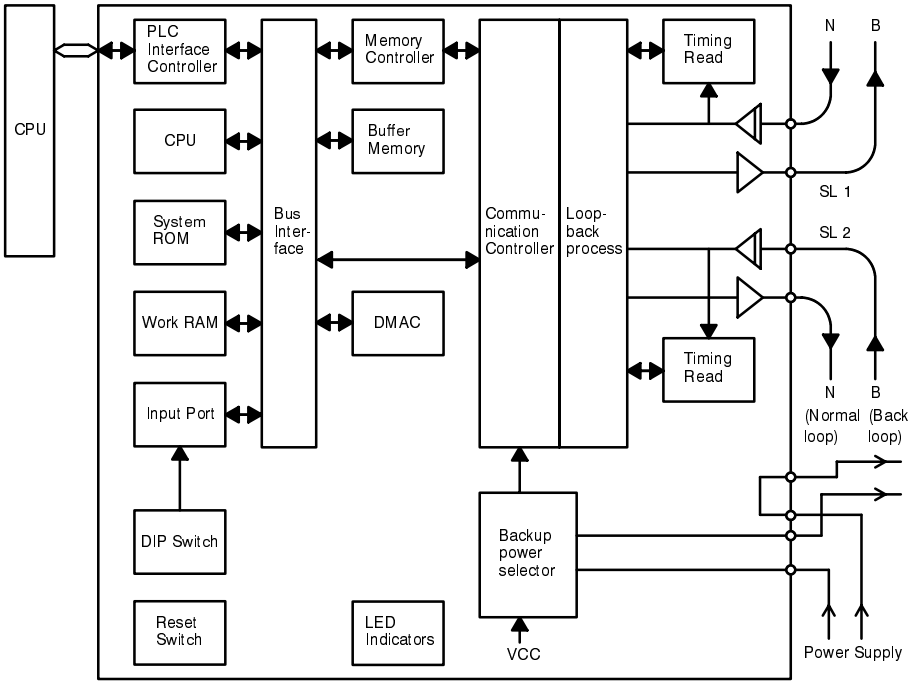
Set the data transfer time delay between the slaves in a group. Select the time according to the load condition of the whole system. The time set should be longer when the load is great and receiving time out occurs (error status turns ON). The timer value can be written directly to the Master setting area described below using the memory/write function of the diagnosis utility (DIAG). The master setting area used though, is determined by the DIP switch settings, which must be performed manually. The data is always valid when power is supplied to the SYSMAC NET Link Module. This value will be effective when the next data link operation is executed.



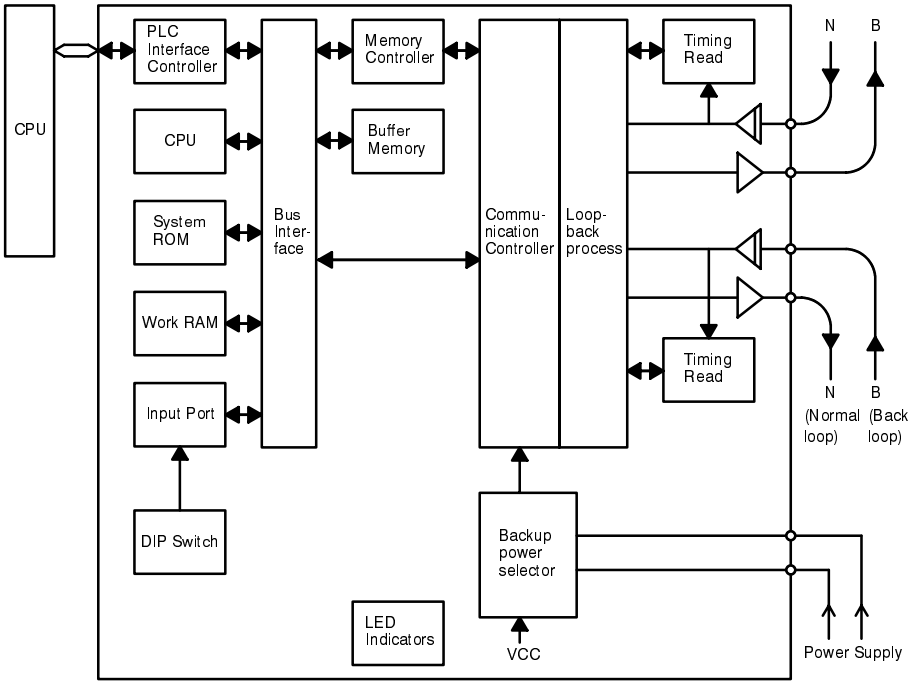
1-4 Internal Configuration

The SYSMAC NET Link Module is used to send and receive data from other network nodes, as well to communicate with its own CPU. The following diagrams illustrate the internal configurations of the C500-SNT31-V4 and the C200HS-SNT32 and how the units process the data signals.

C500-SNT31-V4



C200HS-SNT32



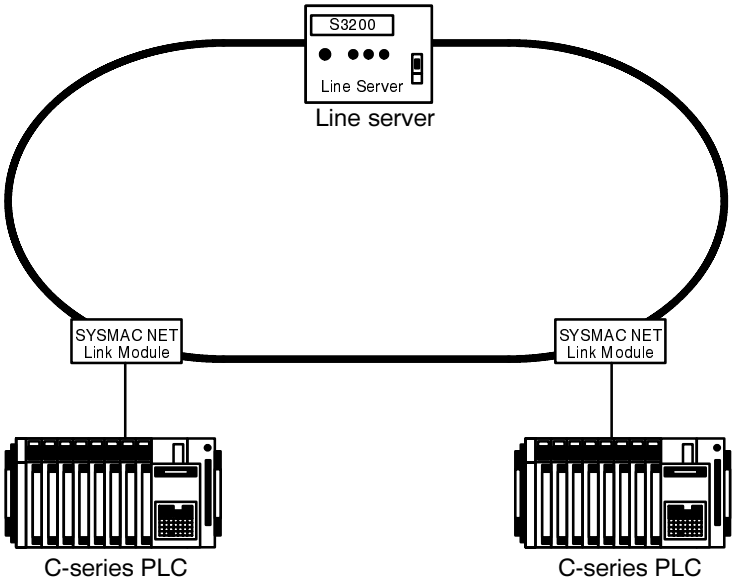
Notes 1. The SYSMAC NET Link Module has normal and back loop paths for data transmission and reception.

2. Two terminals of power connector CN1 must be shorted unless a Local Power Supply will be used with the Module. The Local

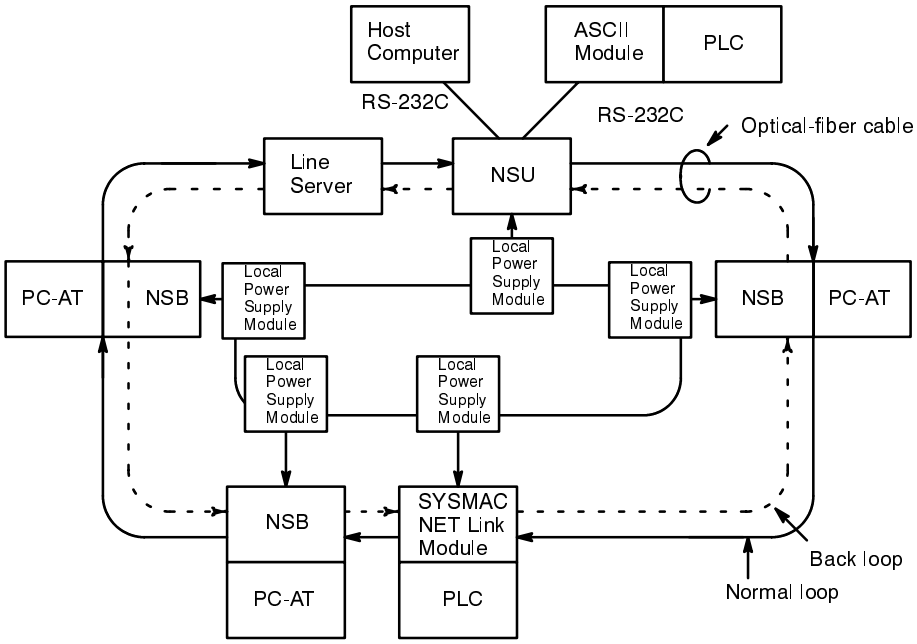
Power Supply option allows the SYSMAC NET Link Module to be powered-down while SYSMAC Net's node bypass function continues to pass information through the node.

1-5 System Configurations

The SYSMAC NET uses optical-fiber cables arranged in a token-ring architecture to direct data flow. For this reason, each network must be arranged in a loop and be composed of one Line Server and up to 126 other nodes. More information concerning the SYSMAC NET local area network can be found in the *SYSMAC NET System Manual (W178)*. The simplest arrangement of the network is composed of the Line Server and two PLCs with SYSMAC NET Link Modules.

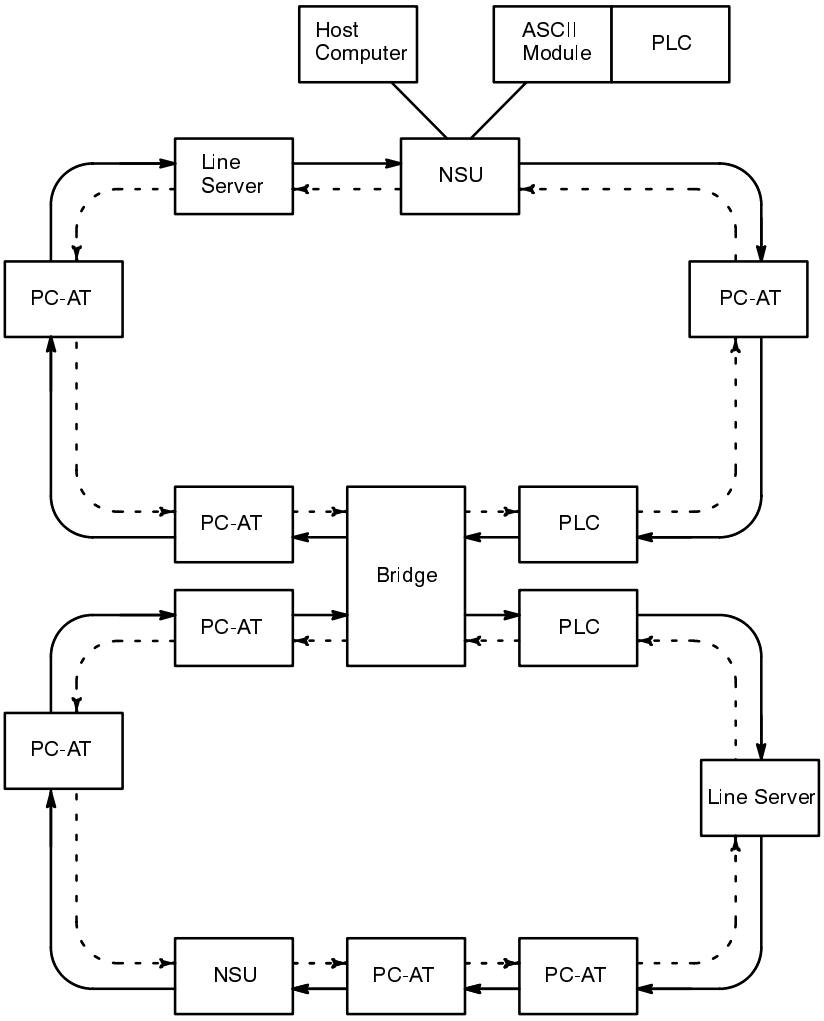


A more typical network loop involves PC-AT nodes equipped with a Network Support Board, and Network Service Modules allowing connection to RS-232C devices.



NSB: Network Support Board
NSU: Network Service Module

The next diagram shows the equipment configuration for sharing data between PLCs of two different network loops. Note that linking these network loops requires the use of a Bridge.



Data is transferred through the use of data links or datagrams. Data links differ from datagrams in that data links are more direct than the datagrams. If two PLCs will often be sending information to each other,and seldom sending information to other nodes of the network, then establishing a data link is advantageous. Data links require one PLC to act as master, and others on the data link to act as slaves. Information is then directed to a memory area of the PLC specified by the SW1 DIP switches or by programming.

Up to four layers of data links can be established, each consisting of up to 32 PLCs. Information is sent to the same memory area of all PLCs. Up to 32 words of the LR area may be addressed as well as up to 99 words of additional memory areas. The valid memory areas used for these data links vary from PLC to PLC.

A more detailed comparison of these two forms of communication can be found in the *SYSMAC NET System Manual (W178)*. More specific information regarding data links is found in *Section 4 Data Link Applications*.

PLC Initial Mode (C500-SNT31-V4)

SW3 pin 1 on the back panel of the SYSMAC NET Link Module decides the operation mode of the PLC as follows:

Mounted Module			SYSMAC NET Link Module	
			SW3 pin 1 Setting	
			ON	OFF
No other mounted Module*			MONITOR mode	RUN mode
Programming Console			Conforms to the mode selected by switch on the Programming Console	
CPU-mount Host Link Module	SW1 pin 8 Setting	ON	**	RUN mode
		OFF	MONITOR mode	PROGRAM mode
Rack-mount C500-LK103 (-P)/LK203	SW1 pin 8 Setting	ON	MONITOR mode***	MONITOR mode***
		OFF	MONITOR mode***	RUN mode***
Peripheral I/F Module, Prom Writer, Printer I/F Module, Floppy Disk I/F Module			MONITOR mode	PROGRAM mode
SYSMAC NET Link Module	SW3 pin 1 Setting	ON	MONITOR mode**	MONITOR mode**
		OFF	MONITOR mode**	RUN mode**

*Other “mounted Modules” are the Rack-mount Host Link Module, the CPU-mount Host Link Module, the Programming Console, the Peripheral Interface Module, the PROM Writer, the Printer Interface Module, and the Floppy Disk Interface Module.

**When a CPU-mount Host Link Module is used with SW3 pin 1 of the SYSMAC NET Link Module set to ON, SW1 pin 8 of the Host Link Module must be set to OFF.

***When the Programming Console is mounted to the PLC, the PLC is set to the mode selected by the switch on the Programming Console.

Caution If the PLC is set in RUN or MONITOR mode, the PLC starts operating as soon as power is applied.

1-6 Mounting Location on the PLC's Backplane

The SYSMAC NET Link Module can be mounted on various slots depending on the model of PLC being used. The following diagrams explain mounting location.

Mounting Position of the SYSMAC NET Link Module

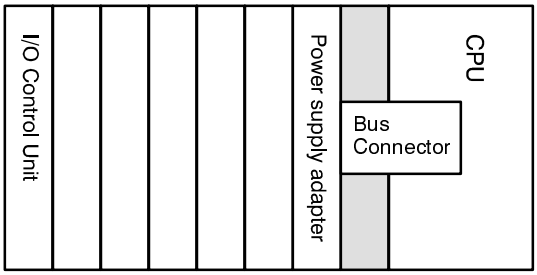
The SYSMAC NET Link Module can be mounted in the following I/O slots

PLC	I/O slot
C200H/C200HS (One Module)	The right slot
C200H/C200HS (Two Modules)	The two right slots
C500/C1000H (3G2A5-BC081/051)	Any of the 3 right slots on the CPU rack
C500/C1000H (C500-BC082/052)	Any of the 5 right slots on the CPU rack
C500/C1000H (C500-BC031)	Any of the 3 right slots on the CPU rack
C500/C1000H (C500-BC061)	Any of the 5 right slots on the CPU rack
C500/C1000H (C500-BC091)	Any of the 5 right slots on the CPU rack **
C2000H simplex system	Any slot on the CPU rack
C2000H duplex system	Any of the 6 right slots on the I/O rack *

* The I/O Rack as distinct from the I/O Expansion Rack.

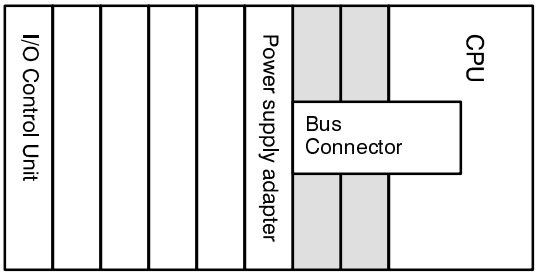
**C500-BC091 has one more link slot.

C200H/C200HS (one Module)



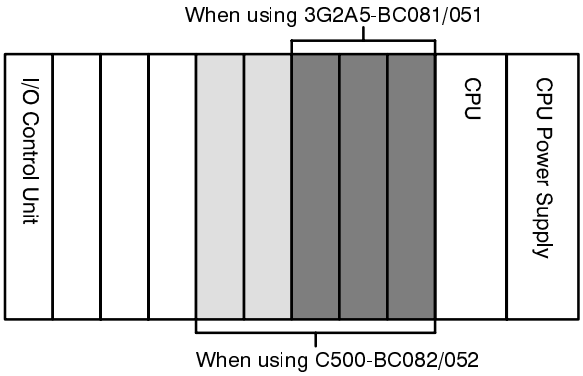
In the above configuration, the C200H-CE001 Bus Connector must be used to connect the CPU and SYSMAC NET Link Module.

C200H/C200HS (two Modules)

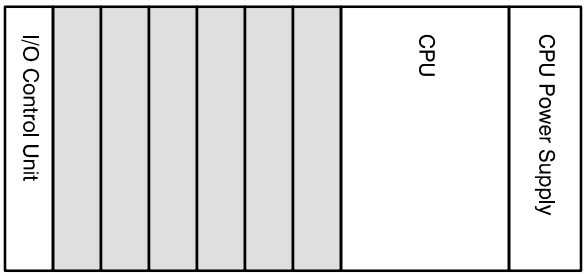


In the above configuration, the C200H-CE002 Bus Connector must be used to connect the CPU and SYSMAC NET Link Modules.

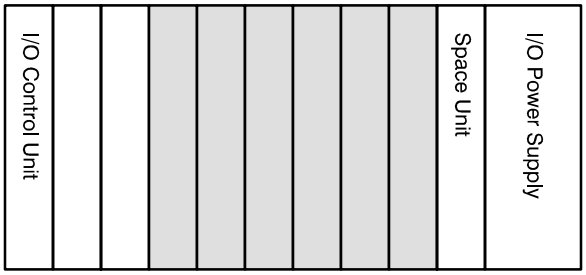
C500/C1000H



C2000H Simplex System (CPU Rack)



C2000H Duplex System (I/O Rack)



1-7 Using the SYSMAC NET Link Module with other Link Modules

Depending on the models of PLCs used and the attached Link Modules (i.e. Host Link Module or PLC Link Module), it may or may not be possible to have another Link Module operating with the SYSMAC NET Link Module. The following table explains the compatibility between various CPU's and Link Modules.

	CPU		
	3G2C3-CPU11-EV1	C1000H-CPU01-EV1 C2000H-CPU01-EV1	C2000H-CPU01-EV1 Duplex
Two SYSMAC NET Link Modules	N	Y (SNT31-V4) (See Note 2)	N
SYSMAC NET Link Module and SYSMAC Link Module (SLK22)	N	Y (See Note 2 and 3)	N
SYSMAC NET Link Module and Single-loop PLC Link Module	Y (See Note 3)	N	N
SYSMAC NET Link Module and Multi-loop PLC Link Module	Y (See Note 3)	Y (See Note 3)	(Y)
SYSMAC NET Link Module and CPU-mounting Host Link Module	Y	Y	Y
SYSMAC NET Link Module and Rack-mounting Host Link Module	N	N	N
SYSMAC NET Link Module and Multi-loop Host Link Module	N	Y (See Note 2)	Y (See Note 2)
SYSMAC NET Link Module and mini MAP Link Module	N	N	N

CPU	2 SYSMAC Net	SYSMAC NET and SYSMAC LINK (SLK22)	SYSMAC NET and PLC LINK (LD003)	SYSMAC NET and Host LINK (LK101, LK202)	SYSMAC NET and CPU-mounting Host Link
C200HS-CPU31-E C200HS-CPU33-E C200H-CPU11-E C200H-CPU31-E (See note 4)	Y (See Note 2)	Y (See Note 2,3)	Y (See Note 3)	Y	Y

N: Impossible to operate on the same PLC.
Y: Possible to operate on the same PLC.
(Y): Possible to operate when the SYSMAC NET Link Module data link is not operating.

Notes 1. The PLC Link and SYSMAC LINK differ functionally from the SYSMAC NET Data Link and application software.

2. Do not set the same loop number (0 or 1) for both CPUs.

3. When the PLC Link and SYSMAC LINK are used with the SYSMAC NET Data Link, do not set each Module to use the SR area as the data link and Link area.
4. The C200H-SNT31 cannot be used with the C200HS-CPU31-E or C200HS-CPU33-E.
5. The C200HS-SNT32 cannot be used with the C200H-CPU01.
6. The C500-SNT31, -V1, -V2 and -V3 cannot be used concurrently with the C500-SNT31-V4.
7. The C200H-SLK11 or C200H-SLK21-V1 SYSMAC LINK Module cannot be used with the C200HS-CPU31-E or C200HS-CPU33-E. Use the C200HS-SLK12 or C200HS-SLK22 with the C200HS-CPU31-E or C200HS-CPU33-E.

SECTION 2
Pre-Operation

2-1 Cabling

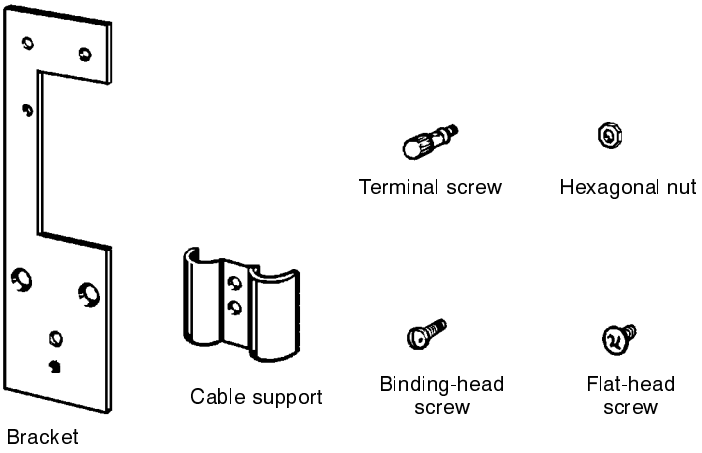
Because the SYSMAC NET Link Module uses optical fiber cabling to connect to the SYSMAC NET local area network, special attention must be paid when connecting these cables to the Module. If the cables being used do not already have connectors, refer to the relevant *Optical Fiber Cable manual* for instructions on connector assembly.

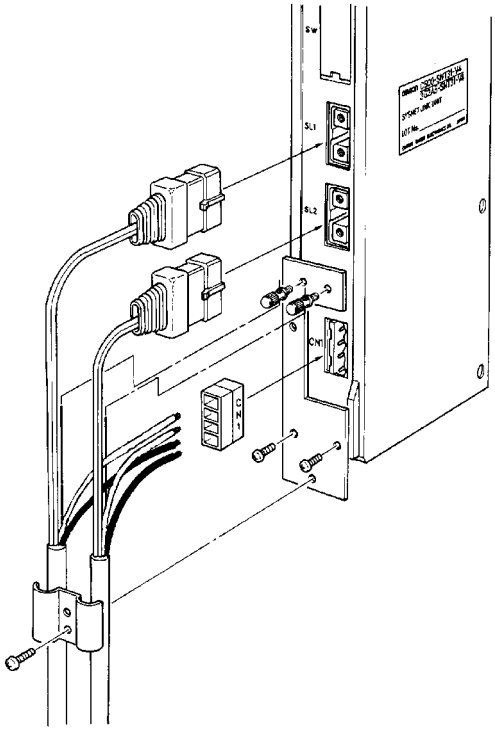
Network cabling should be installed beginning from the network loop's Line Server through successive nodes. Before a new node is added to the loop, the LED status should indicate that communication is operating without problems with the present nodes. By adding new nodes from the Line Server only after verifying that existing nodes are operational, troubleshooting is greatly aided. Reference the *SYSMAC NET System Manual (W178)* for more information. This section assumes that the connectors have been connected to the cables and tested, and that the SYSMAC NET Link Module is ready to be added to the network loop.

The SYSMAC NET Link Module is shipped with a bracket to ensure a good connection between the Module and rest of the network. The parts included are described below.

C500-SNT31-V4

No.	Name	Qty.
1	Bracket	1
2	Cable Support	1
3	Terminal Screws	2
4	M3 Hexagonal Nuts	2
5	Flat-head Screws (M3 x 6)	2
6	Binding-head Screws (M3 x 10)	1





1. Detach power connector CN1, and fasten the cables to CN1 in the following order: upper red node, lower red node, upper white node, lower white node. Tighten securely to prevent the wire of the cable from working loose.
2. Connect the optical connector to the SYSMAC NET Link Module. Connect the upper node (upstream data) optical connector to SL1, and the lower node (downstream data) optical connector to SL2.
3. Reconnect CN1.
4. Connect the tension member by inserting it into the hole of the terminal and tightening the terminal screw.
5. Place the cable into the hollow of the cable holder and mount it with the screw provided.

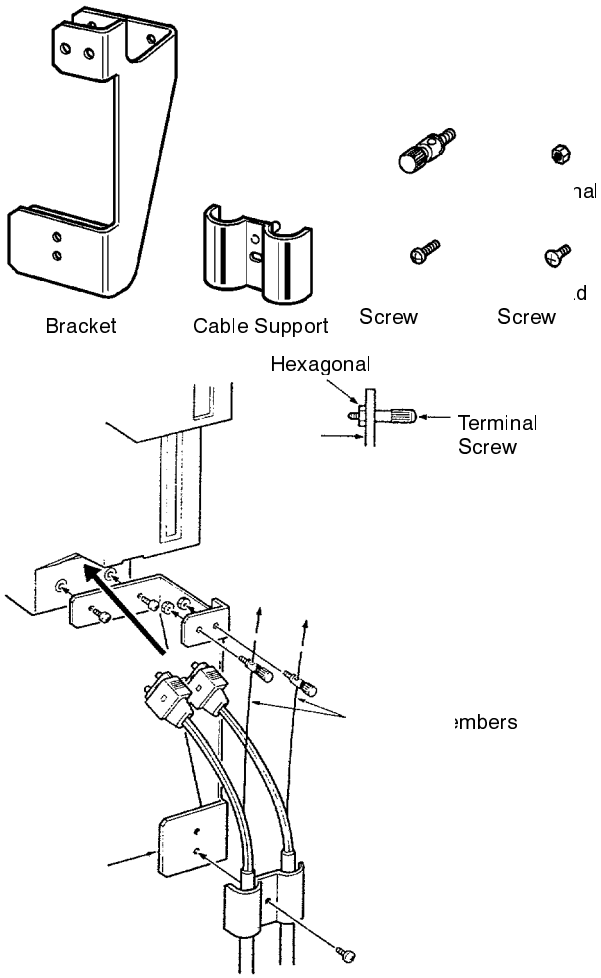
Once the mounting bracket is installed, the cables may be attached.

CAUTION Ensure that power to the CPU is OFF. On the SYSMAC NET network, the cable from SL1 of the previous (upstream) node always goes to SL2 of the next (downstream) node, and SL2 is always attached to SL1.

C200HS-SNT32

This Bracket must be used to support an optical fiber cable connected to the C200HS-SNT32 SYSMAC NET Link Module.

No.	Name	Qty.
1	Bracket	1
2	Cable Support	1
3	Terminal Screws	2
4	M3 Hexagonal Nuts	2
5	Flat-head Screws (M3 x 6)	2
6	Binding-head Screws (M3 x 10)	1

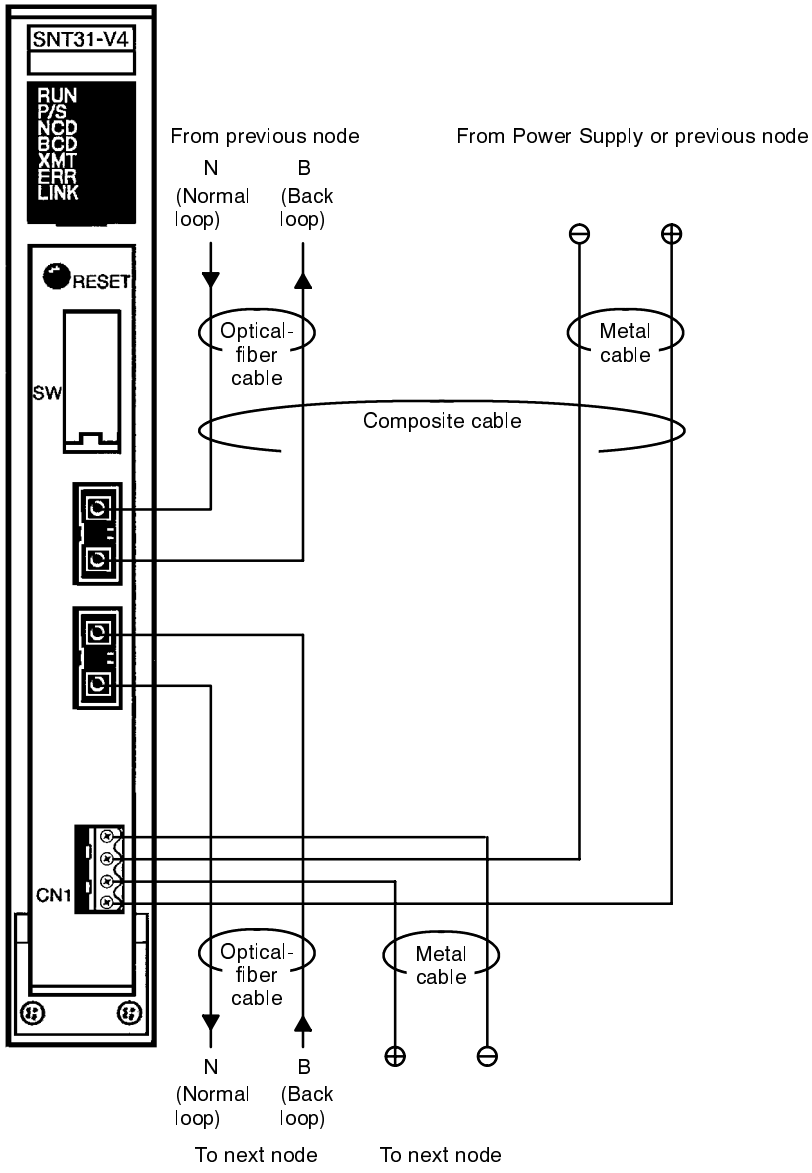


1. Attach the Terminal Screws to the Bracket so that the holes in the Screws are vertical and secure the Screws from the back side using the Hexagonal Nuts.
2. Attach the Bracket to the Module using the Flat-head Screws.
3. Pass the tension members of the optical fiber cables through the holes in the Terminal Screws. (This step is necessary only for cables with tension members.)
4. Connect the optical fiber cable connecters to the Module, being sure to press the connecters completely in.
5. Align the optical fiber cables over the lower portion of the Bracket and secure them in place using the Cable Support and the Binding-head

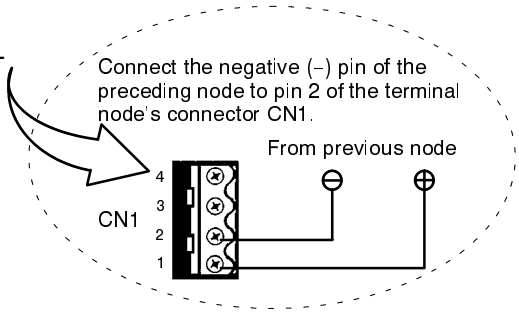
screws. The cables must run between the Bracket and the Cable Support.

6. Tighten the screws on the Terminal Screws to secure the tension members in place.

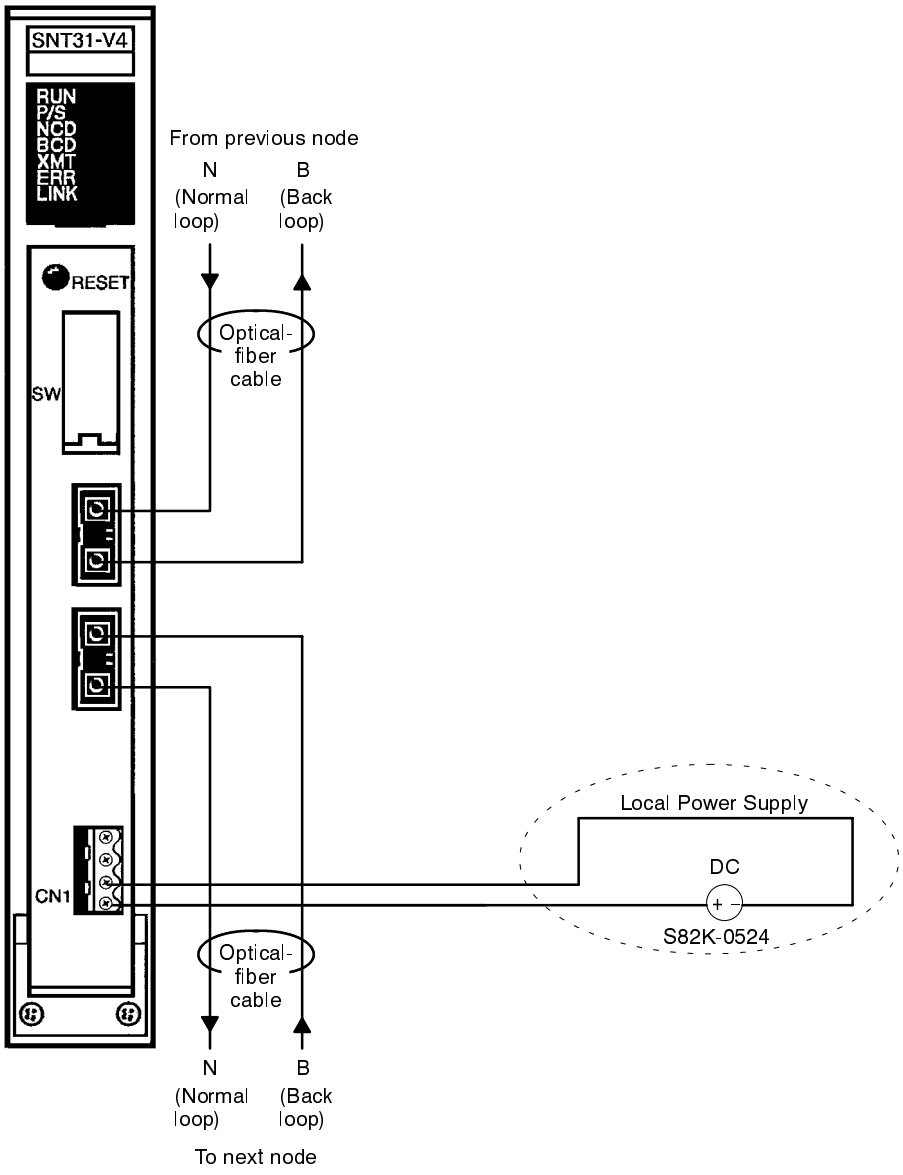
Central Power Supply



Notice: Connect this way only on LAST or END SNT of network.



Local Power Supply

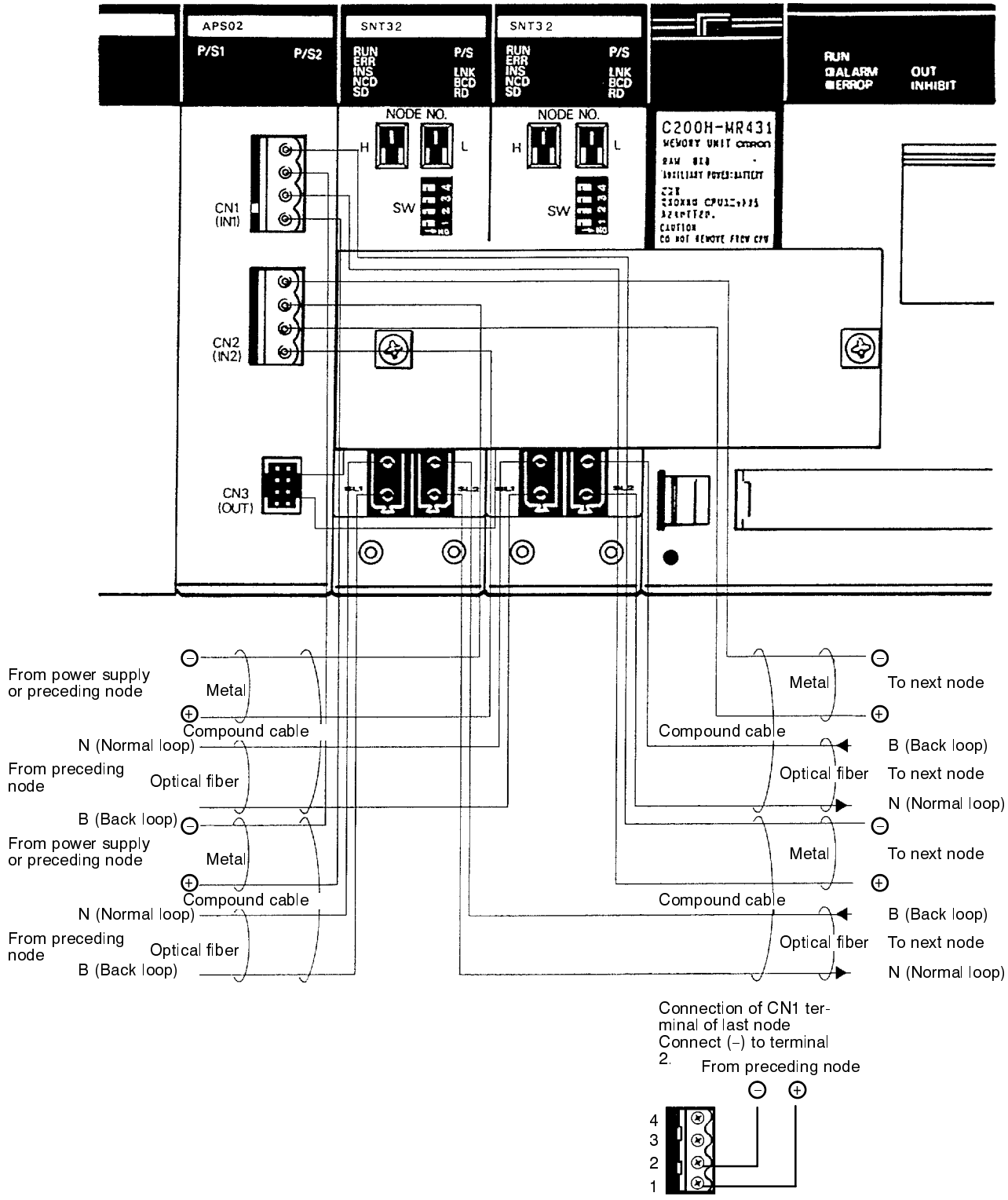


Central Power Supply

When a Central Power Supply is used, mount the Power Supply Adapter to the immediate left of the Link Module. There are two models of Power Supply Adapter: the C200H-APS01 (for one Link Module); and the C200H-APS02 (for two Link Modules). The C500-SNT31-V4 has a built-in Power Supply Adapter.

The C200H/C200HS CPU Module is connected to the SYSMAC NET Link Module by means of a CPU Base Connection Module (C200H-CE001, C200H-CE002). The C200H-CE001 CPU Base Connection Module connects one Link Module and the C200H-CE002 connects 2 Link Modules (these Modules correspond to Link Modules C200HS-SNT32 and C200HS-SLK22).

Note The Central Power Supply is available only in Japan.



When the cables have been connected to the Module, apply power to the CPU and verify the status of the LED indicators. If this is the last node of the network then both the NCD and BCD LEDs should be lit.

2-2 Data Transfer Times

The SYSMAC NET local area network transfers data at a rate of 2M bit/second. Data is transferred in 2K-byte packets, with an average of 50 ms

required to transfer this information between two PLCs on a network with light traffic. When 2K bytes of data are transferred with datagrams, the delay time is calculated as follows:

Td: Delay time

Ts: DMA transmission time ≈ Transmission or reception bytes x 4 μs/byte

Tg: Permission to transmit detection time

T: Data transmission/reception time ≈
Transmission or reception bytes x 4 μs/byte

ns: Number of nodes

Tn: Time/node ≈ 2 μs/4 bits of data

To: Delay for optical fiber cable ≈ 5 μs/km (10 bits of data/km)

ls: Cable length

Tls: Delay at Line Server ≈ 10 s (20 bits of data, passing delay is 0 μs)

Tr: Reception DMA time ≈ 8.2 ms

Formula

Td = Ts + Tg + T + (ns x Tn) + (To x ls) + Tls + Tr

The maximum value for Tg is calculated as follows:

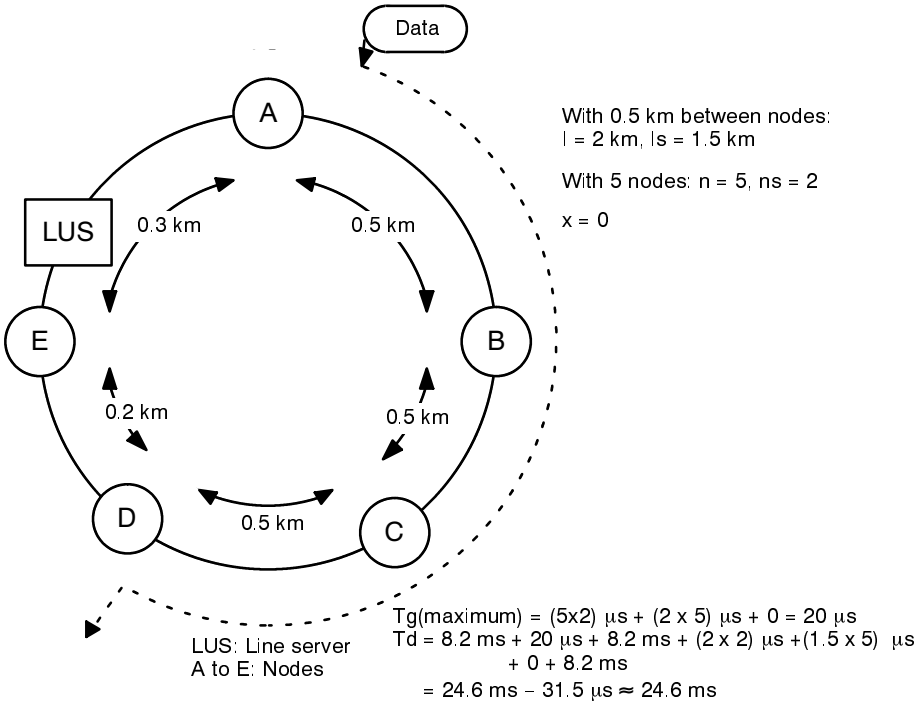
Tg (maximum) = To x l + Tn x n + Tls + T x X

l: Total length of loop cable

n: Total number of nodes

X: Number of other nodes waiting to transmit

Example



Processing time required to transfer data between the SYSMAC NET Link Module and another node includes the time for creating the header, the cycle time, and the times listed in the above formula. The processing time required by the SYSMAC NET Link Module is the largest portion of the delay time. Data is generally delivered to the SYSMAC NET Link Module in ASCII format, with the conversion into binary format requiring 50 ms for each 2K bytes of data. If data is input to the SYSMAC NET Link Module in binary format, processing is hastened.

Not all users require the use of data links. If required, a further explanation on data link transmission times is given in *4-6 Data Link Transmission Times*.

2-3 Word Allocation

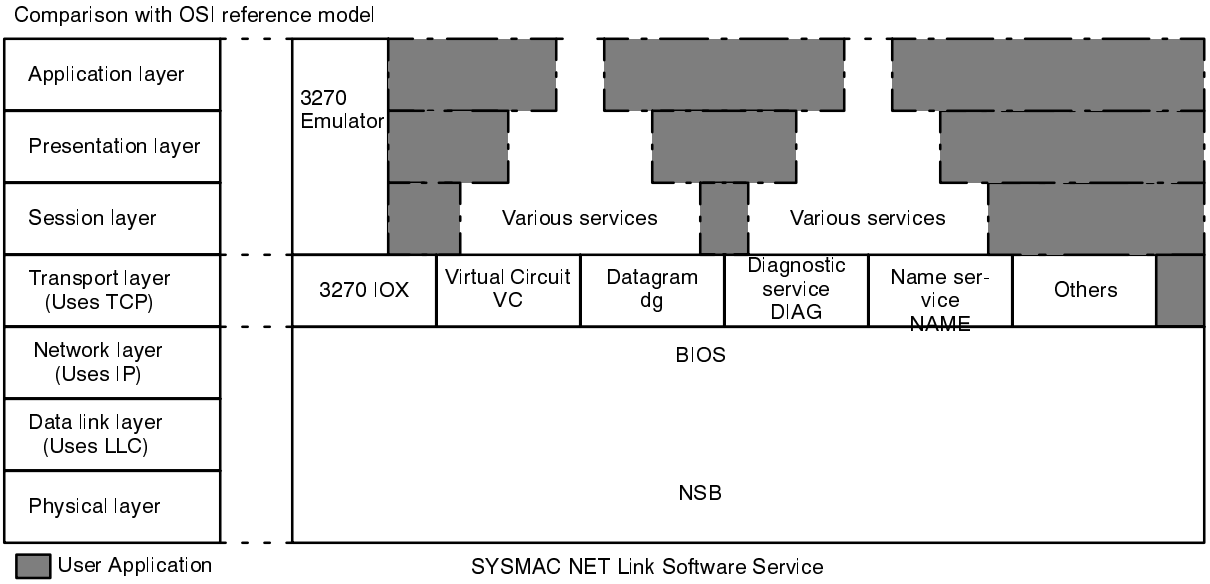
The SW1 DIP switch determines data link settings. As described in *1-3 DIP Switch Settings*, pins 3 and 4 select the data area(s). Use pins 5 and 6 to set which words will be used in the LR and/or DM areas. The following chart correlates these settings with word allocation.

(#: Node Address)

LR Wd	DM Wd	Selector Setting and Node No.			
		00	10	01	11
00 to 01	000 to 003	#1	#1	#1	#1
02 to 03	004 to 007	#2			
04 to 05	008 to 011	#3	#2		
06 to 07	012 to 015	#4			
08 to 09	016 to 019	#5	#3	#2	
10 to 11	020 to 023	#6			
12 to 13	024 to 027	#7	#4		
14 to 15	028 to 031	#8			
16 to 17	032 to 035	#9	#5	#3	#2
18 to 19	036 to 039	#10			
20 to 21	040 to 043	#11	#6		
22 to 23	044 to 047	#12			
24 to 25	048 to 051	#13	#7	#4	
26 to 27	052 to 055	#14			
28 to 29	056 to 059	#15	#8		
30 to 31	060 to 063	#16			
32 to 33	064 to 067	#17	#9	#5	#3
34 to 35	068 to 071	#18			
36 to 37	072 to 075	#19	#10		
38 to 39	076 to 079	#20			
40 to 41	080 to 083	#21	#11	#6	
42 to 43	084 to 087	#22			
44 to 45	088 to 091	#23	#12		
46 to 47	092 to 095	#24			
48 to 49	096 to 099	#25	#13	#7	#4
50 to 51	100 to 103	#26			
52 to 53	104 to 107	#27	#14		
54 to 55	108 to 111	#28			
56 to 57	112 to 115	#29	#15	#8	
58 to 59	116 to 119	#30			
60 to 61	120 to 123	#31	#16		
62 to 63	124 to 127	#32			

2-4 Software Functions

The SYSMAC NET Link Module operates at the Transport layer of the seven-level OSI model of ISO. The Module can use datagrams to access the hardware. The OSI model is shown below.

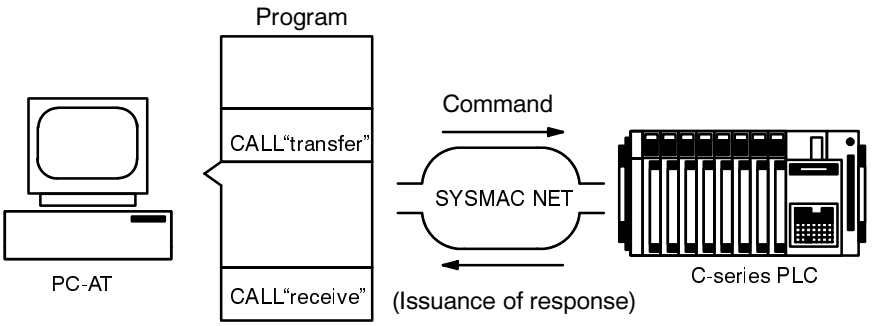


Datagram Service Application

The commands/responses of the SYSMAC NET Link Module can also be used between the SYSMAC NET Link Module and other nodes via datagrams. Note that communication involving PLCs requires that a response be returned to the transmitting SYSMAC NET Link Module that the message was received. When transferring between two PLCs, this response is automatic. When transferring from a PLC to a computer, this response is also required, but since it is not automatic it must be programmed. Not receiving a response in this instance will result in an error flag. When errors are encountered on SYSMAC NET, the error is reported but a retry is not automatic. Retries can be programmed if required.

Computers Transferring/Receiving PLC Programs

A PC-AT computer equipped with a Network Support Board can send or receive a PLC's program. The computer's programming is written using the BASIC I/F routine for datagram service. No special programming is required for the PLC.



Data Transfers with PLCs and Computers

Data can be exchanged between PLCs and computer nodes. To transfer data from a PLC to a computer, or NET Service Module, use the commands SEND or @SEND in the program of the PLC.

FUN (90)	← Transfer instruction (@SEND is a differential output instruction.)
S	← Source start word No. (SYSMAC)
D	← Destination start word No. (PC-AT) *
P	← First word of parameter

* When the destination node is a NSB or NSU, the setting is ignored.

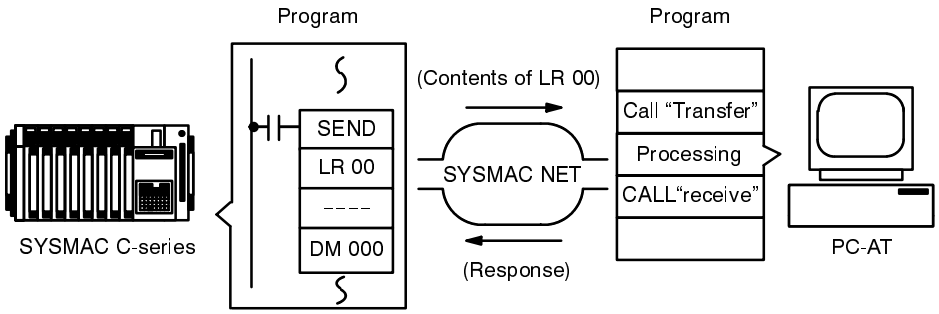
The node which has received this data must then issue a response.

Use the RECV or @RECV instruction in the PLC program to request data from a computer or NET Service Module.

FUN (98)	← Transfer request instruction
S	← Source start word No. (PC-AT) *
D	← Destination start word No. (SYSMAC)
P	← First word of parameter

* When the source node is a NSB or NSU, the setting is ignored.

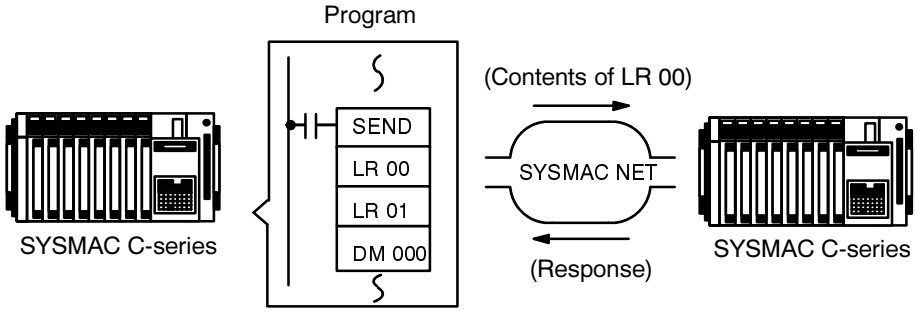
The computer or Network Service Module then issues a response, data write.



Transfers Between PLCs

PLCs may share information using SYSMAC NET datagrams, as well as the more traditional data links to the LR area. This section explains the PLC's use of datagrams.

To transfer the contents of words in a PLC's data area, use SEND, RECV, or the differential (@) forms of these instructions. When a PLC issues a SEND, no response need be issued from the destination node. Likewise, when issuing a RECV, no programming of a response is required at the source node.



Diagnostic (DIAG) Functions

Six diagnostic utilities can be used with the SYSMAC NET Link Module.

1. Status Read Response

   A node receiving a Status Read Request returns its status.

2. Memory Dump Response

   A node receiving a Memory Dump Request returns its memory contents.

3. Memory Write Response

   A node receiving a Memory Write Request returns a response. The area accessible for this request in HEX is $0000: 0000 through $0000:7FFFF. The two components making up the address here represent the segment and offset respectively.

4. Echo back Response

   A node receiving an Echo Back Command returns the echo back data as it is.

5. Simultaneous Multiple Address Loop Test Function

   Receives the Simultaneous Multiple Address Loop Test request and responds with the results of the the status read.

6. Loop Construction Inspection Function

   Inspects the loop construction from the network control node.

SYSMAC NET Link Module Software Buffers

The SYSMAC NET Link Module is equipped with fifteen hardware, seven software, one send, and one data link buffer.

Data enters the Module through the hardware buffer. The first unit of data received by the buffer is the first to be processed. If the 15 buffers are full, a busy flag turns ON. The buffers are fixed in size each being 2K bytes. Software buffers (w/datagrams) have priority over the data link buffers.

The CPU is responsible for moving the information through the buffers. It checks every 5 ms to see what should be moved or sent. Information is moved from the hardware buffers via the software buffers to the CPU. The hardware buffer can be cleared but the software buffer cannot be cleared. If the software is buffer is full, then a busy signal is issued and no more data is allowed into these seven buffers. If the seventh software buffer is filled, the CPU takes the data from this buffer and the data from the other six buffers is all shifted up one. The hardware buffer then sends its next unit of data.

PLC responses are directed to the send buffer to be returned to the node which issued the message. These responses are issued automatically from the PLC which received the message. If a PLC sends a message to a computer, the computer should be programmed to return a response. If a PLC sends a message and no response is returned, the error flag turns ON, and the ERR LED is lit.

If the buffer is full, a busy signal is returned and the error flag turns ON. The user program determines if the data will be present.

Data is sent from the send buffer and the response is received through the hardware buffer. The datagram buffer is only used when another node has sent a command. If the seven software buffers are full, a busy signal is issued and the sending node may re-transmit. The total number of messages which can be received almost simultaneously is then 15 + 7 = 22 messages. If a node sends data and there is no room in the receiving node's buffers, a busy flag turns ON. The data can be sent again if the programming demands a retry in this event.

2-5 Connections between Network Loops

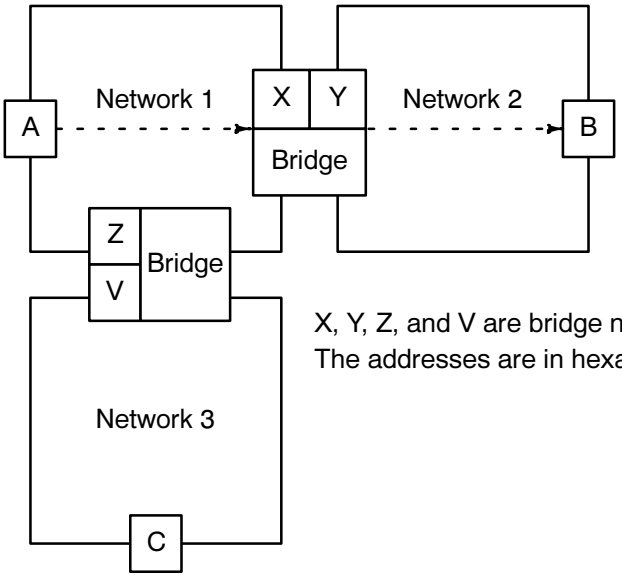
A network loop is composed of up to 127 nodes. Two or more network loops can be connected by use of a Bridge. Bridges allow nodes from separate loops to transmit data to each other.

Each node on the SYSMAC NET local area network has both a node address and a network address. All nodes on a single network loop must have the same network address. When shipped from the factory, Modules have the network address set to "0." Two networks that will be connected by a Bridge must have different network addresses for each of the loops. For example, one side of the Bridge could have "0" set for all nodes as the network addresses while the other side of the Bridge could have ten set for all its nodes as the network address.

The Bridge has two sets of ports: one for each of the network loops that will be bridged. The Bridge also has two network and node addresses: one for each of the network loops that will be bridged.

A routing table must be established for the PLCs and the Bridges to direct communication through a given Bridge to a node on a separate network loop. A routing table does not need to be established if there will be no communication through Bridges to separate network loops.

The following diagram illustrates how bridges may be included in a communications system to allow data to be transferred between nodes on separate networks.



If node A of network 1 wants to communicate with node B of network 2, three processes occur. First, node A sends the information to X, the Bridge's node address on network 1. Node X then transfers the information to node Y, the same Bridge Module but the node of a different network.

Finally, node Y transfers the information to node B. The response is then directed back to the PLC which sent the data, along the same path.

SYSMAC NET requires that routing tables be established and stored in the BIOS. Other manufacturers do not require routing tables as they have the sending node do a broadcast to determine routing to the message's destination. By keeping the routing table in the BIOS, transfers are faster and dependable.

The routing table is stored in a file called ROUTE.DAT. The table lists up to 20 bridges and their addresses. While in theory, up to 126 loops can be connected together using Bridges, the routing tables have been designed to connect 20 network loops, since this satisfies almost all applications. Any node can have a routing table allowing it to communicate with up to 20 loops.

A routing table has the following appearance. All addresses are in hexadecimal.

HR		Bit		
Loop 1	Loop 0	15 to 08		07 to 00
Wd 00	Wd 22	15 Status	14 No. of bridges used 08	Own Network No.
Wd 01	Wd 23	Network No. 1		Bridge Address 1
Wd 02	Wd 24	Network No. 2		Bridge Address 2
Wd 03	Wd 25	Network No. 3		Bridge Address 3
∫	∫	∫		∫
Wd 18	Wd 40	Network No. 18		Bridge Address 18
Wd 19	Wd 41	Network No. 19		Bridge Address 19
Wd 20	Wd 42	Network No. 20		Bridge Address 20

All address are in hexadecimal.
The set number of pairs of networks N1 and their addresses are valid.
Unused area can be used as a normal HR area.

Word 0 bit 15 (word 22 bit 15) keeps track of the status of the routing table. When the CPU is reset or powered ON, this status is set.

	HR Wd 0 bit 15 (HR Wd 22 bit 15)
Setting Error	ON
Normal	OFF

When the CPU power is ON, or the reset button is pushed, the routing table is checked and the status is set.

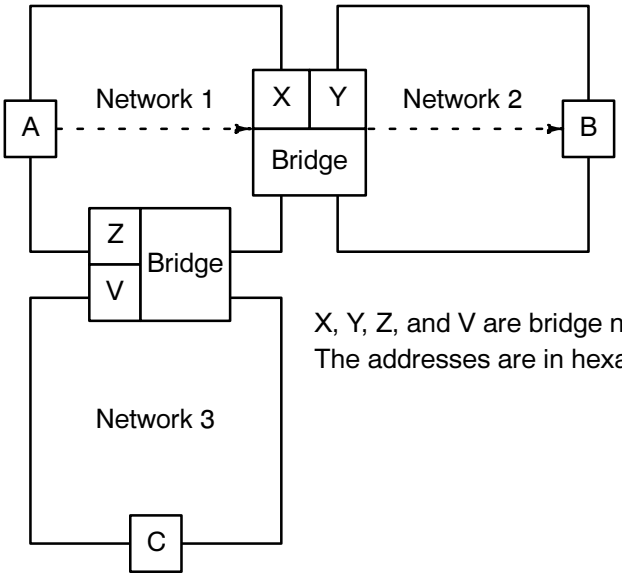
Note The numbers in parentheses "( )" are the setting for Loop 0.

The following table explains the valid words and bits of the HR memory area. Unused areas of the routing table are used as normal HR area.

Item	Set Wd/Bit	Set Value	Function
No. of Bridges	HR Wd 0 (HR Wd 22) bits 14 to 08	$00 to $14	Sets the number of pairs of bridge addresses and network numbers.
Own Network No.	HR Wd 0 (HR Wd 22) bits 07 to 00	$01 to $7F	Sets the own network number.
Network No.	HR Wds 1 to 16 (HR Wds 23~42) bits 15 to 08	$01 to $7F	Sets the number of the network to be connected.
Bridge Address	HR Wds 1 to 16 (HR Wds 23~42) bits 07 to 00	$01 to $7E	Sets the bridge node address for connection within the own network.

As indicated above, a routing table can contain up to 20 addresses. If 20 network loops are entered, but only five are registered as the number of Bridges being used, only the first five bridges are available. Conversely, if 5 network loops are entered but 20 is entered as the number of Bridges being used, errors occur.

If there are two or more alternate routes possible for communication, only one route should be chosen and listed in the routing tables. Choose the route for which the least amount of network traffic is anticipated.



X, Y, Z, and V are bridge node addresses. The addresses are in hexadecimal.

In the above network configuration, the routing tables for the three PLCs could have the following appearance. As always, bits 00 through 07 are used for Bridge addresses, and the letters in the tables following should have these addresses substituted.

Node A (Loop 1)

Bit / HR	15 to 08	07 to 00
Wd 0	$02	$01
Wd 1	$02	X
Wd 2	$03	Z

Node B (Loop 0)

Bit / HR	15 to 08	07 to 00
Wd 0	$02	$02
Wd 1	$01	Y
Wd 2	$03	Y

Node C (Loop 1)

Bit / HR	15 to 08	07 to 00
Wd 0	$02	$03
Wd 1	$01	V
Wd 2	$02	V

Because a single Bridge appears as a node on two networks, Bridges have a routing table set for each side.

The routing table can be initialized locally from the PLC, or from a computer running the CONFIG32 software. The routing table is valid when SW3-2 (of the C500-SNT31-V4) or SW3-3 (of the C200HS-SNT32) on the back panel is set to ON. The HR area may then be set directly using the PLC's programming device. Finally, push the PLC's reset button or turn the power OFF and ON again.

If the routing table is to be initialized remotely, use the routing table setting command. Following this transmit the initialization command or press the reset button.

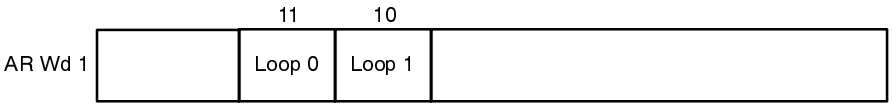
PLC Local Setting Procedure

By connecting the PLC programming console, HR can be set directly. If using the C500-SNT31-V4, press the reset button on the front panel; if using the C200HS-SNT32, turn the SYSMAC NET AR reset flag to ON, or turn the PLC Module OFF and then ON again. Ensure prior to this that SW3-2 (of the C500-SNT31-V4) or SW3-3 (of the C200HS-SNT32) on the back panel is ON. Note that the initialization may still be invalid if only the HR area table setting is performed.

The routing tables are stored in the HR memory area, so their contents are saved if power is interrupted or accidentally switched OFF.

SYSMAC NET reset flag (C200H/C200HS only)

This flag is assigned to word 1 of the AR Area. A reset occurs when this flag is turned ON.



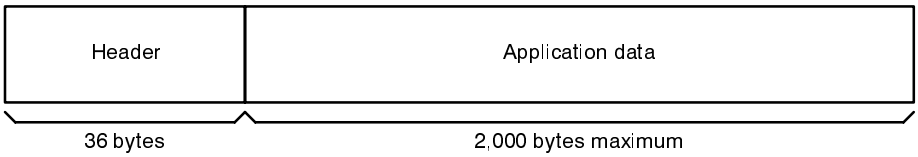
SECTION 3
Commands and Responses

3-1 Data Format

The SYSMAC NET Link Module has many commands which facilitate communication between system devices. This section explains these commands.

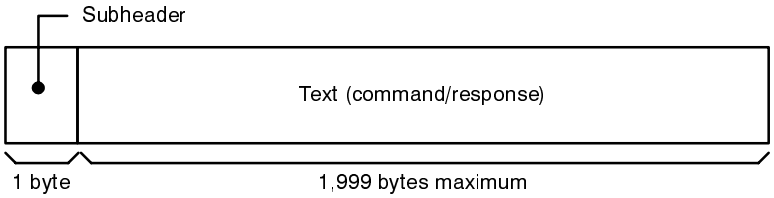
Messages are transferred in 2K-byte packets. A packet is divided into a header portion and a data portion. The header contains routing information, while the data portion contains the command/response.

Message Format

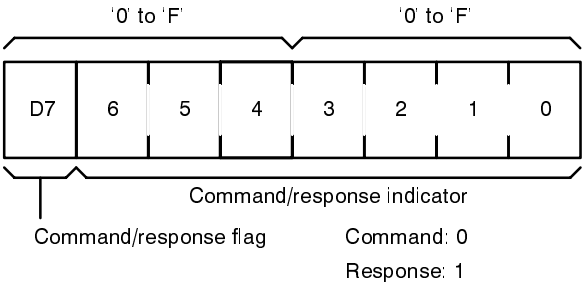


Binary Code

Application Data Format



Subheader Byte Format



The data portion of the message is composed of a 1-byte subheader and up to 1,999 bytes of command/response data. The subheader dictates which command or response follows. The text length depends on the specific command/response. Commands are messages instructing the SYSMAC NET Link Module to do some processing. The table on the following page lists the hexadecimal command codes along with valid PLC modes.

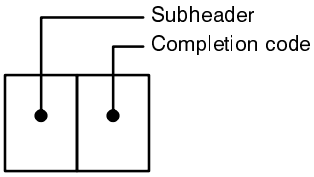
Subheader	PLC Mode			Command
	Run	Monitor	Program	
$00	Y	Y	Y	IR/SR Area Read
$01	N	Y	Y	IR Area Write
$02	Y	Y	Y	LR Area Read
$03	N	Y	Y	LR Area Write
$04	Y	Y	Y	HR Area Read
$05	N	Y	Y	HR Area Write
$06	Y	Y	Y	PV Area Read
$07	N	Y	Y	PV Area Write
$08	Y	Y	Y	TC Area Read
$09	N	Y	Y	TC Area Write
$0A	Y	Y	Y	DM Area Read
$0B	N	Y	Y	DM Area Write
$0C	Y	Y	Y	SV Read 1
$0D	Y	Y	Y	SV Read 2
$0E	N	Y	Y	SV Change 1
$0F	N	Y	Y	SV Change 2
$10	Y	Y	Y	Status Read
$11	Y	Y	Y	Status Write
$12	Y	Y	Y	Error Read
$13	N	Y	Y	Force Set/Reset
$14	N	Y	Y	Force Set/Reset Cancel
$15	Y	Y	Y	I/O Register
$16	Y	Y	Y	I/O Read
$17	Y	Y	Y	Program Read
$18	N	N	Y	Program Write
$1A	N	N	Y	I/O Table Generation
$1B	N	N	Y	DM Size Change
$1C	Y	Y	Y	AR Area Read
$1D	N	Y	Y	AR Area Write
$1E	Y	Y	Y	Data Link Status Read
$1F	Y	Y	Y	Data Link Setting Table Read
$20	Y	Y	Y	Data Link Setting table Write
$21	Y	Y	Y	Data Link Start
$22	Y	Y	Y	Data Link Stop
$23	Y	Y	Y	Routing Table Setting
$24	Y	Y	Y	Routing Table Read
$25	Y	Y	Y	Test
$26	Y	Y	Y	Initialize (Command)
$27	Y	Y	Y	FM Data Read
$28	Y	Y	Y	FM Index Read
$29	Y	Y	Y	FM Area Write
$2A	Y	Y	Y	Name Set
$2B	Y	Y	Y	Name Delete
$2C	Y	Y	Y	Name Read
$2D	N	Y	Y	Time Set
$2E	N	Y	Y	Multiple Forced Set/Reset
$2F	N	Y	Y	Multiple Forced Set/Rest Status Read
$FF	Y	Y	Y	Undefined Command Error (Response)
$60	Y	Y	Y	Data Transmit*
$61	Y	Y	Y	Data Request*

*Only when APLC is the transmitting mode.

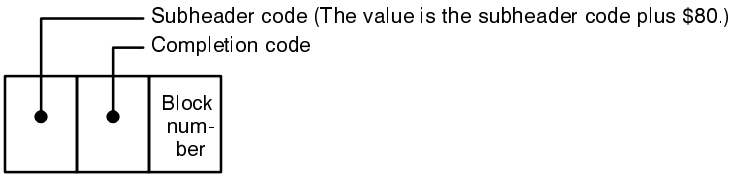
A response is a message in response to an issued command. A response's format is very similar to the format of the command that was issued. Specifically, the response has a header, a subheader code, and a completion code, followed by any data that was requested to be returned.

If an error occurs, an error response is sent. An error response has only the header, subheader code and the completion code. Read/write error responses contain the header, subheader code, completion code, and the block number where the error was encountered.

Error Response



Error Response during Program Read/Write



The subheader code for a response is simply the value of the command subheader plus $80.

Completion codes are listed in the following table. A completion code of 00 indicates that no error was encountered during execution.

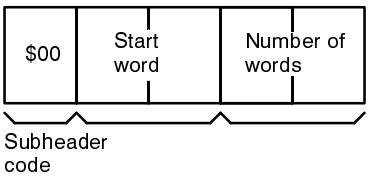
Error Code X161 (Hexadecimal)	Error Code X161 (Hexadecimal)	Error Contents
0	0	Normal completion
0	1	Not executable in RUN mode
0	2	Not executable in MONITOR mode
0	3	Not executable in PROGRAM mode
0	4	Not executable in DEBUG mode
0	5	Not executable in STANDBY mode
0	6	Not executable because SYSMAC NET Link Module is busy
0	7	Not executable with present I/O register
0	9	Not executable because of changed CPU
0	A	Not executable because of “protect”
0	B	File memory not initialized (not executable)
1	0	Format error (parameter length error)
1	1	Parameter error, data code error, data length error, code error, etc.
1	2	Instruction not found
1	3	Address overflow
1	4	Block number error
2	0	Not executable (unexecutable error clear or unexecutable DM size change)
2	1	Not executable by CPU error
2	2	Not executable because there is no memory mounted
2	3	Not executable with only 8K bytes of memory
2	4	Not executable with PROM
2	5	I/O table generation impossible (unrecognized Remote I/O Module, word over, duplication of Optical Transmitting I/O Module, I/O bus error)
2	6	Not a Control Module (not executable)
2	7	Sum check error
2	8	EEPROM is write-protected
2	9	Not executable because there is no networks path setting
3	A	Not executable because of a routing table error
3	0	Data link table generation is impossible (data link operation, default table)
3	1	Not executable because of data link start-up
3	2	Not executable because the data link is not operating
3	3	Not executable because of a data link setting table error
3	4	Not executable because the data link setting table has not been registered
3	5	Not a Master (not executable)

JIS (Japan Industrial Standard) 8 code differs slightly from the binary code used in countries outside Japan. The JIS 8 format uses a 2-byte subheader and a 1,998-byte maximum command/response area. Coding which requires four bits in binary requires eight JIS 8 bits.

Example of IR Area Read

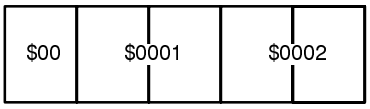
An IR Area Read command is used to read the contents of the specified IR words. Note, values are in hexadecimal. The command format is as follows:

Command Format



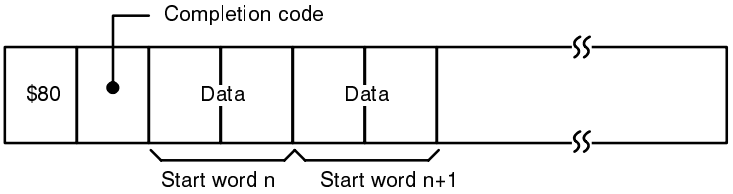
To read the contents of word 1 and 2 of the IR area, the binary command is as follows:

Binary Code



The response format is shown in the next diagram.

Response Format



3-2 PLC Send/Receive Commands

Any node can send or receive data from any other node of the network at any time using the SEND or RECV commands.

Item	Specification
Direction of Transmission	1:1 Data send/receive 1:n Data send only (no response) (Broadcasting data transfer, n: max. 126)
Data length	C-series PLCs: 1000 words max. CVM1/CV-series PLCs: 990 words max. Only in the same area
Send/receive data to/from PLC	The command/response format data for data transmission or that for data receive are sent/received if SEND or RECV has been executed by the program command
Send/receive data to/from Module other than PLC	Command/response By data send or data receive
Watchdog timer response	1 second (default value) or Watchdog Timer Setting Value (10 minutes 55.35 seconds max.)

Send/Receive Data Area

Area	PLC				
	C200H	C200HS	C500	C1000H	C2000H
IR	000~252 (253~255*)	000~511 (See note 3.)	00~60 (61~63*)	000~252 (253~255*)	000~252 (251~256*)
LR	00~63	00~63	00~31	00~63	00~63
HR	00~99	00~99	00~31	00~99	00~99
TIM/CNT	000~511	000~511	000~127	000~511	000~511
DM	0000~1999 (See note 1.)	0000~6655	000~511	0000~4095	0000~6655
AR	00~27	00~27	-	00~27	00~27

*These addresses are read-only.

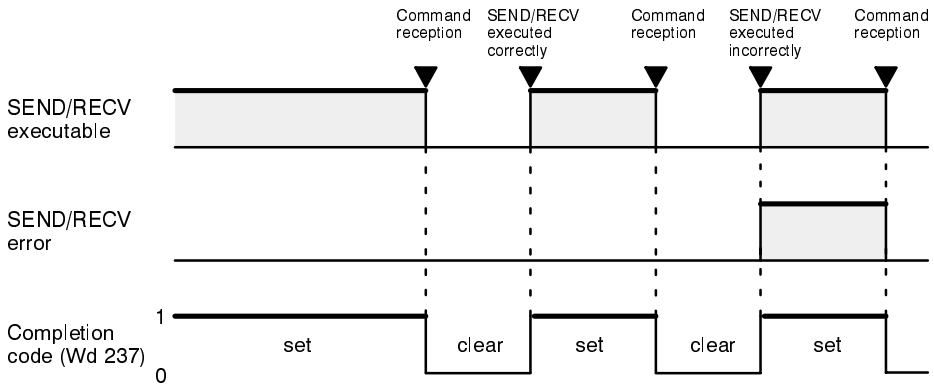
Notes 1. RECV cannot be executed to DM 1000 through 1999 of the C200H.

2. The base unit in the above table are words or Wd.

3. Nothing can be written to word 253, 254, or 255 of the C200HS.

When SYSMAC NET SEND/RECV command is invoked, the data transfer/data reception command/response is executed. The SEND/RECV is complete after the response is received.

Name	C200H/C200HS		C500	C1000/C2000H		Function
SEND/RECV executable	loop 0	25201	6004	loop 0	25204	The flag is 0 when SEND/RECV is in progress (command/response execution is also included). The flag is 1 while SEND/RECV is not in progress. Therefore, the SEND/RECV command is executable when the flag is 1.
	loop 1	25204		loop 1		
SEND/RECV error	loop 0	25200	6003	loop 0	25203	The flag is 0 when SEND/RECV is executed correctly, and 1 when SEND/RECV is executed incorrectly (after response is complete). This status is maintained until the next SEND/RECV command is executed. Though the flag is set to 1 because of incorrect execution, the next execution of SEND/RECV sets the flag to 0. Possible errors include: SEND/RECV time out error (command/response execution takes more than 1 second, or more than set value of monitoring timer); SEND/RECV data error; and routing data error.
	loop 1	25203		loop 1		



The following should be noted when several SEND/RECV commands are executed:

C200H/C200HS

For either loop 0 or 1, one SEND/RECV command is valid for one execution. Exclusive control should be exerted by the SR as described above when several SEND/RECV commands are used in the same loop.

C500

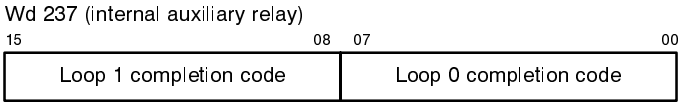
For both loops, one SEND/RECV command is valid for one execution. Exclusive control should be exerted by the SR as described above when several SEND/RECV commands are used for both loops.

C1000H/C2000H

One SEND/RECV command is valid for one execution. Exclusive control should be executed by the SR as described above when several SEND/RECV commands are used.

SEND/RECV command execution status (C200H/C200HS only)

The result of an executed SEND/RECV command is sent to the appropriate area of the PLC and the relevant completion code is sent to Wd 237. A list of the completion codes is shown in the following table.



Completion code	Details and solution	
$00	Executed correctly	
$01	Parameter error	The wrong kind and range of word numbers were set when the sender's communication start word is specified indirectly. Check the command parameter
$02	Routing error	Check the routing table
$03	Destination busy	The routing table has no destination network address. Re-transfer after a certain interval
$04	Transfer error (token loss)...Check the LIne Server	
$05	Loop error	Check the cable
$06	No response	Destination node doesn't exist. Set longer response monitoring time.
$07	Response error	Occurred when the RECV instruction was executed. The number of request transmission words and the number of reception words did not coincide. Response format incorrect

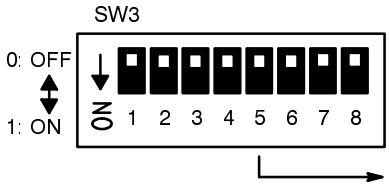
3-3 Watchdog Timer Setting for Response

Watchdog Timer Response Time

The watchdog timer has a default setting of 1 second, but can be set to any value from 0 to 1,966,050 ms in multiples of 30 ms. To set the watchdog timer, adjust the relevant DIP switch for the given SYSMAC NET Link Module. The OFF position of the DIP switch indicates the default setting of 1-second for the response time.

SYSMAC NET Link Module	Switch
C500-SNT31-V4	SW3 pin 5
C200HS-SNT32	SW3 pin 4

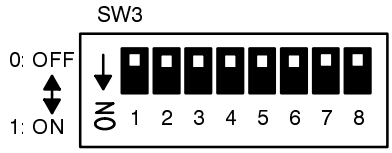
C500-SNT31-V4



SEND/RECV Watchdog Timer Setting Switch

S5	Function
0	When using the default value (1 s)
1	When set by the Watchdog Timer

C200HS-SNT32



SEND/RECV Watchdog Timer Setting Switch

S4	Function
0	When using the default value (1 s)
1	When set by the Watchdog Timer

The timer can be set by using either the programming console of the PLC or by sending application commands from another node to the Module.

Setting the Watchdog Timer with a PLC

To set the Watchdog Timer in the HR area of the PLC with the Programming Console, first turn the power to the PLC OFF. Set pin 5 of DIP switch SW3 for the C500-SNT31-V4 (SW3 pin 4 for the C200HS-SNT32) to the ON position. Turn the Power to the unit ON again and complete the process by setting the timer in the HR area of the PLC. This may be accomplished by either setting the SYSMAC NET reset flag of the AR area to ON or by pressing the RESET button on the SYSMAC NET Link Module.

Note Setting the Watchdog Timer to the HR word does not by itself validate the setting. The approapriate DIP switch must be adjusted to ensure the correct operation of the timer.

Setting the Watchdog Timer with Application Commands from Other Nodes

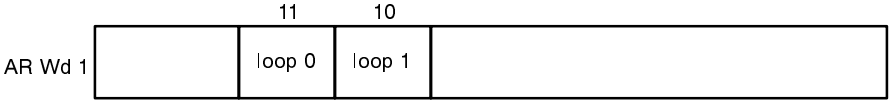
Set the watchdog timer with the HR write command. Then send the initialization command and turn the SYSMAC NET reset flag ON by pressing the SYSMAC NET Link Module's RESET button.

Notes 1. The HR write command alone does not validate the setting.

2. The watchdog timer setting requires 2 bytes in the HR area.

When SW3 pin 2 (SW3 pin 3 for the C200HS-SNT32) is ON (i.e. the routing table is running), the HR word is determined by the set number of the routing table. For example, when the set number is 2, the HR word is word 3 in loop 1 and word 25 in loop 0. When SW3 pin 2 is OFF, the HR word is word 0 in loop 1 and word 22 in loop 0. The last word number of the routing table plus 1 is the relevant word for the watchdog timer.

SYSMAC NET Reset Flag (C200H/C200HS only)



The SYSMAC NET Reset Flag is assigned to AR Word 1 of the AR area.

Usage

Execute SEND/RECV to start the command transmission from the PLC with the program.

Programming Precautions

Take the following precautions when writing ladder programs that use SEND(90) and RECV(98) instructions.

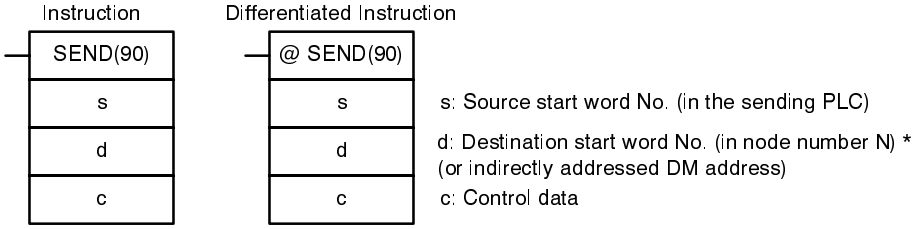
1. Always make sure that the SEND(90)/RECV(98) Enable Flag (SR 25204) is ON before executing one of these instructions.
2. Prepare an transmission retry subroutine that uses the SEND(90)/RECV(98) Error Flag (SR 25203) to recognize when an error has occurred during execution of a SEND(90)/RECV(98) instruction, retries the transmission, and indicates that an error has occurred (with an indicator, etc.).
3. The timing of changes to the SEND(90)/RECV(98) Error Flag (SR 25203) and Enable Flag (SR 25204) depends on the PLC and settings. Be sure that the program takes the timing of the flags into account.
4. The communications load is limited. Group data together as much as possible and transmit it at one time.
5. Only one SEND(90)/RECV(98) instruction can be processed at a time, so design applications carefully when communications are performed with high-speed timing.

3-3-1 SEND(90)

SEND sends data to a device linked by the SYSMAC NET.

The SEND command is transmitted from data area 0 if the number of words n = 0 have been specified.

When the node number is set to 0, data is sent to all nodes within the specified network (both PLCs and personal computers).



* When the destination node is a NSB or a NSU, the setting is ignored.

Control Data

	15 through 8	7 through 0
Wd c	Number of words $0000 ~$03E8 (0 ~ 1000)	
Wd c+1	0 | *1 | 0 | *2 | 0	Network Number $00 ~ $7F (0 ~ 127)
Wd c+2	Destination port No. PLC=0, NSB=0, NSU=01 or 02	Destination node number $00 ~ $7E (0 ~ 126)

Notes *1. SYSMAC NET loop

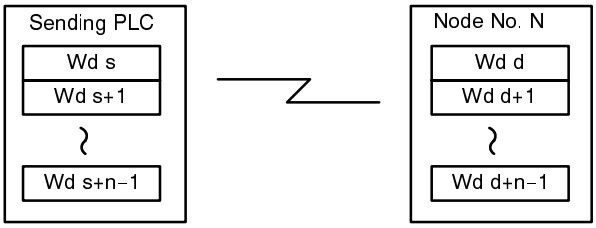
*2. Indirect addressing control bit for the destination beginning word. Turn ON to specify indirect addressing.

Set Value

Number of words to be transmitted	$0000 ~ $03E8 (0 ~ 1000)
Network number	$00 ~ $7F (0~126) Sends data to the relevant node within its network if the network number is $00 Set to $00 if there is no transmitting function between the networks *
Destination port number	PLC = 0, NSB = 00, NSU = 01, or 02
Destination node number	$00 ~ $7E (0 ~ 126)

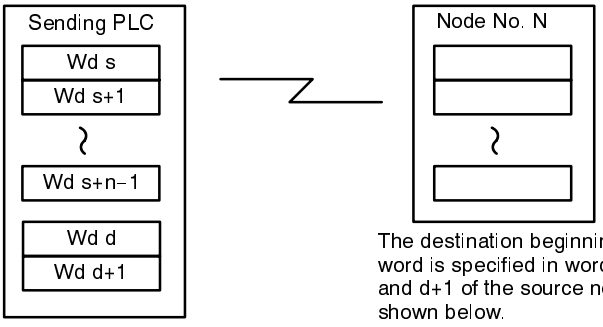
*Set the following to OFF: SW3 pin 2 (C500-SNT31-V4); SW3 pin 3 (C200HS-SNT32).

The SYSMAC NET loop corresponds to the loop switch of the relevant SYSMAC NET Link Module. When the loop switch is ON (loop #0), the SYSMAC NET loop is 1. When the loop switch is OFF (loop #1) the SYSMAC NET loop is 0.



If the SEND is set with the number of word to be sent n = 0, SEND is transferred with no data area. If the destination node number is set to “0,” the data is transferred to all nodes (PLCs, Personal computers etc.) in the destination network.

When the indirect addressing control bit (bit 12 of c+1) is ON in a C200H/C200HS PLC with a C200HS-SNT32 installed, the destination beginning word must be specified in words d and d+1 of the local node. The diagram below shows the format for specifying the destination beginning word. The indirect addressing control bit cannot be used in most cases – only with C200H/C200HS PLCs containing a C200HS-SNT32.



The destination beginning word is specified in words d and d+1 of the source node, as shown below.

Set the destination beginning word address in d and d+1 of the source node.

	15 through 8	7 through 4	3 through 0	
Wd d	Data area specifier	0	Word no.	Left-most digit
Wd d + 1	Word no.			Right-most 4 digits

(Set the word address in BCD.)

C-series Data Areas

Data area	Area specifier	Word addresses
IR Area	00	0 to 511
LR Area	06	0 to 63
HR Area	07	0 to 99
AR Area	08	0 to 27
TC Area	03	0 to 511
DM Area	05	0 to 9999

CV-series Data Areas

Settings			Corresponding CV-series data area	
Data area	Area specifier	Word addresses	Data area	Word addresses
I/O Area, Work Area, and SYSMAC BUS/2 Area	00	0 to 999	CIO Area	0 to 999
Link Area	06	0 to 63		1000 to 1063
Holding Area	07	0 to 99		1064 to 1163
Supplemental Area	08	0 to 27		1164 to 1191
Timer PVs	03	0 to 1023	Timer Present Values	0 to 1023 (0 to 511)
DM	05	0 to 24575	Data Memory	0 to 24575 (0 to 8191)

Note The word addresses in parentheses indicate CV500 ranges. Counter present values, the CPU Bus Link Area, Auxiliary Area, and Extended Data Memory (EM) Area are not supported.

Allowable Settings for S, D, and C in SEND(90)

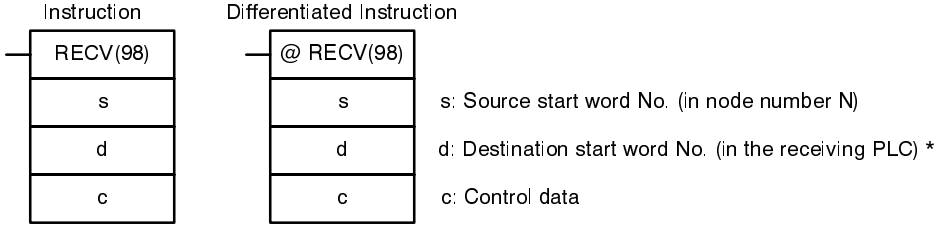
Data area		S	D	C
IR area, SR area	C200H	000 to 255	000 to 235 (234)	000 to 233
	C200HS	000 to 255 256 to 511 (see note 2)	000 to 511 (0 to 234, 300 to 510)	000 to 233 300 to 509
	C1000H/C2000H	000 to 255	000 to 236	000 to 234
	C500	00 to 63	00 to 57	00 to 55
HR area	Other than C500	HR 00 to 99	HR 00 to 99 (98)	HR 00 to 97
	C500	HR 00 to 31	HR 00 to 31	HR 00 to 29
AR Area	Other than C500	AR 00 to 27	AR 00 to 27 (26)	AR 00 to 25
LR area	Other than C500	LR 00 to 63	LR 00 to 63 (62)	LR 00 to 61
	C500	LR 00 to 31	LR 00 to 31	LR 00 to 29
TC area	Other than C500	TC 000 to 511	TC 000 to 511 (510)	TC 000 to 509
	C500	TC 000 to 127	TC 000 to 127	TC 000 to 125
DM area	C200H	DM 0000 to 1999	DM 0000 to 0999 (0998)	DM 0000 to 1997
	C200HS/C2000H	DM 0000 to 6655	DM 0000 to 6655 (6654)	DM 0000 to 6653
	C1000H	DM 0000 to 4095	DM 0000 to 4095	DM 0000 to 4093
	C500	DM 000 to 511	DM 000 to 511	DM 000 to 509
*DM addressing	C200H	*DM 0000 to 1999		
	C200HS	*DM 0000 to 6599		
	C2000H	*DM 0000 to 6655		
	C1000H	*DM 0000 to 4095		
	C500	*DM 000 to 511		

Notes 1. The word addresses in parentheses indicate allowable settings when using indirect addressing in C200H/C200HS PLCs.

2. The source data must not overlap the IR and SR Areas in C200H/C200HS PLCs.

3-3-2 RECV(98)

RECV receives data from a device linked through a SYSMAC NET.



* When the source node is a NSB or a NSU, the setting is ignored.

Control Data

	15 through 8	7 through 0
Wd c	Number of words $0000 ~$03E8 (0 ~ 1000)	
Wd c+1	0 | *1 | 0 | *2 | 0	Network Number $00 ~ $7F (0 ~ 127)
Wd c+2	Source port No. PLC=0, NSB=0, NSU=01 or 02	Source node number $00 ~ $7E (0 ~ 126)

Notes *1. SYSMAC NET loop

*2. Indirect addressing control bit for the destination beginning word. Turn ON to specify indirect addressing.

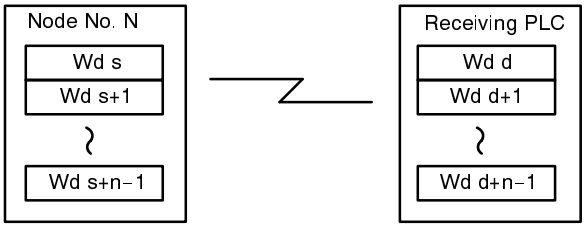
Set Value

Number of words to be transmitted	$0000 ~ $03E8 (0 ~ 1000)
Network number	$00 ~ $7F (0~126) Sends data to the relevant node within its network if the network number is $00 Set to $00 if there is no transmitting function between the networks *
Source port number	PLC = 0, NSB = 00, NSU = 01, or 02
Source node number	$00 ~ $7E (0 ~ 126)

*Set the following to OFF: SW3 pin 2 (C500-SNT31-V4); SW3 pin 3 (C200HS-SNT32).

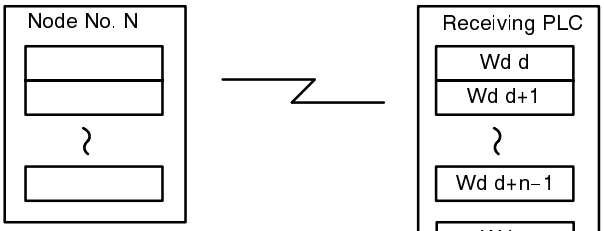
The SYSMAC NET loop corresponds to the loop switch of the relevant SYSMAC NET Link Module. When the loop switch is ON (loop #0), the SYSMAC NET loop is 1. When the loop switch is OFF (loop #1), the SYSMAC NET loop is 0.

The specified number of words of data sent from node N, beginning with the source word s, are written to the requesting PLC's destination words beginning at d.



Note An error will occur if the Destination Node Number is set to 00.

When the indirect addressing control bit (bit 12 of c+1) is ON in a C200H/C200HS PLC with a C200HS-SNT32 installed, the source beginning word must be specified in words s and s+1 of the local node. The diagram below shows the format for specifying the source beginning word. The indirect addressing control bit cannot be used in most cases – only with C200H/C200HS PLCs containing a C200HS-SNT32.



The destination beginning word is specified in words s and s+1 of the source node, as shown below.

Set the destination beginning word address in s and s+1 of the destination node.

	15 through 8	7 through 4	3 through 0	
Wd s	Data area specifier	0	Word no.	Left-most digit
Wd s + 1	Word no.			Right-most 4 digits

(Set the word address in BCD.)

C-series Data Areas

Data area	Area specifier	Word addresses
IR Area	00	0 to 511
LR Area	06	0 to 63
HR Area	07	0 to 99
AR Area	08	0 to 27
TC Area	03	0 to 511
DM Area	05	0 to 9999

CV-series Data Areas

Settings			Corresponding CV-series data area	
Data area	Area specifier	Word addresses	Data area	Word addresses
I/O Area, Work Area, and SYSMAC BUS/2 Area	00	0 to 999	CIO Area	0 to 999
Link Area	06	0 to 63		1000 to 1063
Holding Area	07	0 to 99		1064 to 1163
Supplemental Area	08	0 to 27		1164 to 1191
Timer PVs	03	0 to 1023	Timer Present Values	0 to 1023 (0 to 511)
DM	05	0 to 24575	Data Memory	0 to 24575 (0 to 8191)

Note The word addresses in parentheses indicate CV500 ranges. Counter present values, the CPU Bus Link Area, Auxiliary Area, and Extended Data Memory (EM) Area are not supported.

Allowable Settings for S, D, and C in RECV(98)

Data area		S	D	C
IR area, SR area	C200H	000 to 255 (234)	000 to 235	000 to 233
	C200HS	000 to 511 0 to 234, 300 to 510	000 to 235 300 to 511 (see note 2)	000 to 233 300 to 509
	C1000H/C2000H	000 to 255	000 to 236	000 to 234
	C500	00 to 63	00 to 57	00 to 55
HR area	Other than C500	HR 00 to 99 (98)	HR 00 to 99	HR 00 to 97
	C500	HR 00 to 31	HR 00 to 31	HR 00 to 29
AR Area	Other than C500	AR 00 to 27 (26)	AR 00 to 27	AR 00 to 25
LR area	Other than C500	LR 00 to 63 (62)	LR 00 to 63	LR 00 to 61
	C500	LR 00 to 31	LR 00 to 31	LR 00 to 29
TC area	Other than C500	TC 000 to 511 (510)	TC 000 to 511	TC 000 to 509
	C500	TC 000 to 127	TC 000 to 127	TC 000 to 125
DM area	C200H	DM 0000 to 1999 (DM 0000 to 0998, DM 1000 to 1998)	DM 0000 to 0999	DM 0000 to 1997
	C200HS	DM 0000 to 6655 (6654)	DM 0000 to 5999	DM 0000 to 6653
	C2000H	DM 0000 to 6655 (6654)	DM 0000 to 6655	DM 0000 to 6653
	C1000H	DM 0000 to 4095	DM 0000 to 4095	DM 0000 to 4093
	C500	DM 000 to 511	DM 000 to 511	DM 000 to 509
*DM addressing	C200H	*DM 0000 to 1999		
	C200HS	*DM 0000 to 6599		
	C2000H	*DM 0000 to 6655		
	C1000H	*DM 0000 to 4095		
	C500	*DM 000 to 511		

Notes 1. The word addresses in parentheses indicate allowable settings when using indirect addressing in C200H/C200HS PLCs.

2. The destination data must not overlap the IR and SR Areas in C200H/C200HS PLCs.

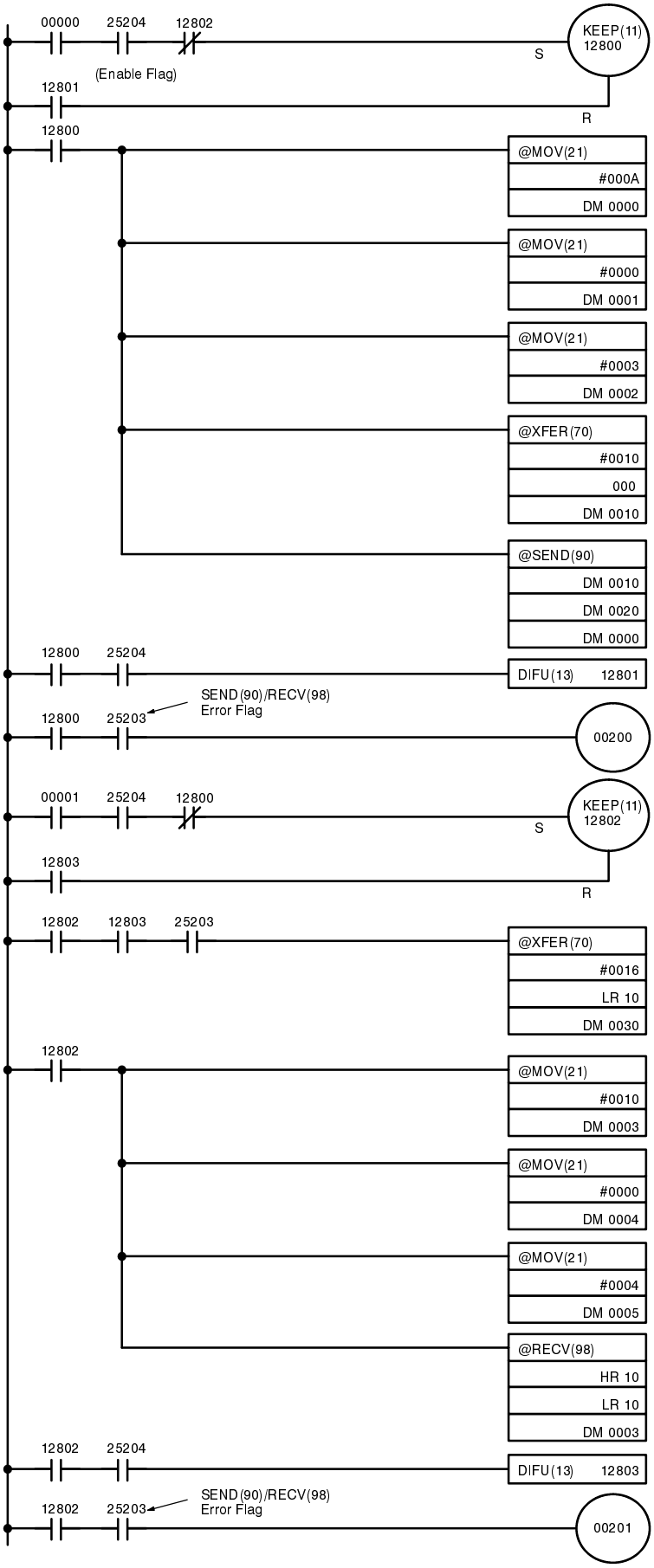
3-4 Program Example (C200H/C200HS/C500/C1000H/C2000H)

A SYSMAC NET Link Module can send the same data to all nodes of the network simultaneously by transmitting to node address 00. This is converted to the code used by the rest of the SYSMAC NET Modules in hexadecimal format for broadcasting, FF. No response will be returned when this broadcast is executed.

Data from a PLC is transmitted as described in the following table.

PLC	Data Transmitted	Transmit/Receive Processing
C500 C200H/C200HS	Data is transmitted when END is processed.	Processed with END.
C2000H Duplex	Data is transmitted during SEND/RECV command execution.	
C1000H C2000H Simplex		Processed with Link Service.

When using SEND/RECV more than once, it is necessary to execute a command to confirm the completion of the SEND/RECV. The following program example illustrates this requirement.



Starts the Send Execute Program if the condition (00000) is ON when SEND/RECV is executable or ON.

12800 turns ON from the start of SEND until the completion of SEND.

Transfers 10 words of data, starting from DM 0010 of the requested PLC, to Node No. 3, starting from DM 020.

DM 0000	0	0	0	A	Number of Transmit Words : Word 10
DM 0001	0	0	0	0	Transmission END Node Number: 3
DM 0002	0	0	0	3	

Generates transmit data.

Stores 10 words of data transmitted from word 000 to DM, starting from DM 0010.

Starts the Receive Execute Program if the condition (00001) is ON when SEND/RECV is executable or ON.

Transmits ERROR Indication.

12802 turns ON from the start of RECV until the next execution of SEND/RECV.

Transmitted data moved into words beginning at DM 0030 for storage.

Data moved into control data words to specify the 16 words to be transmitted from node 4 in operating level 0.

DM 003	0 0	1 0	16 words
DM 004	0 0	0 0	
DM 005	0 0	0 4	Node 4 (a PLC)

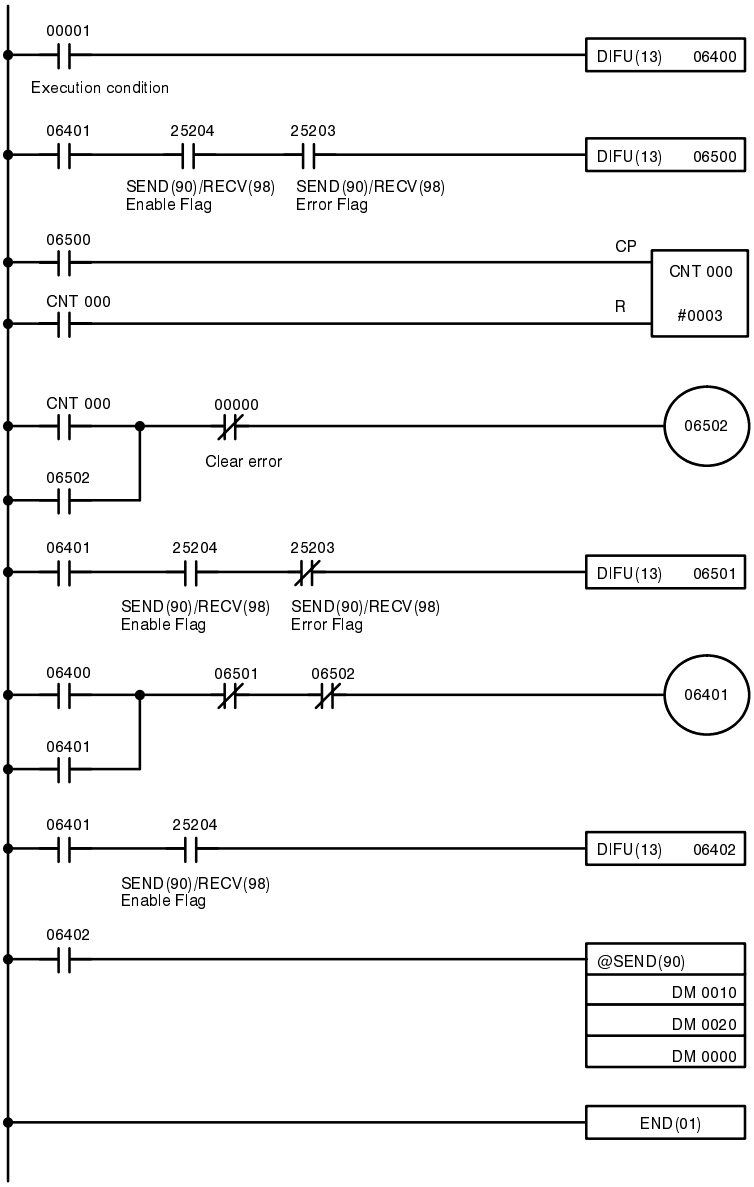
Turns ON to indicate reception error.

Sample Transmission Retry Program

When the execution condition (IR 00001) goes ON, the SEND(90) instruction is either completed normally or stopped if there are errors in 3 attempts.

IR 06501 is turned ON by DIFU(13) if the transmission is completed normally and IR 06502 is turned ON if the transmission is aborted after 3 retries.

The error can be cleared by turning ON bit IR 00000.



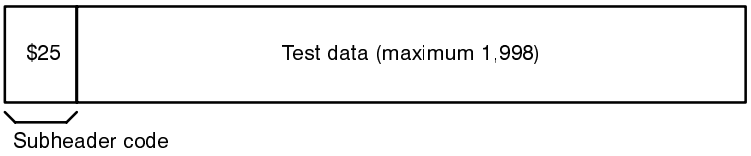
3-5 Command and Response Formats

The remainder of this section lists the command and response formats for the SYSMAC NET Link Module.

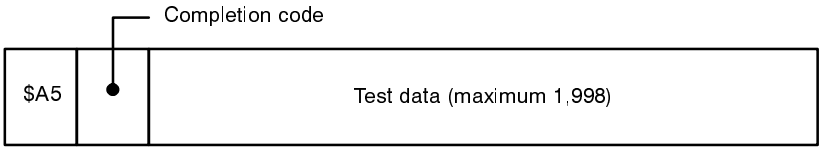
Test

Receives data from another node and returns the same data without alteration.

Command Format



Response Format

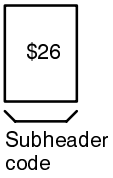


Initialize (Command only)

Initializes the software of the SYSMAC NET Link Module. No response is returned as a result of executing this command.

After this command has been received, a processing time of 100 ms is required before the next command can be received.

Command Format

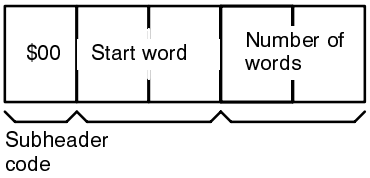


3-5-1 Memory Areas

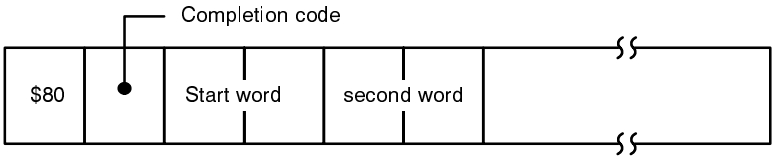
IR Area Read

Reads the contents of the specified number of IR (I/O and internal auxiliary relay) words, starting from the specified word.

Command Format



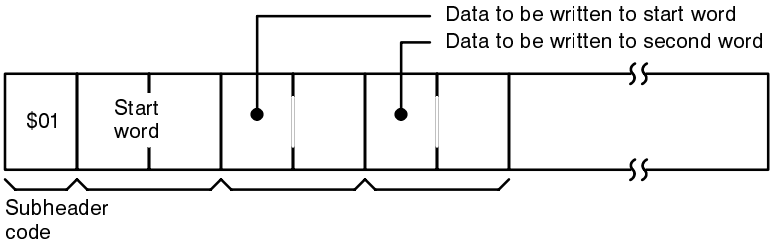
Response Format



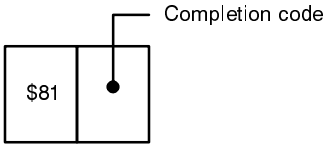
IR Area Write

Writes data to the IR area, starting from the specified word, in word units. No data can be written to the SR area.

Command Format



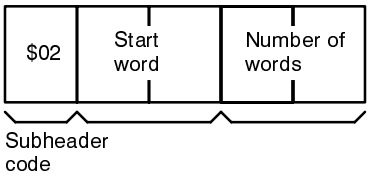
Response Format



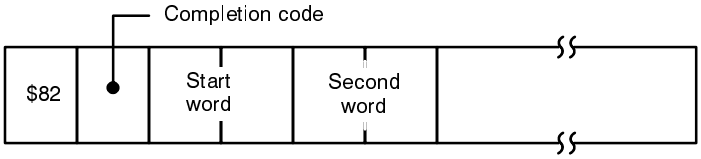
LR Area Read

Reads the contents of the specified number of LR area words, starting from the specified word.

Command Format



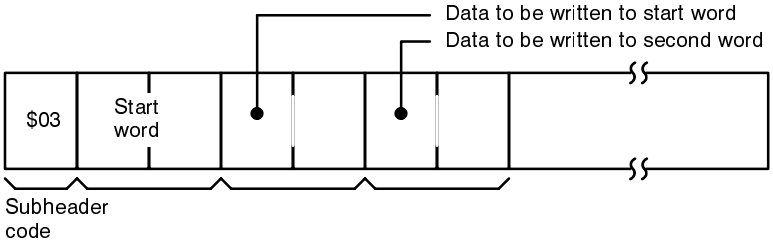
Response Format



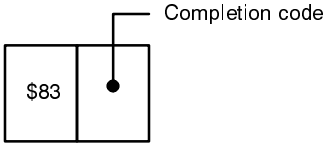
LR Area Write

Writes data to the LR area, starting from the specified word, in word units.

Command Format



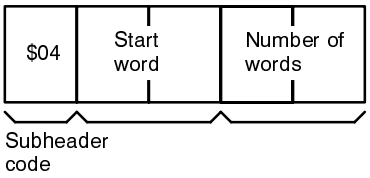
Response Format



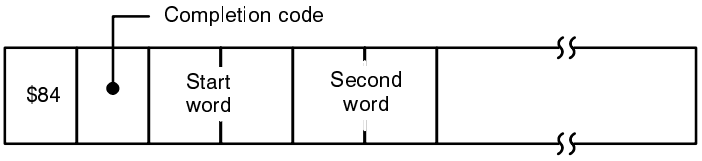
HR Area Read

Reads the contents of the specified number of HR area words, starting from the specified word.

Command Format



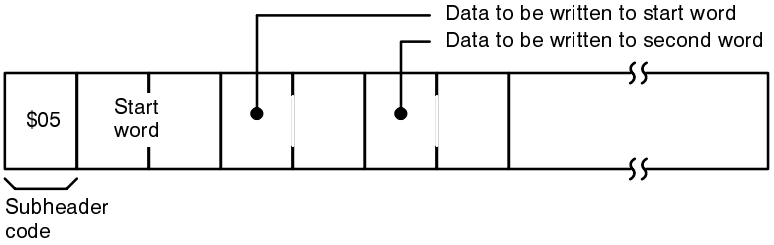
Response Format



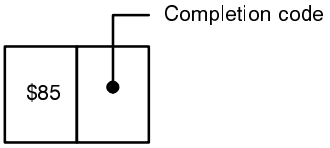
HR Area Write

Writes data to the HR area, starting from the specified word, in word units.

Command Format



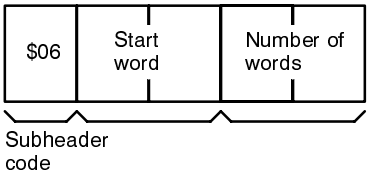
Response Format



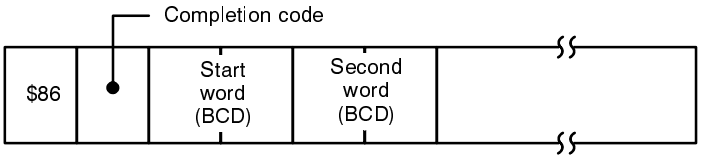
PV Area Read

Reads the specified number of PV area words, starting from the specified word.

Command Format



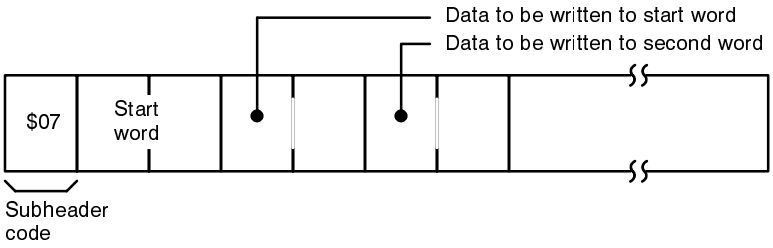
Response Format



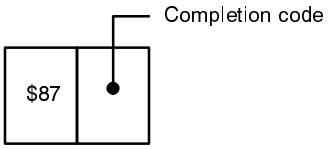
PV Area Write

Writes data to the PV area, starting from the specified word, in word units.

Command Format



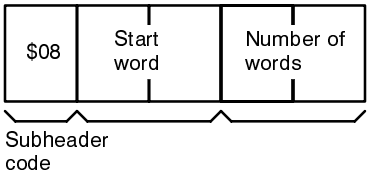
Response Format



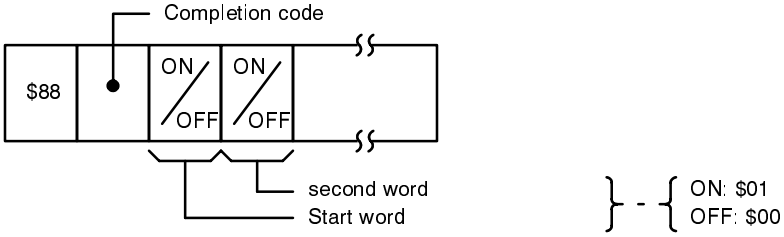
TC Area Read

Reads the contents of the specified number of TC area words, starting from the specified word.

Command Format



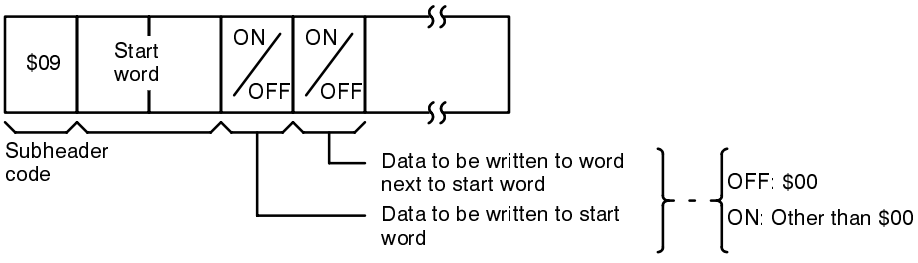
Response Format



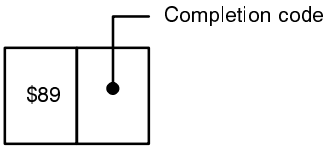
TC Area Write

Writes data to the TC area, starting from the specified word, in word units.

Command Format



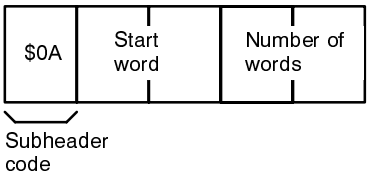
Response Format



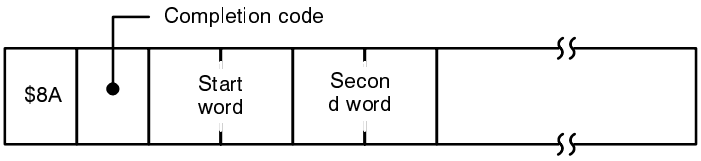
DM Area Read

Reads the contents of the specified number of DM area words, starting from the specified word.

Command Format



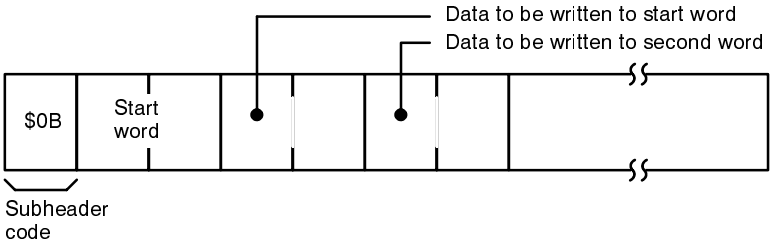
Response Format



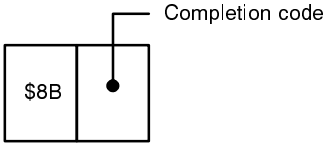
DM Area Write

Writes data to the DM area, starting from the specified word, in word units.

Command Format



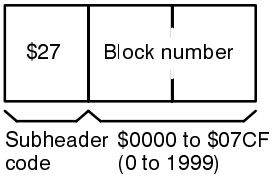
Response Format



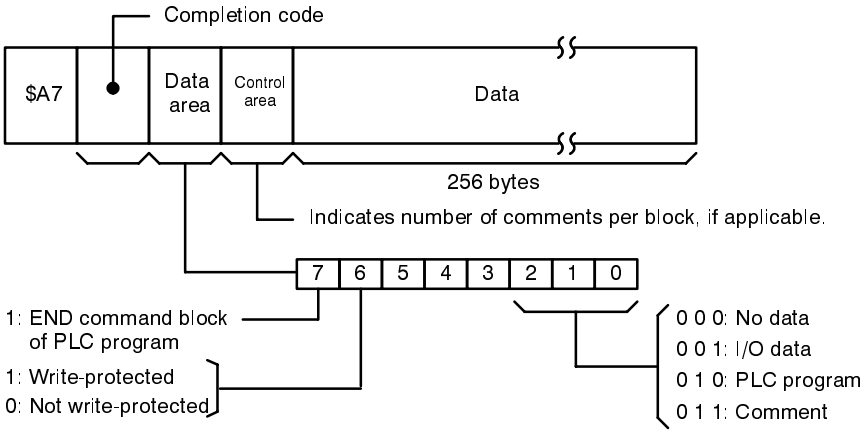
FM Data Read (C1000H/C2000H only)

Reads the contents of the specified number of FM area blocks, starting from the specified block.

Command Format



Response Format

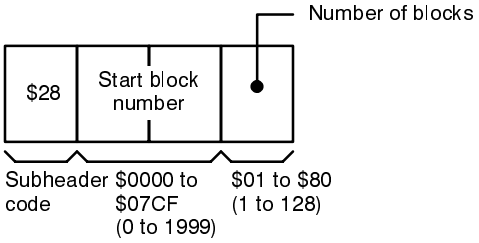


Note This command is valid for the C1000H and C2000H only. The END command block is valid only in the PLC program.

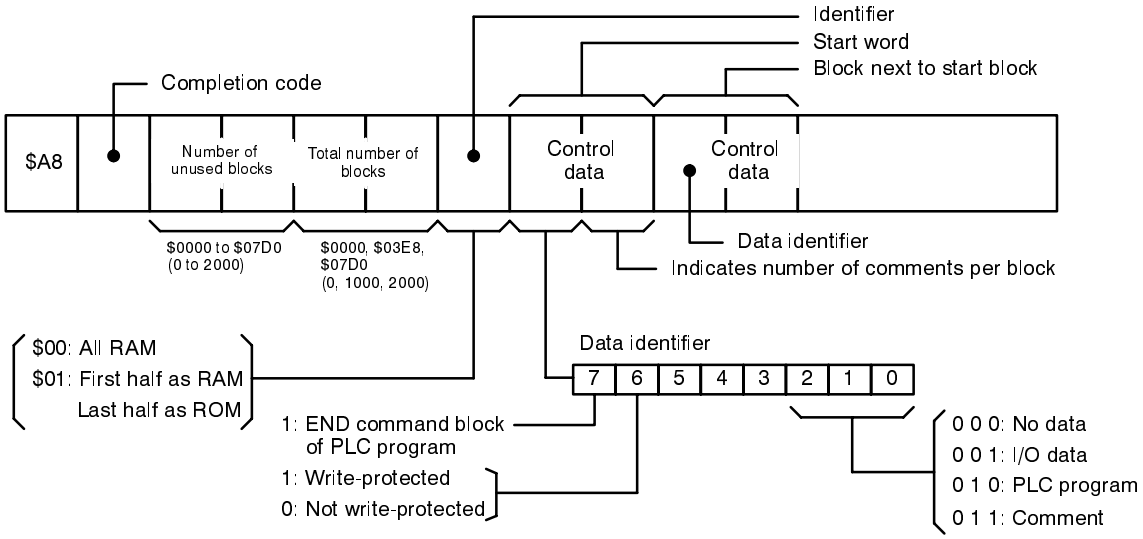
FM Index Read (C1000H/C2000H only)

Reads the contents of the specified number of FM area index blocks, starting from the specified block.

Command Format



Response Format

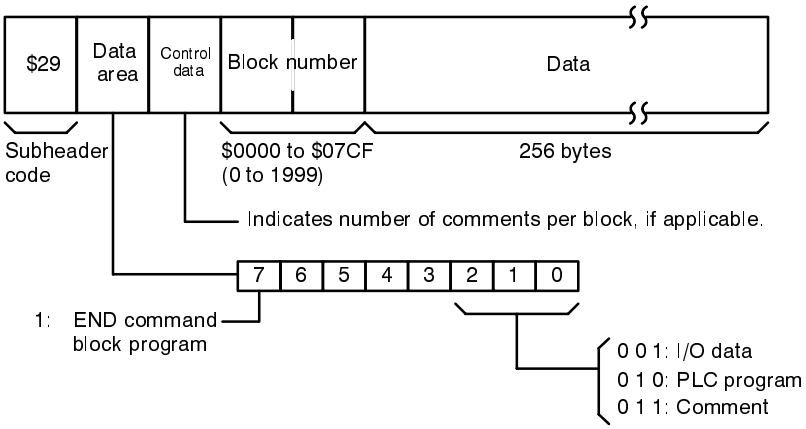


Note This command is only valid for C1000H and C2000H. The END command block is only valid in the PLC program.

FM Area Write (C1000H/C2000H only)

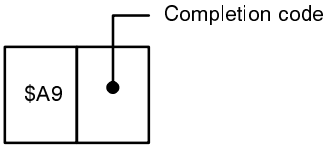
Writes data blocks to the FM area, starting from the specified block, in blocks.

Command Format



Note This command is only valid for C1000H and C2000H. Specify the END block to be 'ON' when the block includes END or when it is a completion block.

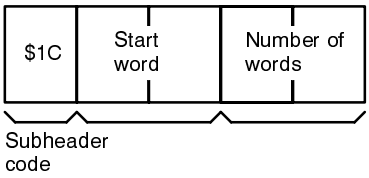
Response Format



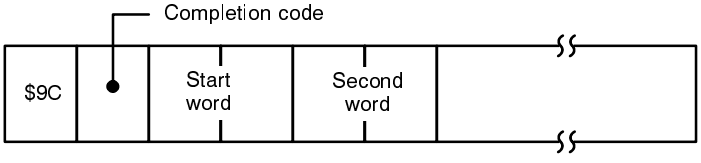
AR Area Read (C200H/C200HS/C1000H/C2000H only)

Reads the contents of the specified number of AR (auxiliary memory realy) words, starting from the specified word.

Command Format



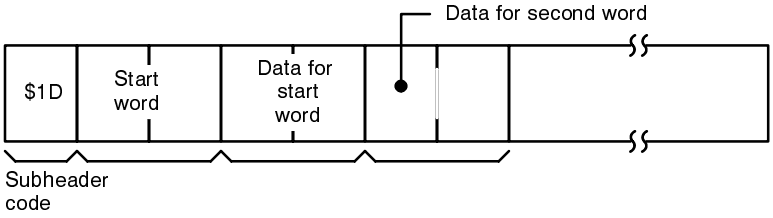
Response Format



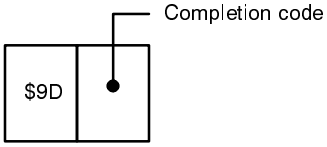
AR Area Write (C200H/C200HS/C1000H/C2000H only)

Writes data to the AR area, starting from the specified word, in words.

Command Format



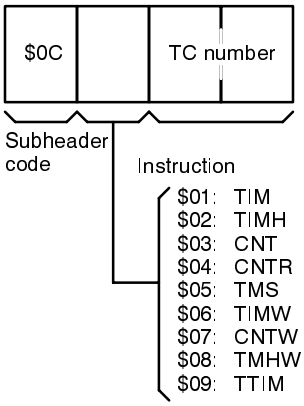
Response Format



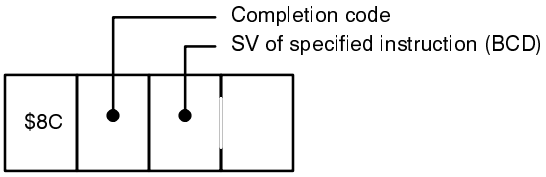
SV Read 1

Reads the set value (constant only) of the specified instruction.

Command Format



Response Format



Note If the instruction is programmed more than once, the value of the first instruction is read.

The following table lists the instructions available for each PLC.

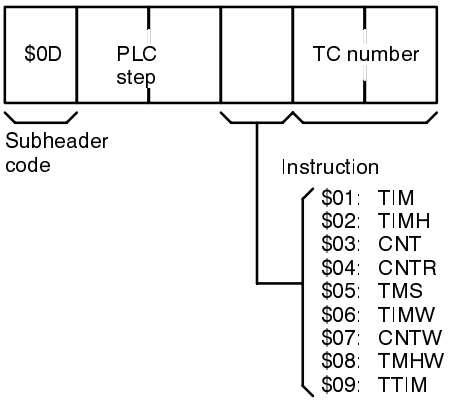
PLC	Instruction code								
	1	2	3	4	5	6	7	8	9
C200H	Y	Y	Y	Y	N	N	N	N	N
C500	Y	Y	Y	Y	N	N	N	N	N
C1000H	Y	Y	Y	Y	N	Y	Y	Y	N
C2000H	Y	Y	Y	Y	N	Y	Y	Y	N
C200HS	Y	Y	Y	Y	N	N	N	N	Y

Y: Possible
N: Impossible

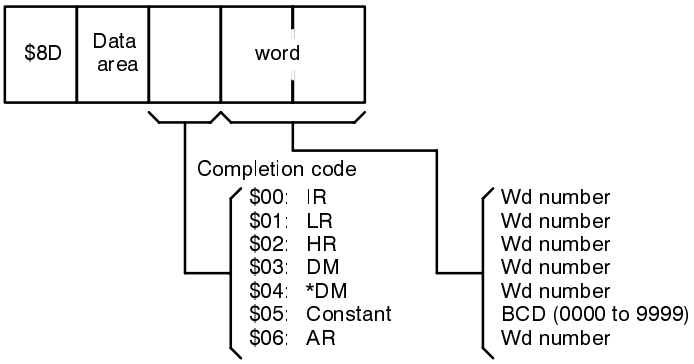
SV Read 2

Reads the set value (constant, or data area and word) of the specified instruction.

Command Format



Response Format



The following table lists the instructions available for each PLC.

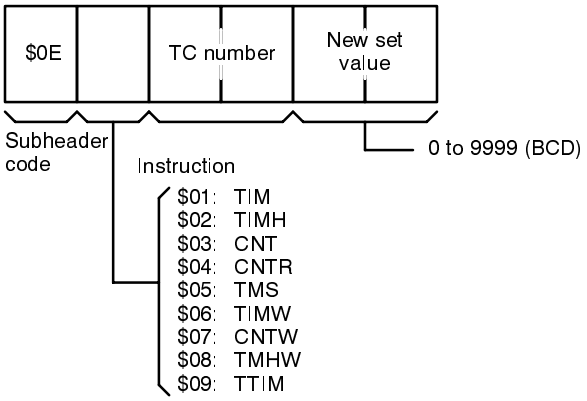
PLC	Instruction code									Area code						
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
C200H	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
C500	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y	N	N	Y	N
C1000H	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
C2000H	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
C200HS	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y

Y: Possible
N: Impossible

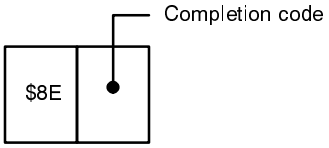
SV Change 1

Changes the set value (constant only) of the specified instruction.

Command Format



Response Format



The following table lists the instructions available for each PLC.

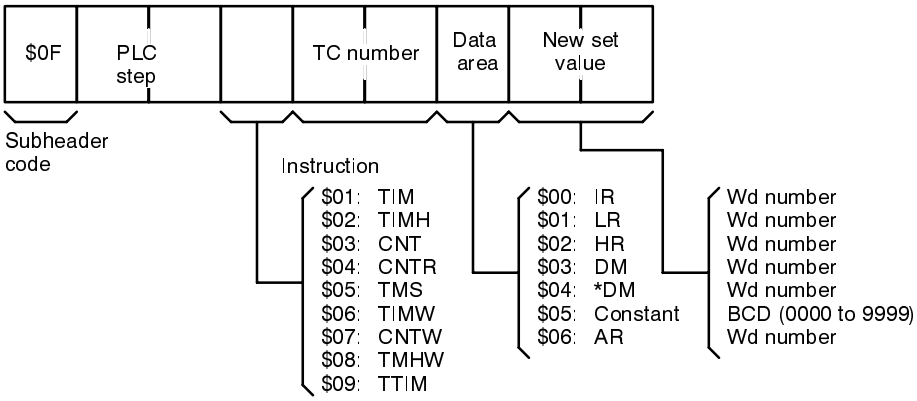
PLC	Instruction code								
	1	2	3	4	5	6	7	8	9
C200H	Y	Y	Y	Y	N	N	N	N	N
C500	Y	Y	Y	Y	N	N	N	N	N
C1000H	Y	Y	Y	Y	N	Y	Y	Y	N
C2000H	Y	Y	Y	Y	N	Y	Y	Y	N
C200HS	Y	Y	Y	Y	N	N	N	N	Y

Y: Possible
N: Impossible

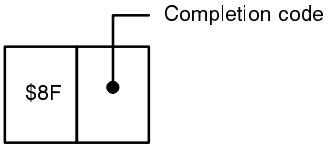
SV Change 2

Changes the set value (constant, or data area and word) of the specified instruction.

Command Format



Response Format



The following table lists the instructions available for each PLC.

PLC	Instruction code									Area code						
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
C200H	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
C500	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y	N	N	Y	N
C1000H	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
C2000H	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
C200HS	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y

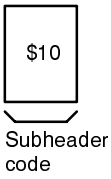
Y: Possible
N: Impossible

3-5-2 Status

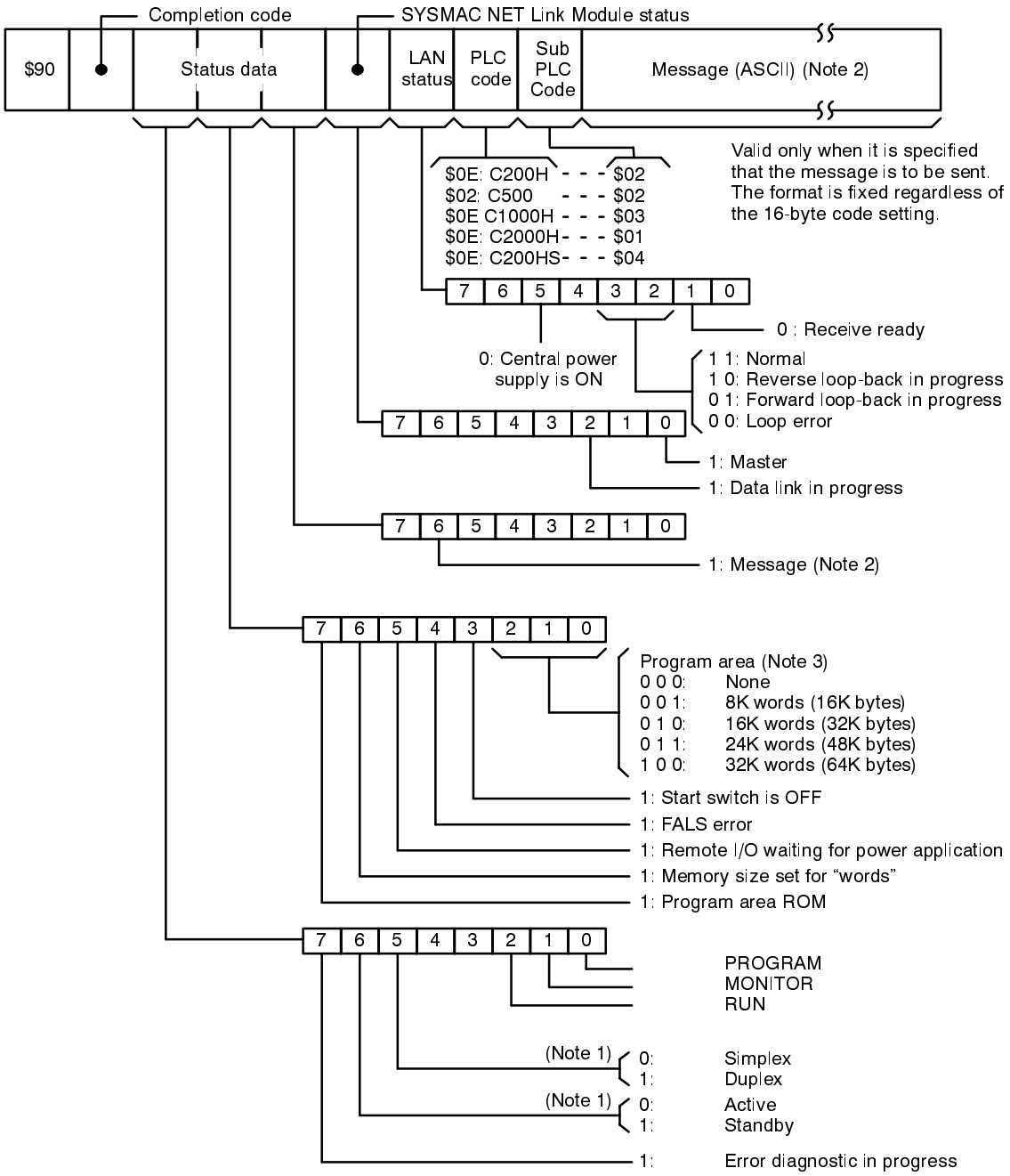
Status Read

Reads the operating status of the PLC.

Command Format



Response Format



Notes 1. Valid for the C2000H only.

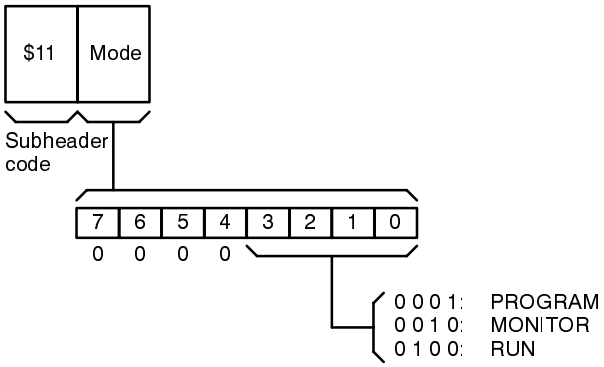
2. Valid for the C200H, C200HS, C1000H and C2000H only.

3. When the memory size is set for "words," the program area is measured in the units of words. The values placed in parentheses are bytes (valid when the memory size is not set for words).

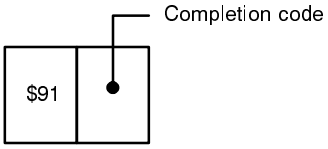
Status Write

Changes the operation mode of the PLC.

Command Format



Response Format

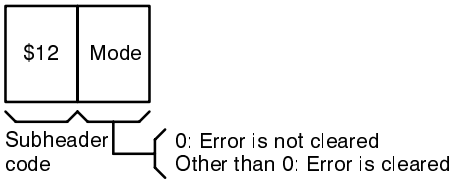


3-5-3 Error

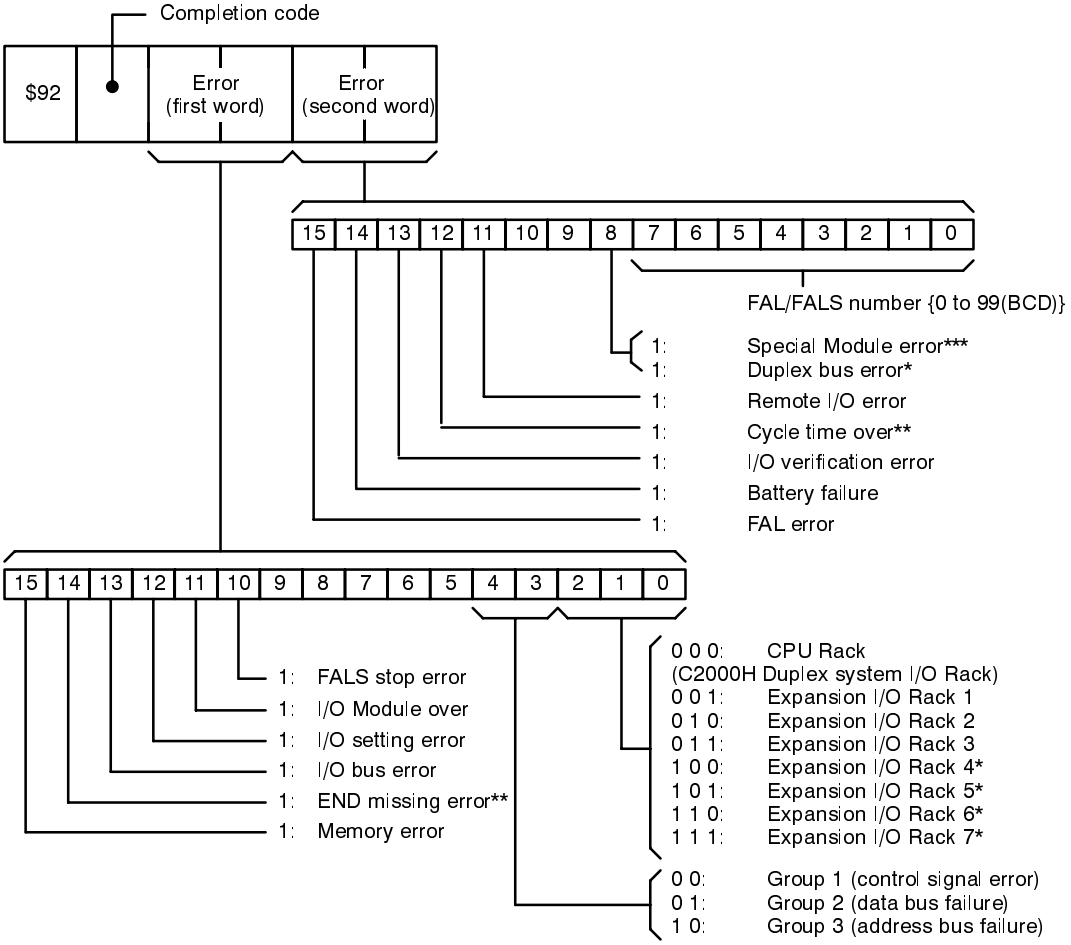
Error Read

Reads and clears (if specified) errors in the PLC.

Command Format



Response Format



*Valid for C1000H and C2000H only.

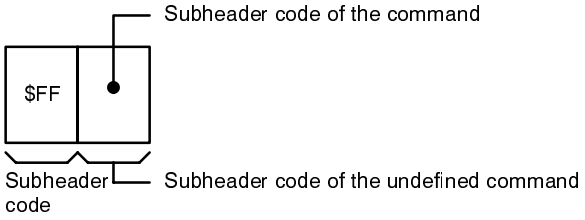
**Valid for the C500, C1000H and C2000H only.

***Valid for the C200H/C200HS only.

Undefined Command Error (Response only)

Indicates that the subheader code could not be decoded.

Response Format

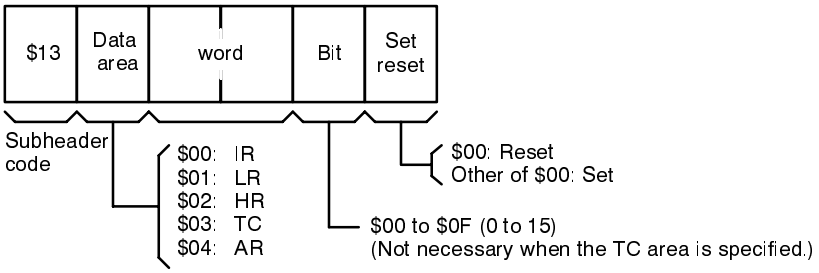


3-5-4 Set/Reset

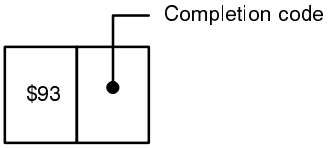
Forced Set/Reset

Force sets/resets an IR, LR, HR, or AR areas, or timer/counter.

Command Format



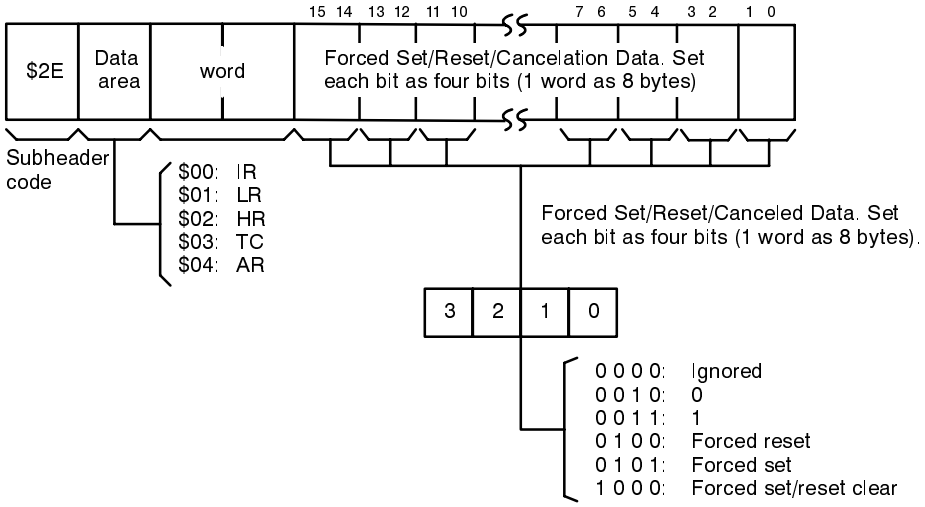
Response Format



Multiple Forced Set/Reset (C200H/C200HS only)

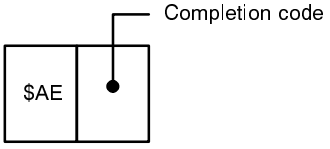
Force sets or force resets an IR, LR, HR, or AR area, or a timer/counter. Multiple Forced Set/Resets can be performed simultaneously to more than one word.

Command Format



Note For the TC data area, only the leftmost 4 bits (15th bit) are valid. Set other data (bits 0 through 14) to 0.

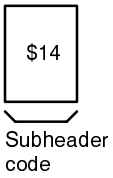
Response Format



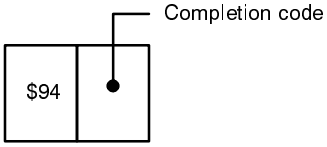
Forced Set/Reset Cancel

Cancels forced set/reset.

Command Format



Response Format



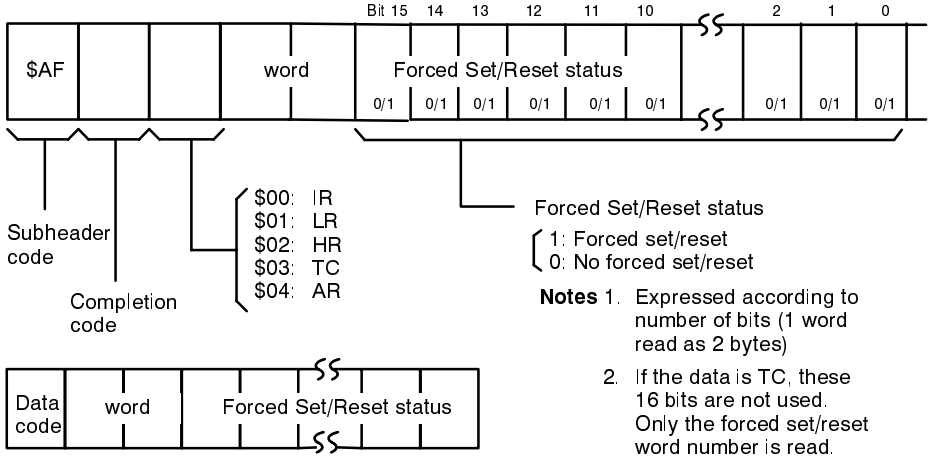
Note The C200H/C200HS releases multi-point forced set/reset.

Multiple Forced Set/Reset Status Read (C200H/C200HS only)

Reads the forced set/reset status of the PLC to which the specified Host Link Module is mounted.

Command Format

Response Format



Notes 1. Expressed according to number of bits (1 word read as 2 bytes)

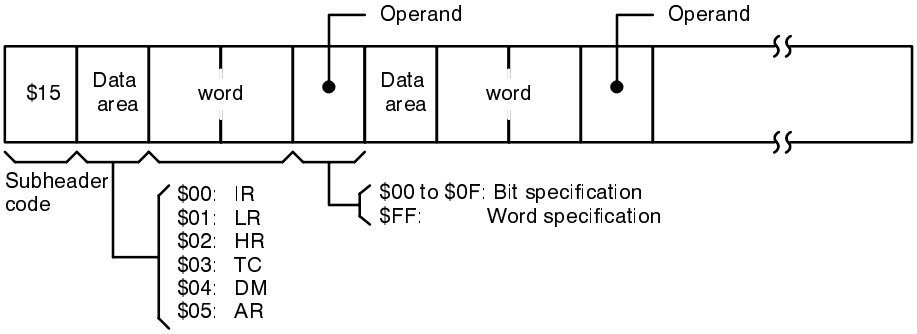
2. If the data is TC, these 16 bits are not used. Only the forced set/reset word number is read.

3-5-5 I/O

I/O Register

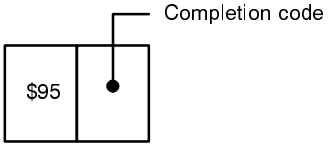
Registers a table of IR, LR, HR, or AR areas, or timer/counters, or DM words to be read by the I/O read command. Registered data is retained until new data is registered or the power is turned OFF.

Command Format



Data area		Operand	Response
Bit	IR	$00 to $0F	ON/OFF
	LR	$00 to $0F	ON/OFF
	HR	$00 to $0F	ON/OFF
	TC	Other than $FF	ON/OFF
	AR	$00 to $0F	ON/OFF
Wd	IR	$FF	word data
	LR	$FF	word data
	HR	$FF	word data
	TC	$FF	ON/OFF + PV (present value)
	DM	Free	word data
	AR	$FF	word data

Response Format



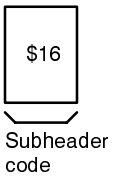
A maximum of six tables can be registered per node. If more than six tables are registered, the oldest table is lost. The data set for one node cannot be read from another node.

Note A maximum of 128 words can be registered per table. The T/C word is counted as 2 words.

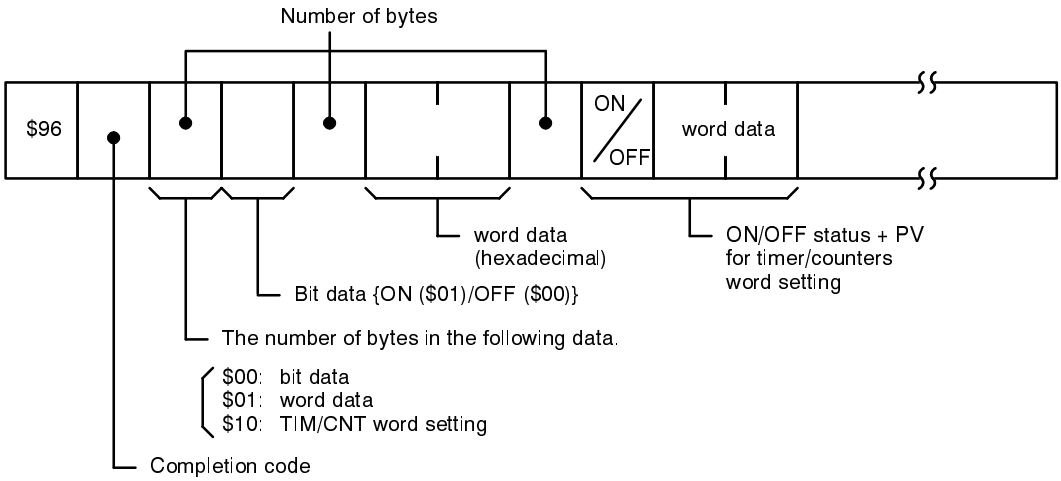
I/O Read

Reads data from a table created by the I/O register command.

Command Format



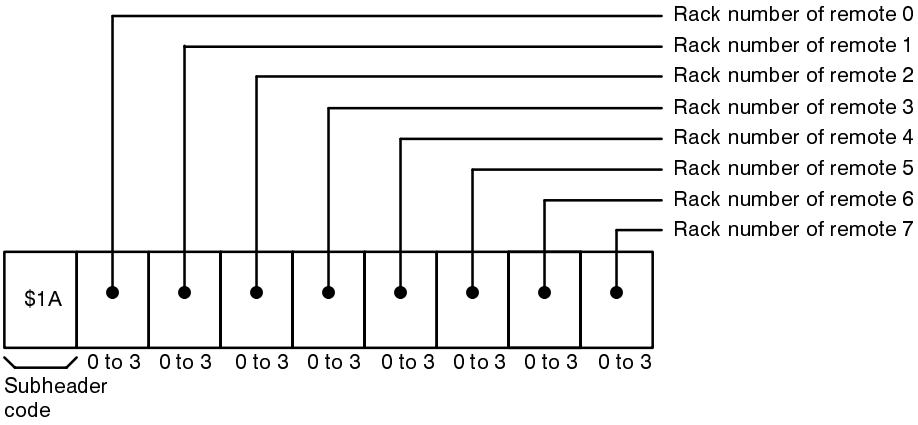
Response Format



I/O Table Generation

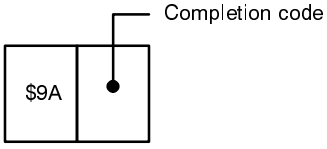
Updates the contents of the registered I/O table with those of the actual I/O table.

Command Format



Any data can be set as the rack number for the C200H/C200HS and C500. Set a number other than 0, 1, 2 or 3 for the C1000H and C2000H when the rack number is not needed.

Response Format

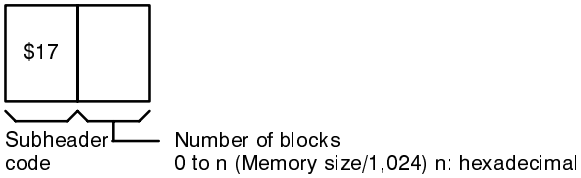


3-5-6 Program

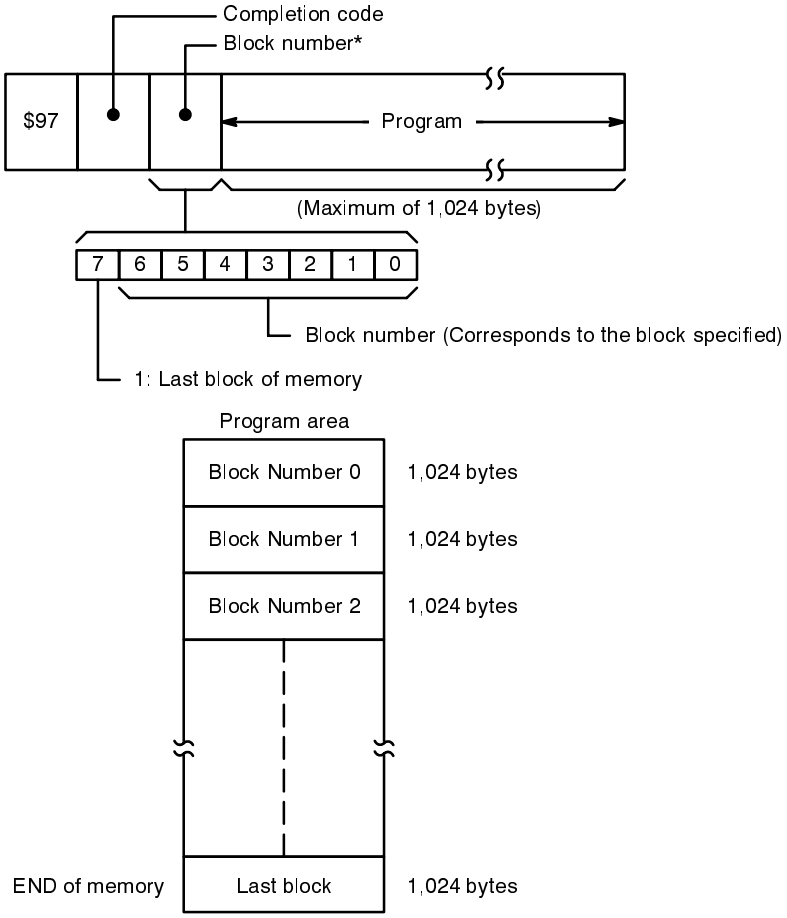
Program Read

Reads the contents of the PLC program memory, and converts the program into machine language code.

Command Format



Response Format



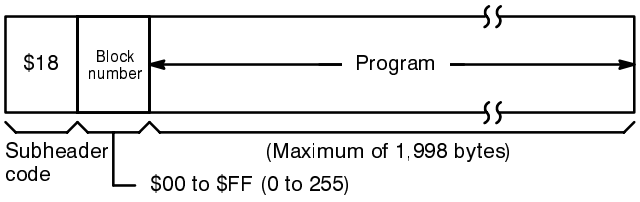
Notes 1. One block is 1,024 bytes.

2. The C200H/C200HS reads 640 (128) bytes only for the last block.

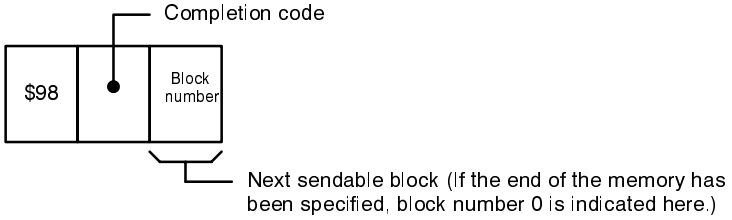
Program Write

Converts machine language code into high-level language codes and writes it to the PLC.

Command Format



Response Format



The block number is set in ascending order from 0.

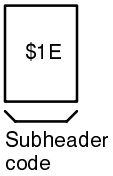
The program section can be a maximum of 1,998 bytes.

3-5-7 Data Link

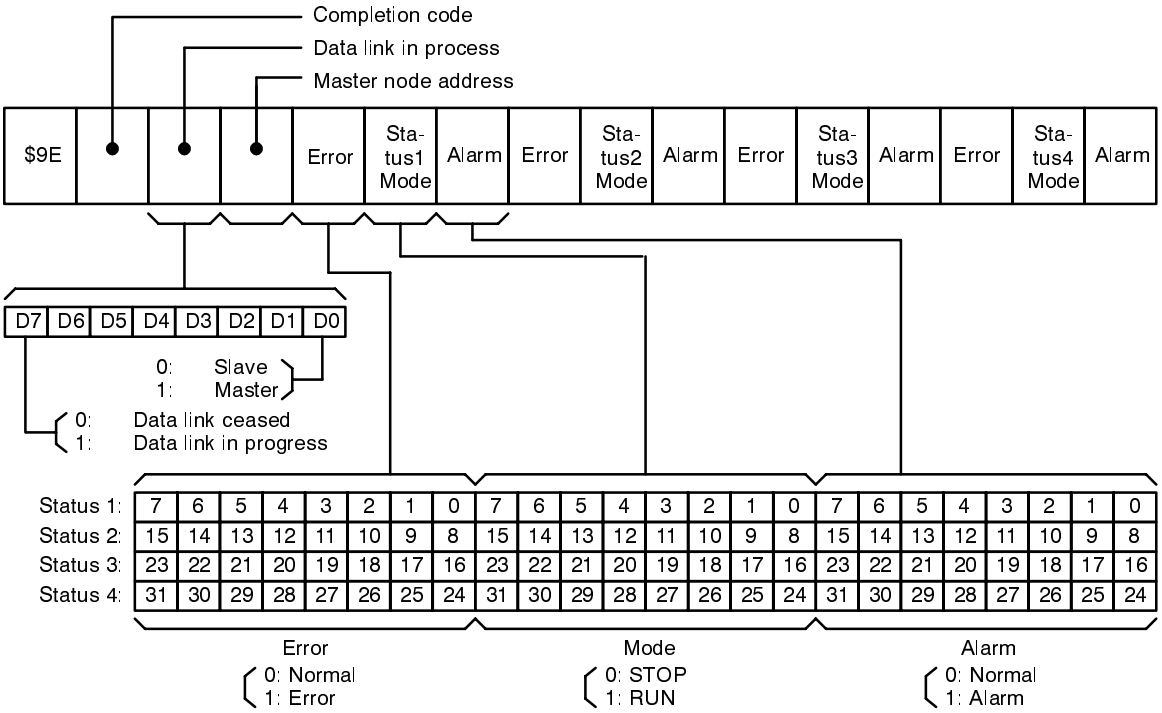
Data Link Status Read

Reads the contents of the specified number of data link words, starting from the specified word.

Command Format



Response Format

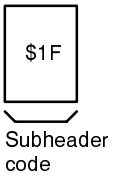


Note The bit numbers of statuses 1 through 4 corresponds to the node numbers in the data link table.

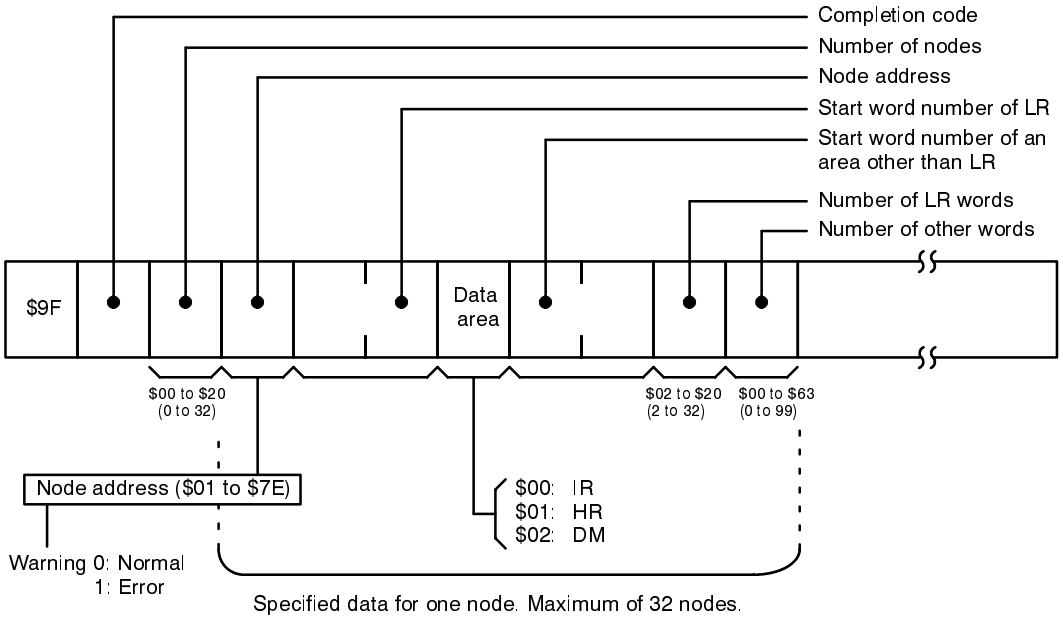
Data Link Setting Table Read

Reads the contents of the data link table.

Command Format



Response Format

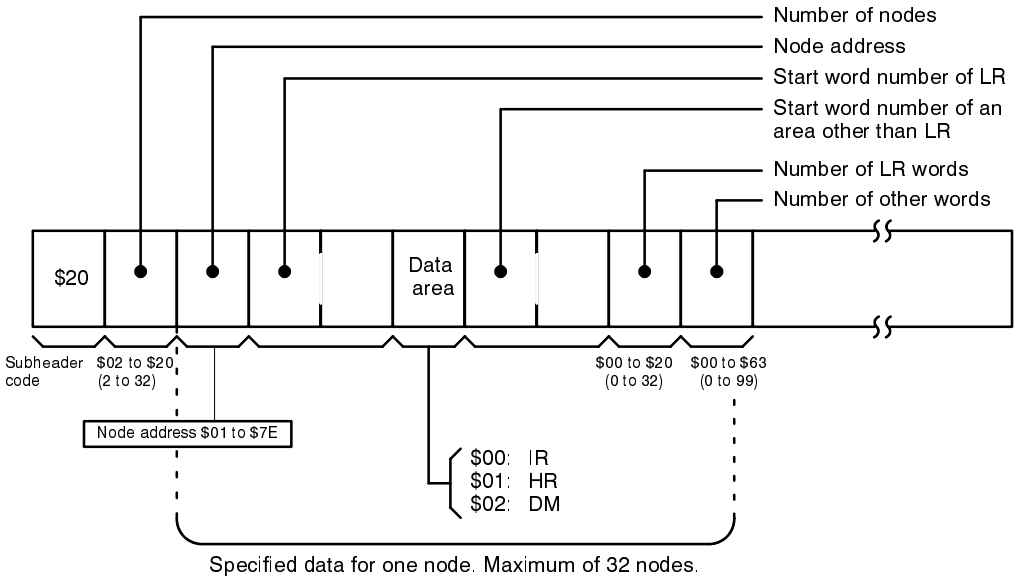


Note The warning bit is checked by the CPU of the node receiving the command. The warning bit indicates that it is impossible to write the specified data to the table.

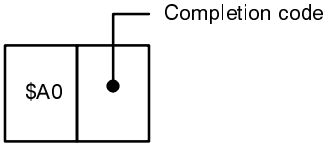
Data Link Setting Table Generation

This command is sent to the master to generate a data link table.

Command Format



Response Format

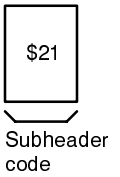


Note The table cannot be generated while the data link is operating.

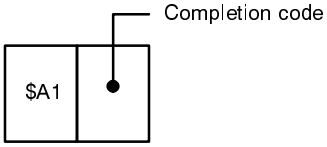
Data Link Start

This command is sent to the master to make the data link.

Command Format



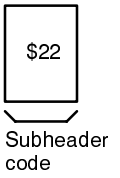
Response Format



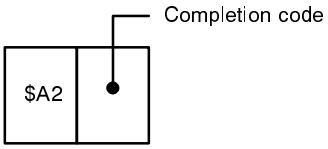
Data Link Stop

This command is sent to the master to break the data link.

Command Format



Response Format

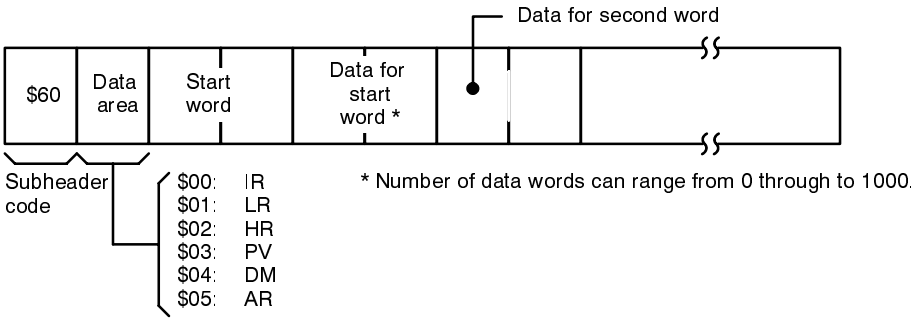


3-5-8 Data

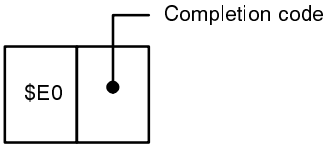
Data Transmit (Send)

Responds to the SEND command.

Command Format



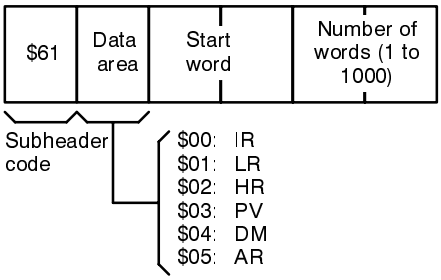
Response Format



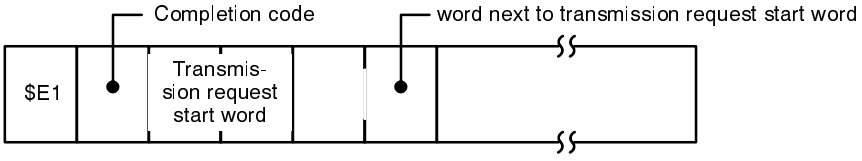
Data Request(Receive)

Responds to the RECV command.

Command Format



Response Format

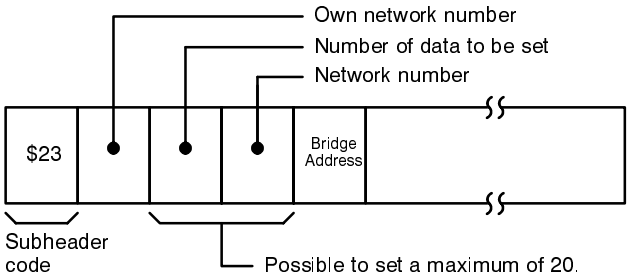


3-5-9 Routing Table

Routing Table Setting

Sets a specified routing table which is necessary for data communication between networks. All nodes of a network must have the same table.

Command Format

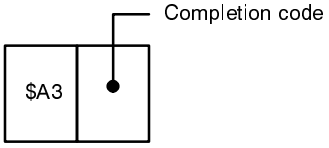


Own Network Number	$01 to $7F
Number of data	$00 to $14
Network Number	$01 to $7F
Bridge Address	$01 to $7E

Set the number of data to $00 when only the own network number is to be set.

The table settings are stored in the HR area of PLC.

Response Format



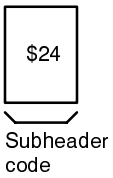
The Settable Routing Table is a loop (0 or 1) of SYSMAC NET Link Module which is the destination of the command.

The setting is not valid immediately. The setting is valid after the power on reset or the initial command reception of the corresponding node.

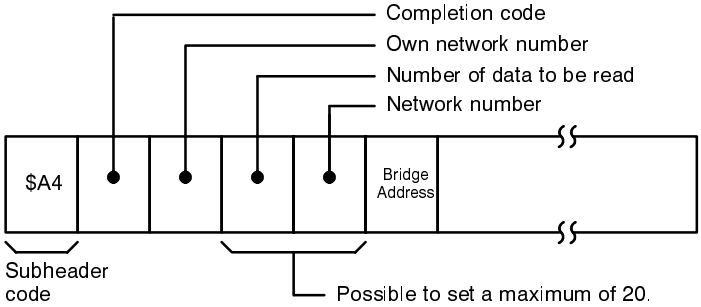
Routing Table Read

The Routing Table is valid after pushing the reset button of the node, or after receiving the initialization command.

Command Format



Response Format



The own network default number is $00.

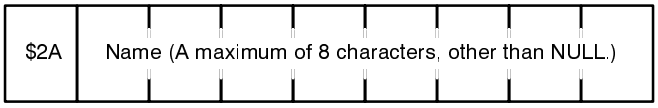
The Readable Routing Table is a loop (0 or 1) of SYSMAC NET Link Module which is the destination of the command.

3-5-10 Name

Name Set

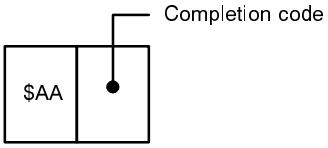
Names the specified node.

Command Format



The name data format is fixed.

Response Format

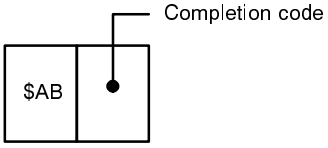


Name Delete

Clears the registered name of the specified node.

Command Format

Response Format

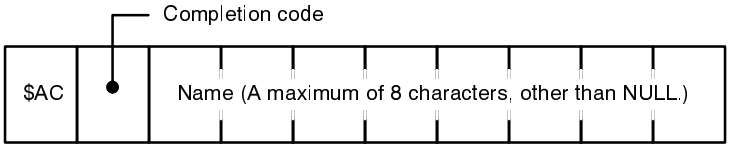


Name Read

Reads the registered name of the specified node.

Command Format

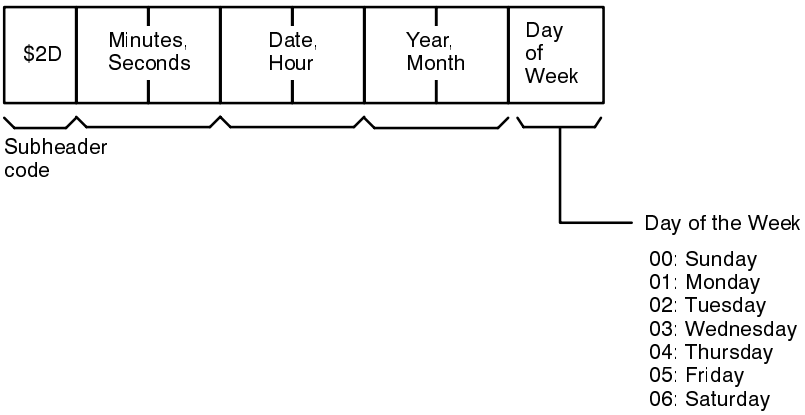
Response Format



3-5-11 Time Setting (C200H/C200HS only)

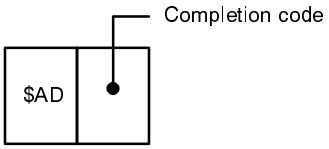
Set the time to words 18 through 21 of the AR Area to start automatic operation.

Command Format



AR 18 (H)	Minutes	BCD: 00~59
AR 18 (L)	Seconds	BCD: 00~59
AR 19 (H)	Date	BCD: 01~31
AR 19 (L)	Hour	BCD: 00~23 (24-Hour clock)
AR 20 (H)	Year	BCD: 00~99 (Rightmost two digits)
AR 20 (L)	Month	BCD: 01~12
AR 20 (L)	Day of Week	BCD: 01~06

Response Format



Note Execute the AR Area Read Command for words AR 18 through 21 to read the time.

SECTION 4
Data Link Applications

Introduction

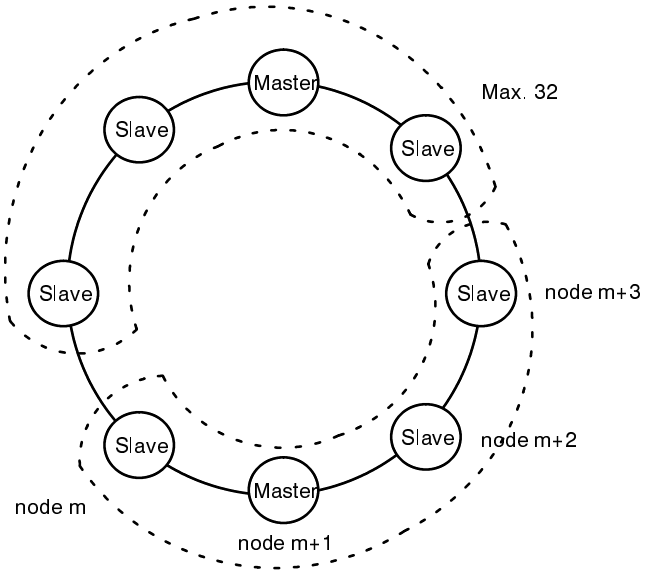
A data link is a communications method in which PLCs transfer information to a memory area, such as the LR area, common to a number of PLCs. Master and slave nodes are established within each data link. This section discusses this form of communication.

4-1 Introducing Data Links

The SYSMAC NET data link feature allows a user to direct groups of PLCs to share a common memory area for fast, transparent data communications in applications such as machine control and co-ordination. Similar to the PLC Link network but even more flexible, a data link, which is identified as part of the data link layer of the ISO model, establishes a common memory area shared by all PLCs. Data in the LR and/or the DM areas of a data link PLC is automatically transferred to the DM areas of all other PLCs on the data link network for use in their application programs.

When using data links, it is necessary to establish master and slave nodes. The slaves are linked to the master of their data link layer. Each layer operates independently of, and asynchronously with, the other layers. A master node may also function as a slave node.

It is possible to establish several data link layers within a single network loop. The following diagram shows two data link layers, each identified bounded by a dotted line.



The maximum number of layers for a single network loop is 63, where the master to slave node ratio is 1:1. If a large number of PLCs will be sharing a single data link layer, four groups of up to 32 PLCs each can be designated for a single data link layer. With this large number of data link stations, one master node and 32 slave nodes, or one master/slave node and 31 slave nodes is permitted.

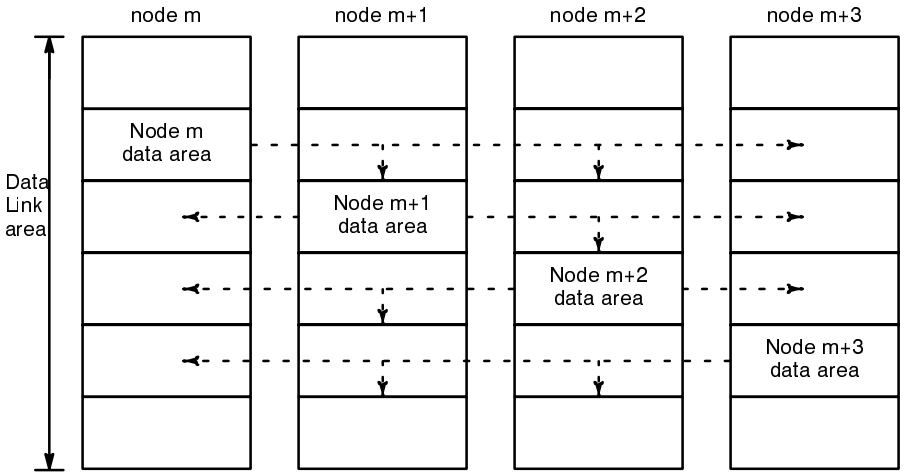
Up to 32 words in the LR area and up to 99 words of other memory areas may be used for the data link. The following chart lists which words are available for each of the PLC's memory areas.

	C200H	C500	C1000H	C2000H	C200HS	CVM1/CV
LR	0 through 63	0 through 31	0 through 63	0 through 63	0 through 63	1000 through 1063
IR	0 through 252	0 through 60	0 through 252	0 through 252	0 through 252	0 through 252
HR	0 through 99	0 through 31	0 through 99	0 through 99	0 through 99	1064 through 1163
DM	0 through 999	0 through 511	0 through 4095	0 through 4095	0 through 5999	0 through 5999

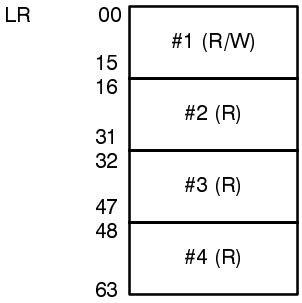
Note The LR and HR of the CVM1- or CV-series PLCs correspond to the above memory areas in the table.

Data links may be specified from a computer equipped with an NSB on the network loop. After the computer initializes the desired SYSMAC NET Link Module as the master, it is necessary to turn OFF the power to the SYSMAC NET Link Module and set the appropriate DIP switch to the master position. Refer to *1-3 DIP Switch Settings*.

Once the master and slaves have been established within the data link layers, the master allows the slaves to communicate directly with each other. If the node assigned to be master of the data link layer stops operating, however, then the other nodes of the layer will not be able to use the data link. The following diagrams show data flow.



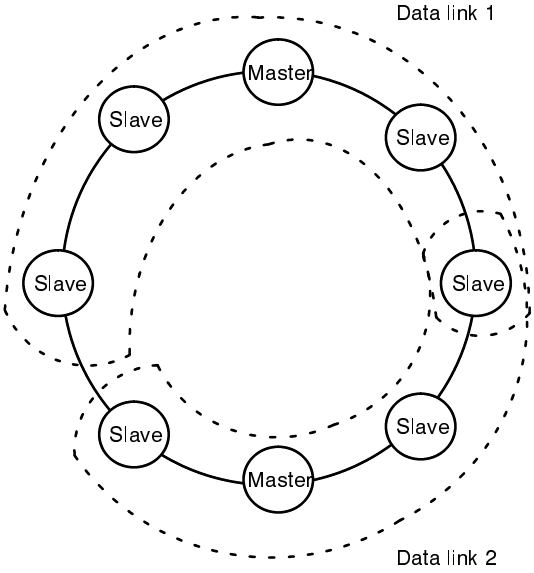
The master node in the preceding network example could be a C1000H with its LR area (words 00 through 63) set as follows:



Data links are similar to PLC Links in that data is transferred to a specific memory area of another PLC. One important difference however is that PLC Link requires use of the LR area, but data links can use any valid memory area.

Care must be taken to ensure that the data area specified for the transfer exists in all the PLCs of the given data link layer. The data areas set for each slave may differ from those of other slaves in the same layer. If so, the data sent from a slave is stored in the other PLCs in the same words of the same data area as specified by the slave. If a node receives data specified for a data area or word that does not exist in the PLC, e.g. data sent from a C1000H DM word 1000 to a C500, that data is lost and an error occurs at the C500 node.

When establishing the data link, do not set a node to be in two different data link layers of the network. The next diagram illustrates such an error.



While data is being sent via data links between nodes, datagrams may also be sent. Send/receive instructions have priority over data links if they arrive at a node simultaneously. If an application is running which sends a lot of data, then data links being sent through this busy portion of the network loop may be delayed. Minimization of traffic should be considered when routing data links in a network.

Computers equipped with NSBs may not participate in a data link, but may be a node located between two SYSMAC NET Link Modules that are involved in a data link.

4-2 Data Link Table

C500-SNT31-V4

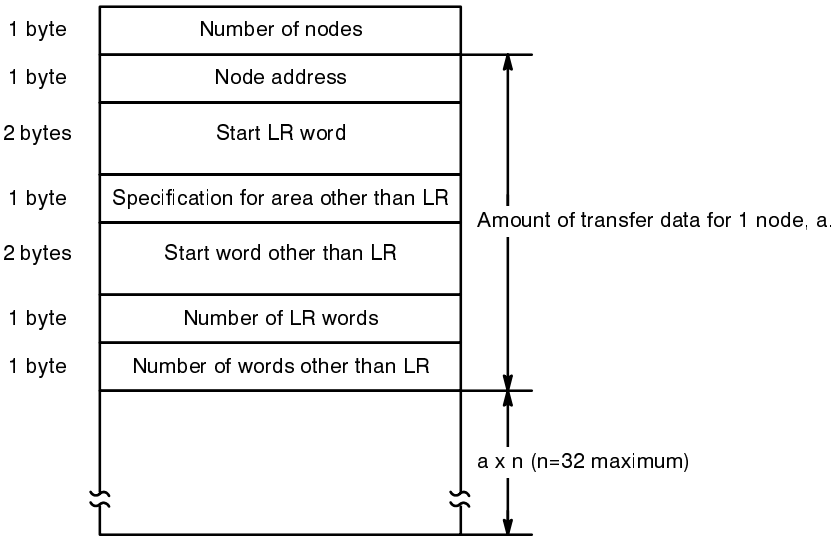
After deciding which node of the data link layer will be the master node, set the data area to be used using pins 3 and 4 of DIP switch 1. For the master node also set pin 2 of DIP switch 1, the same switch, to the ON position. For further information on setting DIP switches refer to *1-3 DIP Switch Settings*.

C200HS-SNT32

After deciding which node of the data link layer will be the master node, set the data area to be used using pins 1 and 2 of DIP switch 2. For the master node also set pin 2 of DIP switch 1 to the ON position. For further information on setting DIP switches refer to *1-3 DIP Switch Settings*.

These settings activate the data link, but the data link may also be activated with a program send from another node. For further details on activation of a datalink via programming from another node, refer to *3-5-7 Data Link*.

While establishing a new data link table, no data link may be currently operating. Settings are established with the hexadecimal code shown in *3-5-7 Data Link*. The following chart shows the format and possible values of the data that make up a table entry.

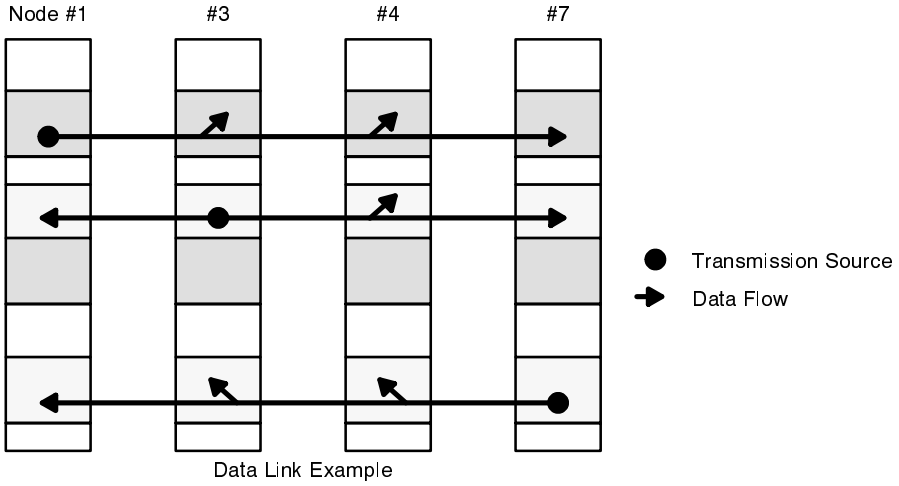


Number of nodes	Nodes in the loop (2 to 32)
Node address	$01 to $7E (1 to 126) do not duplicate
Start LR word	First LR word for the relevant node's data*
Specification for area other than LR	0: IR area 1: HR area 2: DM area
Start word other than LR	First word of the specified data area for the relevant node's data*
The number of LR words	The number of transmission words of the corresponding node except LR words. If LR words are not used, set 0.
The number of words other than LR words.	The number of transmission words of the corresponding node except LR words. If no words other than LR words are used, set 0.

*Do not set an odd word number for the first word.

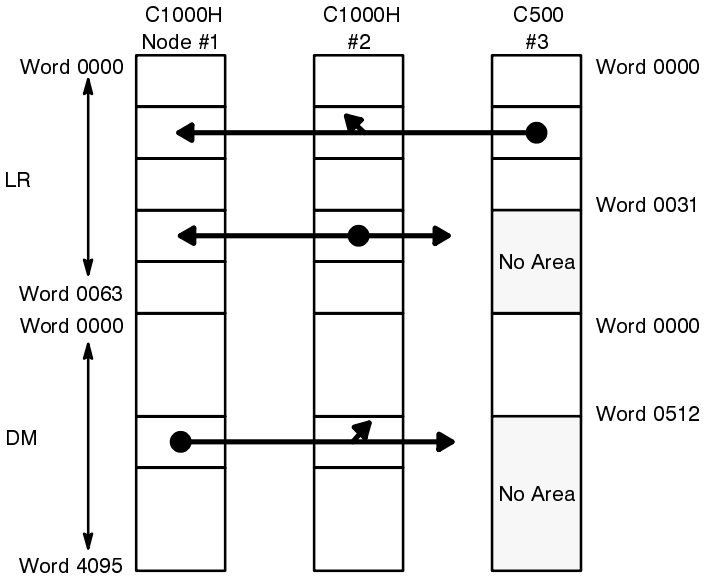
4-3 Area Usage and Errors

Data links exchange data between slaves. The location where the information is sent must be set within the valid bounds of the PLC model being used. For example, sending data to a C500 LR area word 32 is not valid. The same word for a C1000H is valid. If sent properly, a schematic of the data flow looks like the following diagram.



Data Link Example

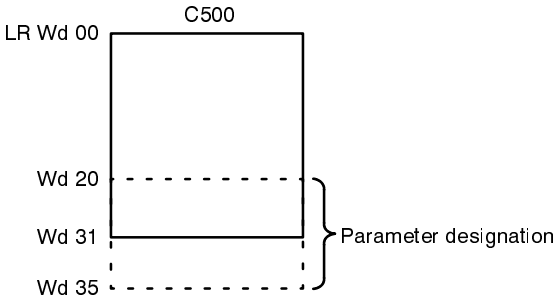
If a node of the data link is sent data for an area which is not valid, the node will ignore the data outside its valid range and it's data link LED indicator will blink indicating an error. The next diagram shows a schematic of a transmission that would result in an error.



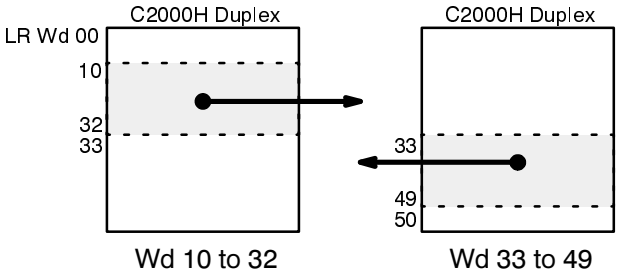
Note that if using a C2000H PLC, the LR area is the only valid area.

Area Errors Occurring during Data links

An error will occur if an attempt is made to send data from an address in a memory area which does not exist. For example, designating a word parameter for a C500 PLC as shown in the next diagram would result in an error.

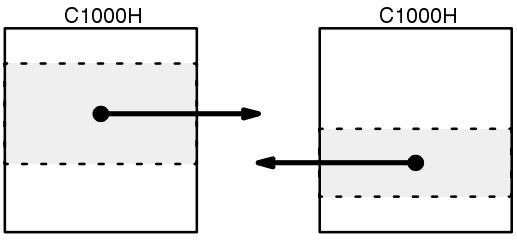


Similarly, do not attempt to send any data from a memory area which is not valid on the PLC. Again, if an error is encountered, the PLC's Link LED will blink. The next diagram illustrates an erroneous example with a C2000H sending data from an area other than the LR area.



Use the Data Link Status Read and Data Link Setting Table Read commands discussed in *3-5-7 Data Link* to check the parameters from the receiving node to verify the correct areas have been selected. If the settings are valid, an exchange between two PLC's of different models can be accomplished.

If the send/receive areas overlap, an error will also be generated. Set each node's transmission area so that it does not overlap the area of another node. The next diagram shows a schematic of a transmission that would result in an error due to overlapping send/receive areas.



Any of these error will result in a warning being issued when a Data Link Status Read or Data Link Setting Read is performed.

Errors will also occur if more than one master is allocated for a given data link layer or if a slave has more than one master. Errors will also occur if the transfer does not take place before the time out. If the Link LED indicator is lit, then execution of the transfer is proceeding.

Data link setting table errors will occur if an invalid area has been chosen. These parameters are checked against the greatest possible values (those of the C2000H) and then checked specifically for each slave.

Data Links with CV-series PLCs

Data links with CV-series PLCs are possible only when a C-series PLC contains the Master. A CV-series PLC cannot be the Master.

Linking the LR Area with other Data Areas

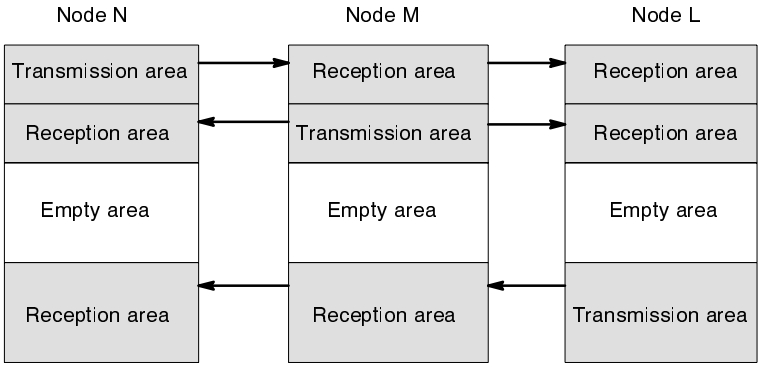
It is not always possible to link the LR Area with other data areas, as shown in the following table.

Other Data Area		LR Area	
		Used in data link	Not in data link
Used in data link	IR	Data link not possible	Data link possible
	HR	Data link not possible	Data link possible
	DM	Data link possible	Data link possible
Not in data link		Data link possible	---

Empty Regions in the Data Link Area

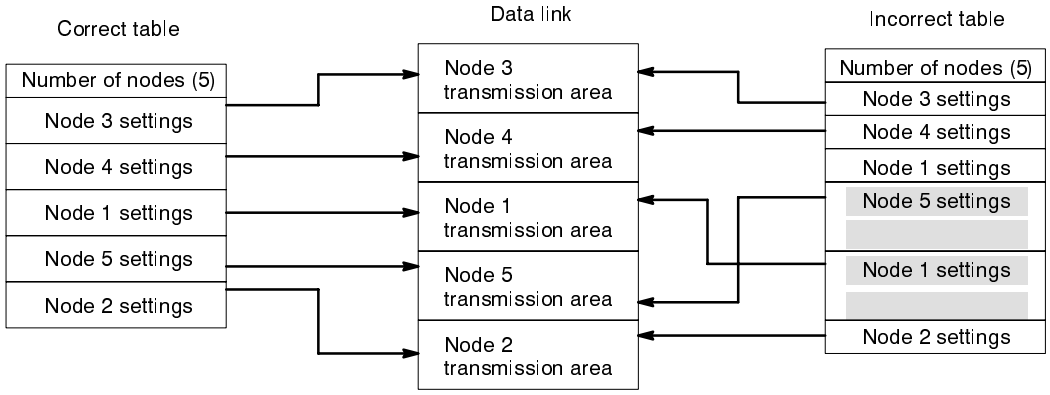
The data link will not start in CV-series PLCs if the data link tables are generated with an empty region within the data link areas. Be sure to set the data link tables so that the regions used by the data link are continuous, without unused regions.

Example of a data link with empty regions:



Data Link Table Structure

Construct the data link table so that each node appears in the order that it occurs in the data link area. The data link will not start in CV-series PLCs if any of the nodes in the data link table are in the incorrect location.



Note The locations for nodes 1 and 5 have been reversed in the incorrect table.

Other Precautions

Some Slaves will participate only in the first data link that is started if they are specified in the data link tables of more than one Master.

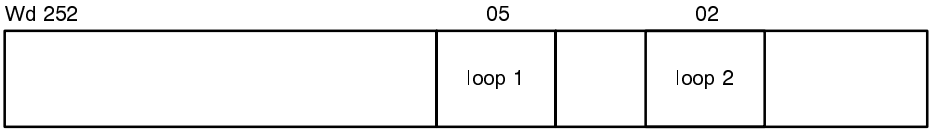
Other Masters cannot be included in the data link table.

Data link tables that include DM 4096 through DM 5999 cannot be set in Modules other than the C200HS-SNT32. When DM 4096 through DM 5999 are included in the data link, a C200HS-SNT32 must be the Master and the data link table must be set in the C200HS-SNT32.

4-4 Error and Run Flags

The PLC's SR area provides error and run flags for the data link. The words and flag bits are as shown below.

C1000H/C2000H



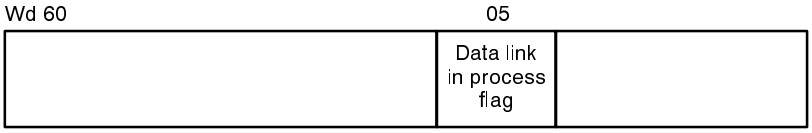
Loop 0		Wd 238	Wd 239	Wd 240	Wd 241
Loop 1 SW3-4	ON (1)	Wd 242	Wd 243	Wd 244	Wd 245
	OFF (0)	Wd 247	Wd 248	Wd 249	Wd 250
15		8	16	24	32
14		7	15	23	31
13		6	14	22	30
12		5	13	21	29
11		4	12	20	28
10		3	11	19	27
09		2	10	18	26
08		1	9	17	25
07		8	16	24	32
06		7	15	23	31
05		6	14	22	30
04		5	13	21	29
03		4	12	20	28
02		3	11	19	27
01		2	10	18	26
00		1	9	17	25

Error flags

PLC run flags

Words 247 through 250 constitute a SR area for data links, regardless of the setting of SW3, in the duplex system of C2000H. The data link in process flag is not provided in the C2000H duplex system.

C500

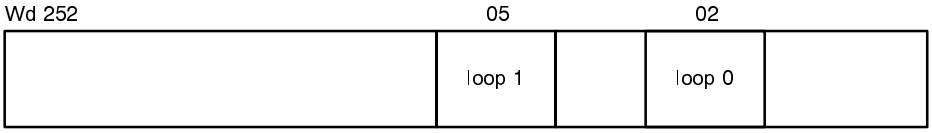


SW3-4	ON (1)	Wd 52	Wd 53	Wd 54	Wd 55
	OFF (0)	Wd 56	Wd 57	Wd 58	Wd 59
15		8	16	24	32
14		7	15	23	31
13		6	14	22	30
12		5	13	21	29
11		4	12	20	28
10		3	11	19	27
09		2	10	18	26
08		1	9	17	25
07		8	16	24	32
06		7	15	23	31
05		6	14	22	30
04		5	13	21	29
03		4	12	20	28
02		3	11	19	27
01		2	10	18	26
00		1	9	17	25

Error flags

PLC run flags

C200H/C200HS



Loop 0	Wd 238	Wd 239	Wd 240	Wd 241
Loop 1	Wd 242	Wd 243	Wd 244	Wd 245
15	8	16	24	32
14	7	15	23	31
13	6	14	22	30
12	5	13	21	29
11	4	12	20	28
10	3	11	19	27
09	2	10	18	26
08	1	9	17	25
07	8	16	24	32
06	7	15	23	31
05	6	14	22	30
04	5	13	21	29
03	4	12	20	28
02	3	11	19	27
01	2	10	18	26
00	1	9	17	25

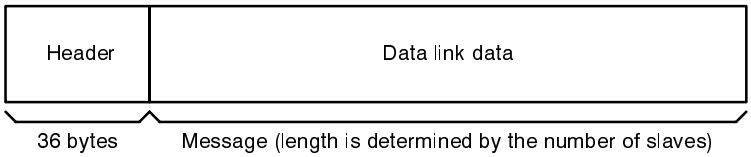
Error flags

PLC run flags

Error and PLC run flags are valid only when the data link in process flag is ON. If the error flag turns ON repeatedly, it may be necessary to check the system settings for errors.

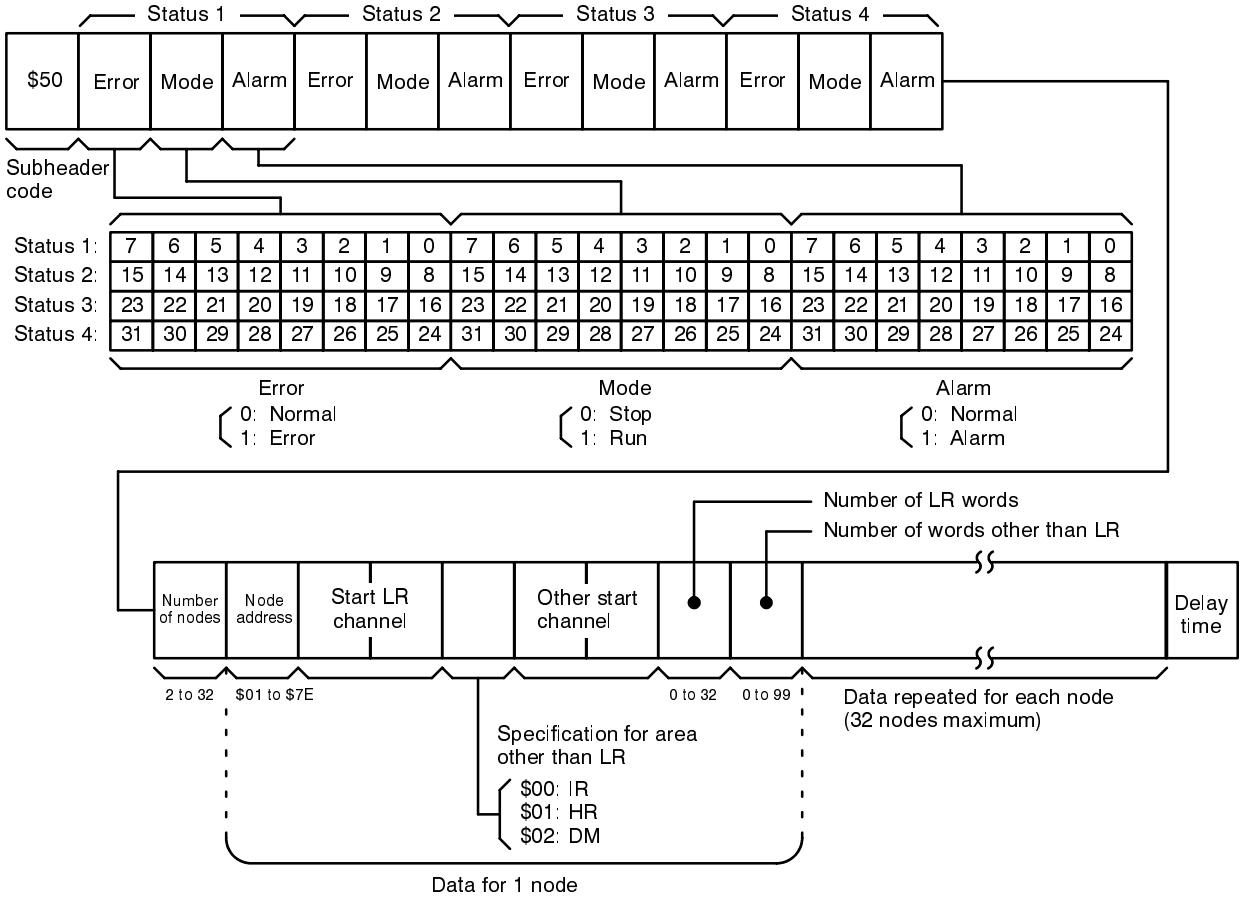
4-5 Format of Data Link Messages

The format of data link messages looks very much like that of datagrams. Messages are composed of a 36-byte header, and a data area with a message length determined by the number of slave nodes.



4-5-1 Data Link Setting Command

The data link settings are sent from the master node to all slave nodes simultaneously. This includes data from data link setting table which used to initial the data link. No response is returned. Note that this command format is similar to the response format of the data link setting table read command.

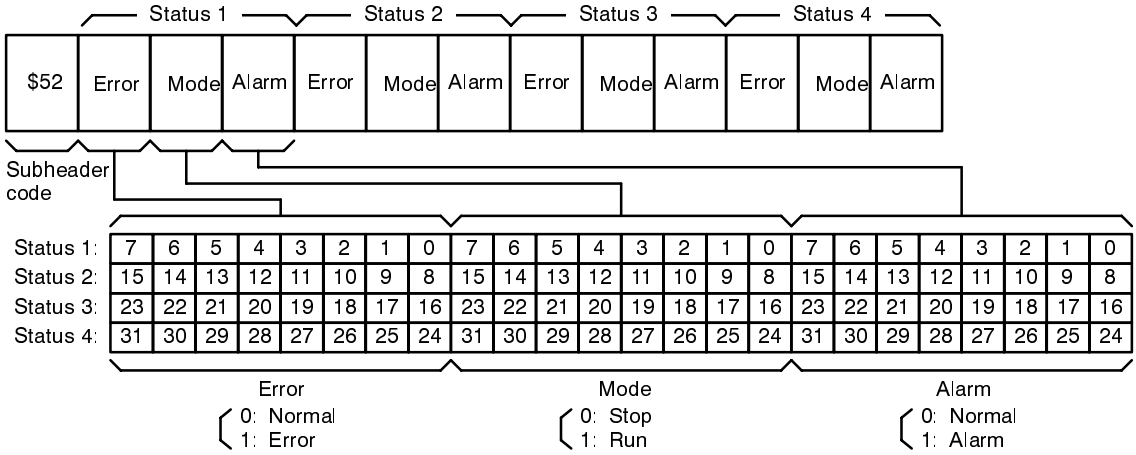


Notes 1. Statuses 1 through 4 are in the same order as the data link table.

2. This command is transmitted to all nodes simultaneously.

4-5-2 Data Link Status Command

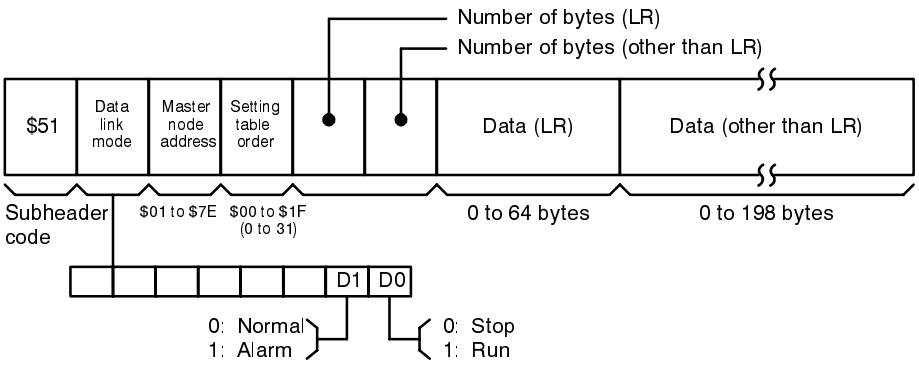
The data link status is sent from the master node to all slave nodes simultaneously. This includes the status of the data link. No response is returned. Note that this command format is similar to the response format of the data link status read.



Note Statuses 1 through 4 are in the same order as the data link setting table.

4-5-3 Data Link Data Transmission

The data link data transmission command instructs the slave nodes to send data. The command is transmitted to all nodes simultaneously. No response is returned.



4-6 Data Link Transmission Times

The duration of time required by the network to complete one cycle of data transmission depends on the data transmission delay time, the number of slave nodes, the amount of data, and the delay time of the network. The time can be calculated using the following formula:

1 cycle (T) = Ti x P + Td

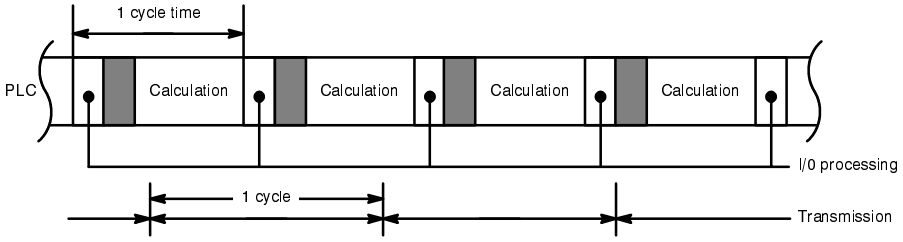
Ti: Data transmission delay time (set by DIP switch SW3)

P: Number of slave nodes

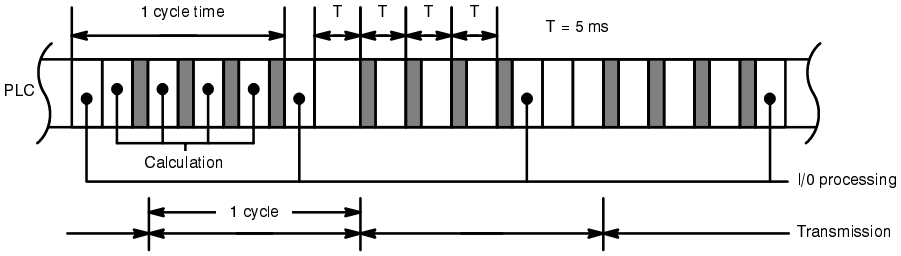
Td: Delay time of the network

Data link transmission and the PLC calculations are not performed in the same time. The timing for these processes is shown in the following diagram.

C200H/C200HS/C500/ C2000H Duplex



C1000H/C2000H Simplex



Mounting Condition	T
One SYSMAC NET	5 ms
Two SYSMAC NET	10 ms
Two SYSMAC LINK	
One SYSMAC NET and one SYSMAC LINK	

The shaded area indicates data exchange timing between a PLC and the SYSMAC NET Link Module's buffer memory. If datagram service is requested at the same time, only one node's data is exchanged at a time (in the order of entry).

If datagram servicing, data link loops, node applications, etc., cause problems for system operation, the error flags in the SR area will turn ON. If these flags turn ON repeatedly, check the settings and timing of the system to determine the cause.

SECTION 5
Troubleshooting

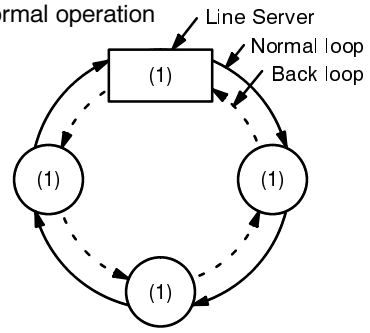
Introduction

The SYSMAC NET Link Module and the SYSMAC NET local area network have features which locate and reduce the impact of system errors. This section describes these features and provides guidelines for troubleshooting the SYSMAC NET Link Module.

5-1 Automatic Back Loop

The automatic back loop function allows the network loop to continue operating when a node is not operating or there is a break in the optical fiber cabling. The back loop path is not used unless the normal path is disrupted. If the normal path is disrupted, the back loop function automatically reverses the direction of the data transmission in the nodes on either side of the fault so that all other functioning devices on the network loop can continue to send and receive messages. The back loop operates as described in the following diagrams.

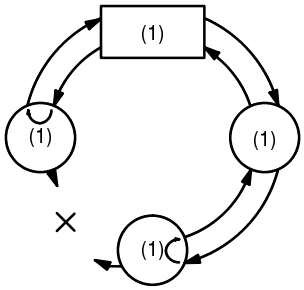
1. Normal operation



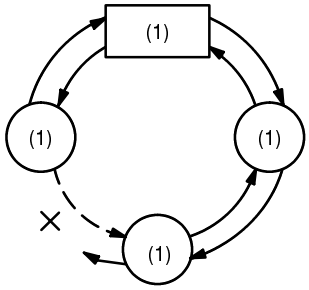
The figure in parentheses is the mode number.
(0) Mode 0, loop abnormality

(1) Mode 1, normal

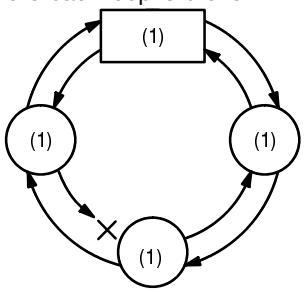
2. Normal and back loops are broken



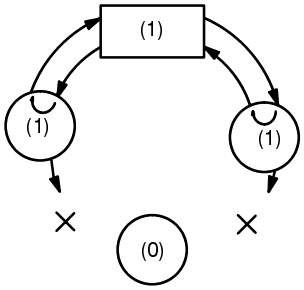
3. Only the normal loop is broken



4. Only the back loop is broken



5. Node connections starting from the back loop

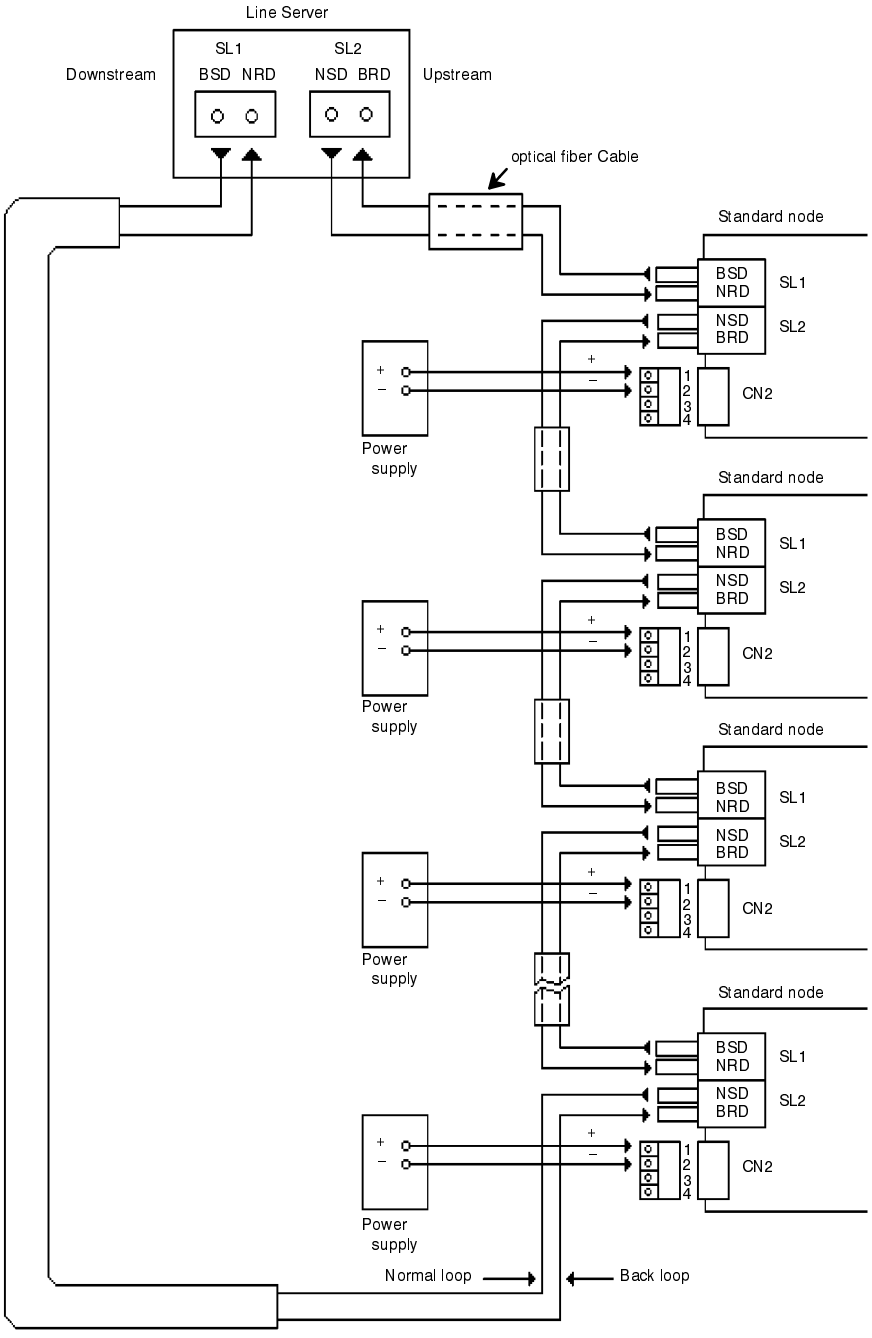


It is recommended to use one of the following methods to verify that the optical fiber connections are normal when a break has occurred at one point in the loop.

C500-SNT31-V4	Use the LAN status command (READ STATUS 10) from a host computer (NSB).
C200HS-SNT32	Use the LAN status command (READ STATUS 10) from a host computer (NSB).
	Check the loop condition of Auxiliary Area word A236.

5-2 Node Bypass with Local Power Supply

All SYSMAC NET components can be connected to an external power supply from the CN1 port. This feature allows individual nodes to continue passing messages even if the main power supply to the device is turned OFF or disconnected. This node bypass operates as shown in the following diagram.



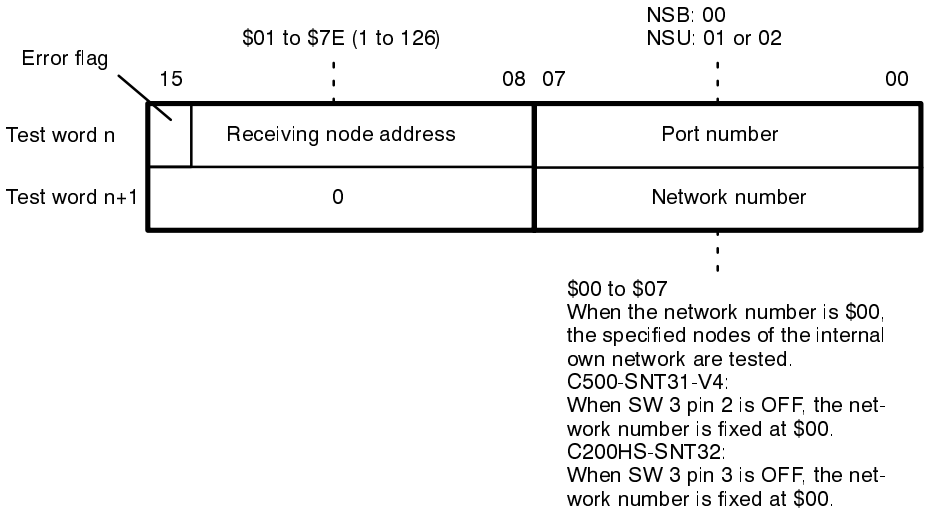
5-3 Data Transfer Test

The SYSMAC NET Link Module can be set to perform a data transfer test by setting pin 8 of DIP SW2 to the ON position (for the C200HS-SNT32, pin 3 of DIP SW1). The PLC performing the test must be in the PROGRAM mode. The PLC being tested can be in any of the three modes. No data may be transferred while this test is operating. The test is repeated as long as the test switch, pin 8 SW2, is ON.

The test words are located in the IR area, but the words used differ depending on the model of PLC being tested.

PLC Model	C200H	C500	C1000H C2000H	C200HS
Test Words	Wd 40, 41	Wd 32, 33	Wd 128, 129	Wd 500, 501

The test data sent to these words is shown below.



Performing the Test

The test procedure is described in the following steps.

1. Set the PLC performing the test to PROGRAM. The PLCs being tested may be in any of its three modes.
2. Set the node address of the first node to be tested.
3. Turn ON the test switch (C500-SNT31-V4, SW2 pin 8 and for C200HS-SNT32, SW1 pin 3) of the node being tested. The test will be repeated until this switch is turned OFF.
4. Change the node address if it is desired to test another node.
5. Turn the test switch OFF.

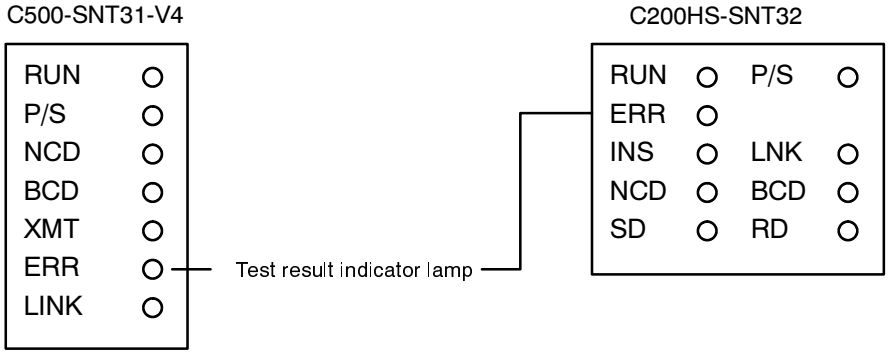
Test Result Confirmation

The results of the test are shown via the use of the LED indicators and are retained in the IR area.

LED Indicators

For each node, the results of the test are shown in the ERROR LED indicator for the given node.

- ⌘ Lit: Test error
- ● Unlit: Test normal



If an error is encountered, the ERROR indicator on the SYSMAC NET Link Module's front panel will be lit. The results are contained in the IR memory area as follows. If any errors are encountered, first reconfirm that both nodes were ready for testing.

IR Area

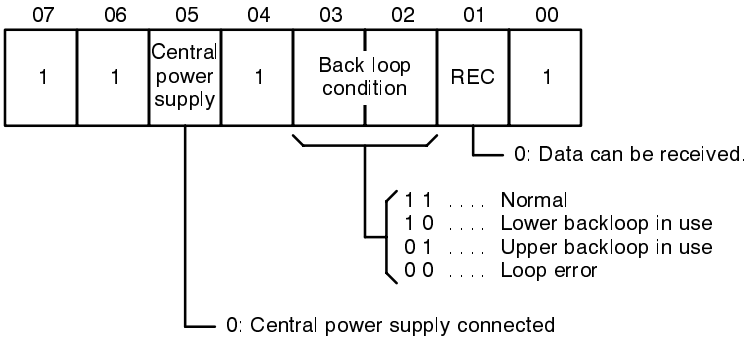
The data is transferred in the following way: for the SYSMAC C500 from word 32, for SYSMAC C1000H and C2000H from word 128, for the SYSMAC C200H from word 40, and for the SYSMAC C200HS from word 500.

Wd 32/128/40/500	*	Destination node address*	Port number
Wd 33/129/41/501	0		Network number
Wd 34/130/42/502	Local node address		Local node status
Wd 35/131/43/503	Number of tests		
Wd 36/132/44/504	Number of errors		

*The error flag turns ON (1) when the port number, NSB/NSU setting, network number, or the destination node address is not set properly.

Caution If data is written to the IR words during the test, the test result data is lost.

The transmitting node address of the results above has its 8 bits assigned as follows. Bit 05 applies only if a Central Power Supply Module is connected.



The following errors are possible:

1. No response within 1 second.
2. Transmitted and received data is not identical. Refer to the Test command in *3-5 Command and Response Formats*.
3. Node address error.
4. Transmitting node not in Program mode.

Note The default value for the response waiting time is 1 second. A different time may be specified as follows:

Address	2 bytes	
$0000: 0104	time*	*10 ms units, 655,350 ms maximum
Segment: offset	L H	

If a SYSMAC NET Link Module is found to be defective, check first for a faulty contact. Remove the Module and wipe the connecting pins with a cotton cloth moistened with industrial alcohol. When remounting make sure that the Module is mounted securely and that the mounting screws are not loose. The connecting cables must also be securely connected.

5-4 Error Tables

Error	Possible Cause	Correction
RUN indicator does not light	SYSMAC NET Link Module is not mounted securely	Check connection and mount securely
	Power not being supplied properly	Supply proper voltage
	SYSMAC NET Link Module is defective	Replace SYSMAC NET Link Module
NCD indicator does not light (BCD indicator lights)	Upper optical fiber cable is cut	Replace cable
	Upper node has an error	Replace the defective Module
BCD indicator does not light (NCD indicator light)	Lower optical fiber cable is cut	Replace cable
	Lower node has an error	Replace the defective Module
NCD and BCD indicators do not light	Line server power is not being supplied properly Low power voltage	Supply proper voltage
	Optical-fiber cable is cut in at least 2 places	Replace cable

Data Link System Errors

Error	Possible Cause	Correction
Slave error flag is ON (alarm)	The Master is not able to receive data sent in one cycle time.	Divide the Slave's data
	Sufficient time is not allowed to exchange data with PLC.	Increase the data link communication time
	Slave power supply is off, cable is cut, etc.	Check Slave power supply, connections, etc.
Data link operation flag is OFF	Master is stopped	Reset the system
	Master power supply is off	Supply power to Master

Appendix A
Standard Models

Name	Model	
Line Server	S3200-LSU03-01E	
Network Support Board and software	S3200-NSB11-E	
Network Support Board for FIT	FIT10-IF401	
SYSMAC NET Link Module for C500, C1000H, C2000H	C500-SNT31-V4	
SYSMAC NET Link Module for C200H/C200HS	C200HS-SNT32	
Bus Connector	When using one SYSMAC NET Link Module	C200H-CE001
	When using two SYSMAC NET Link Modules	C200H-CE002
Network Service Module	S3200-NSUA1-00E	
Network Bridge	S3200-NSUG4-00E	
H-PCF Optical-Fiber Cable for C200HS-SNT32 only	S3200-HC***** (See note.)	
Optical-Fiber Cable Connectors	S3200-COCH62M	
	S3200-COCF2511	
	S3200-COCF62M	
	S3200-COCF62F	

Note The last five characters in the model number vary depending on type and size of cable.

Appendix B
Specifications

Item	Specifications
Specification	Token Ring (N: N communication)
Communication Medium	Manchester Code – Baseband
Data Transmission Rate	2M bits/s
Transmission Lines	2-Conductor Optical-Fiber Cable (Plastic-Clad, Crystal Core: Core dia. 200 μm
Number of Nodes	126 maximum
Interval Between Nodes	1 km maximum (3 km max. when a repeater is used) (see note)
Message Length	2K bytes maximum
Transfer Buffer Capacity	1 message
Reception Buffer Capacity	15 messages
RAS Function	1. Automatic back loop (automatic release 2. Node bypass (by Central Power Supply) 3. Self-diagnosis function (by test mode function) 4. Error detection CRC – CCITT generating function = $X^{16} + X^{12} + X^5 + 1$

Note Settings of the Line Server must be changed to extend the distance between nodes. Refer to the relevant Line Server documentation for details.

• Optical Fiber Cable

Model						Applicable node
S3200-HC □□□□□						
Type (Content)		Color		Cable length		
L	Power line composite cable	B	Black	101	10 m	Can be used to connect any nodes.
C	No power line (Cable without power line)	O	Orange	501	50 m	
				101	100 m	
				501	500 m	
				501	1000 m	

• Optical Connector

Model	Number required	Applicable node
S3200-COCH62M	1 PLC included 1 PLC required for each node	SYSMAC NET Link Module (C500-SNT31/-V1/V2/V3/V4) Line Server (S3200-LSU03-V1) Local Bridge (S3200-NSUG4-10 NSU (S3200-NSUA1-10) NSB for PC-AT (S3200-NSB11) NSB for FIT10 (FIT10-IF401)
S3200-COCF2511	1 PLC included 1 PLC required for each node	Only for Model C200HS-SNT32
S3200-COCF62M	For cable junction 1 PLC required per junction	-
S3200-COCF62F		

Glossary

ASCII code — [A(merican) S(tandard) C(ode for) I(nformation) I(nterchange)]. A standard computer code used to facilitate the interchange of information among various types of data-processing equipment.

baud rate — Transfer speed between two devices in a system measured in bits per second. For example, an optical sensor might be configured to send its information to the FIT at 9600 baud. It is important for both of the devices to be set to the same baud rate.

bit — The smallest piece of information that can be represented on a computer. A bit has the value of either zero or one, corresponding to the electrical signals ON and OFF. A bit is one binary digit.

central processing unit — A device that is capable of storing a program and data, and executing the set of instructions contained in the program. In a PLC System, the central processing unit executes the program, processes I/O signals, communicates with external devices, etc.

communication cable — Cable used to transfer data between components of a control system and conforming to the RS-232C or RS-422 standards.

CPU — An acronym for central processing unit.

cycle time — The total time it takes the PLC to perform internal operations, i.e., reset the watchdog timer, read the program, receive input data, send output data, and execute instructions. Cycle time is monitored by the watchdog timer within the PLC, and if it takes longer than a certain specified amount of time, an error message may be generated, or the CPU may just stop. Cycle times will differ depending on the configuration of the system.

data area — An area in the PLC's memory that is designed to hold a specific type of data, e.g., the LR area is designed to hold common data in a PLC Link System.

data link — Allows for the connection of up to 32 PLCs in a Net Link System where each is contributing information to a common memory area. Data links may be established in the LR and/or DM memory areas.

EPROM — [E(rasable) P(rogrammable) R(ead) O(nly) M(emory)] A type of ROM in which stored data can be erased, by ultraviolet light or other means, and reprogrammed.

factory computer — A general-purpose computer, usually quite similar to a business computer, that is used in automated factory control.

flag — A bit that is turned ON and OFF automatically by the system in order to provide status information.

hexadecimal — Number system used to represent numbers in base 16 with digits 0,1,2...9,A,B...F.

host computer — A computer that is used to transfer data to or receive data from a PLC in a Host Link system. The host computer is used for data management and overall system control. Host computers are generally small personal or business computers.

IBM PC/XT or AT, or compatibles — A computer that has similar architecture to, and is logically compatible with an IBM PC/XT computer; and that can run software designed for that computer.

LAN — An acronym for local area network.

local area network — A network consisting of nodes or positions in a loop arrangement. Each node can be any one of a number of devices. This kind of network usually operates over a small area such as a group of offices or a factory floor.

Module — In OMRON PLC terminology, the word Module is capitalized to indicate any product sold for a PLC System. Though most of the names of these products end with the word Module, not all do, e.g., a Remote Terminal is referred to in a collective sense as a Module. Context generally makes any limitations of this word clear.

PLC — An acronym for Programmable Controller.

Programmable Controller — A small, computer-like device that can control peripheral equipment, such as an electric door or quality control devices, based on programming and peripheral input devices. Any process that can be controlled using electrical signals can be controlled by a PLC. PLCs can be used independently or networked together into a system to control more complex operations.

RAM — [R(andom) A(ccess) M(emory)] RAM will not retain data when power is disconnected. Therefore data should not be stored in RAM.

ROM — [R(ead) O(nly) M(emory)] A type of digital storage that cannot be written to. A ROM chip is manufactured with its program or data already stored in it, and it can never be changed. However, the program or data can be read as many times as desired.

RS-232 interface — An industry standard connector for serial communications.

RS-422 interface — An industry standard connector for serial communications.

system configuration — The arrangement in which Modules in a System are connected. This term refers to the conceptual arrangement and wiring together of all the devices needed to comprise the System. In OMRON terminology, system configuration is used to describe the arrangement and connection of the Modules comprising a Control System that includes one or more PLCs.

token ring network — A special type of network with all the devices on the network connected in the shape of a ring. A special signal (“token”) is passed around the ring, and messages are carried on this signal.

word — In digital circuits, a group of bits. Usually a word consists of four, eight, or sixteen bits. In C-series PLCs, a word consists of sixteen bits. Words can be used to store data, or they can be used for I/O.

Index

A–B

C

D

E–I

M

N–P

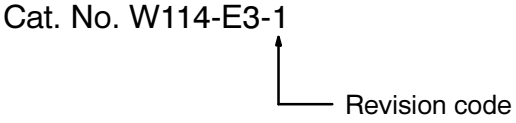
R

S–U

W

Revision History
C500-SNT31-V4/C200HS-SNT32
SYSMAC NET Link Module
Operation Manual

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



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
E-7	August 1994	C200H-SNT31 changed to C200HS-SNT32 throughout the manual. SYSMAC LINK Module models updated throughout the manual. NET Link Module changed to SYSMAC NET Link Module throughout the manual. Scan time changed to cycle time throughout the manual. **Pages 2, 4:** Node address note rewritten. **Page 8:** Additional description added to data transmission time delay setting. Data Link Slave/Master selector description changed. **Page 12:** Minor change to SW 3 settings. Data Transfer Delay Time corrected. Data transmission time delay description changed. **Page 14:** RS-422 and one Local Power Supply Module removed from the network diagram. **Page 15:** Network loop diagram corrected. **Page 19:** CPUs added to the bottom table. **Page 20:** Notes 4 and 7 added. **Pages 22, 23:** Parts names changed and information added **Page 23:** Switched the color of CN1 cables in the illustration. C200HS-SNT32 cabling procedure added. **Page 27:** Data Transfer Times corrected. **Page 35:** HR memory table clarified. **Page 42:** C200HS and note added to table. **Page 43:** Bottom table corrected. **Page 44:** The watchdog timer setting range and characteristics changed. **Page 45:** List of precautions added. **Pages 45 to 47:** Control Data sections were corrected. SEND(90) description changed and added to. **Pages 47, 48:** RECV(98) description changed and added to. **Page 48:** Program example replaced. Sample Transmission Retry Program added. **Pages 56 to 59:** TTIM added to command formats. C200HS added to tables **Page 60:** Corrected status data in the diagram. C200HS added to PLC code list in the diagram. **Page 70:** Node address added to the top command format. **Pages 77, 79:** Data in tables updated. **Page 81:** Data Links with CV-series PLCs added. **Page 85:** Delay time added to data link setting command format. **Page 86:** Diagram for C200H/C200HS/C500/C2000H Duplex corrected. **Page 90:** Verification method added. **Pages 92, 93:** IR Area diagrams were redrawn. C200HS added to table. Indicator diagram corrected.
E3-1	January 1996	Changed PC to PLC and Unit to Module. **Pages 25 and 26 :** Changes to illustrations.