Cat. No. W160-E1-2

SYSMAC

S3200-NSUA1-00E

Network Service Unit

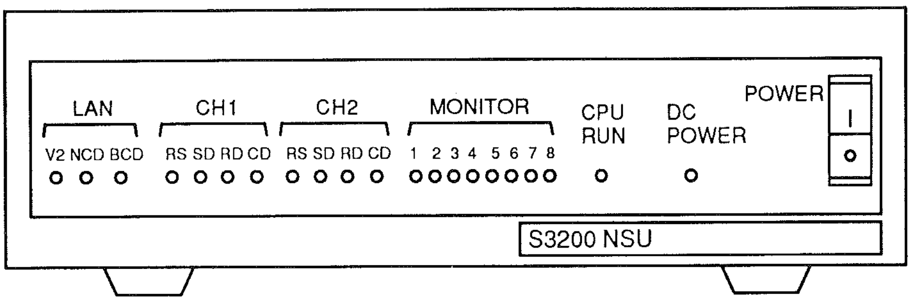
OPERATION MANUAL

OMRON

SYSMAC S3200

Network Support Board

Revised June 1990



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DATEC Inc.

For Your Safety

OMRON products are manufactured for use by qualified operators according to proper procedures and only for the purposes stated in this manual. Thoroughly familiarize yourself with both the product and this manual before attempting operation.

The following conventions are used to indicate warnings and important information in this manual. Always heed the information provided with them:

DANGER! indicates information that, if not heeded, could result in loss of life or serious injury.

Caution indicates information that, if not heeded, could result in minor injury or damage to the product.

Note indicates important supplementary information and clarifications.

Product References

The names of OMRON products are capitalized in this manual. The word "Unit" is capitalized when it refers to an OMRON product, regardless of whether "Unit" is part of the proper name of the product.

The letters "Ch" and "CH" appearing in some displays and on some OMRON products represent the term "word"; "Wd" is also used in text as an abbreviation for "word."

Table Of Contents

About this Manual...

This manual describes the features and operation of the S3200–NSU Network Service Unit. This Unit is used to connect serial devices onto the SYSMAC Net optical fiber network. Other devices that may be connected onto this network include C–series PCs and AT compatible computers.

Section 1 Hardware Description, introduces the SYSMAC Net LAN and describes how to setup the Network Service Unit.

Section 2 Communication, explains protocol for LAN communication as well as the procedures for receiving and transmitting data.

Section 3 Memory Configuration, explains how the Unit's memory is allocated and accessed.

Section 4 Error Processing, describes error messages and how to respond to them.

Appendixes, a **Glossary** and an **Index** are located at the back of the manual.

Thoroughly familiarize yourself with this manual before operating the Network Service Unit.

SECTION 1
Hardware Description

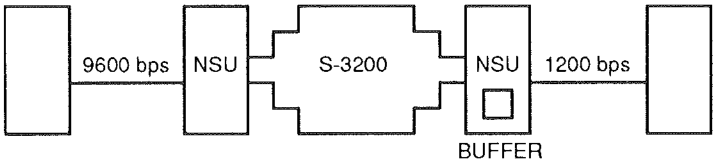
1-1 Introduction

This section introduces the Network Service Unit and the SYSMAC Net optical fiber LAN (local area network). LED indicators and DIP switch settings are also explained

1-2 Product Introduction

The Network Service Unit is used to connect serial communication devices to the SYSMAC Net LAN. The Unit converts between serial and optical signals allowing a device such as a computer, robot, or bar code system, access to other devices on the LAN. The Network Service Unit is available with two RS-232C ports or one RS-232C and one RS-422 port. Synchronous or asynchronous transmission may be selected at speeds from 1200 to 9600 baud.

The Network Service Unit can be used to convert between serial devices that are communicating with different formats such as EBCDIC/JIS8 or with different baud rates. For example, a serial device transmitting at 1200 baud to one Network Service Unit can communicate to another Network Service Unit's serial device at a different rate. Two serial devices connected to two different Network Service Units do not need to have the same communication settings.



SYSMAC Net Description

The Network Service Unit provides access to a high-speed optical fiber network. The network uses token ring architecture. Up to 126 nodes may be connected onto the network loop. This number may be increased by joining separate network loops together via the use of Bridge Units. Transmission speed between nodes is 2M bps, and the maximum distance of the network loop without repeaters is 1 km.

Other SYSMAC Net compatible products include

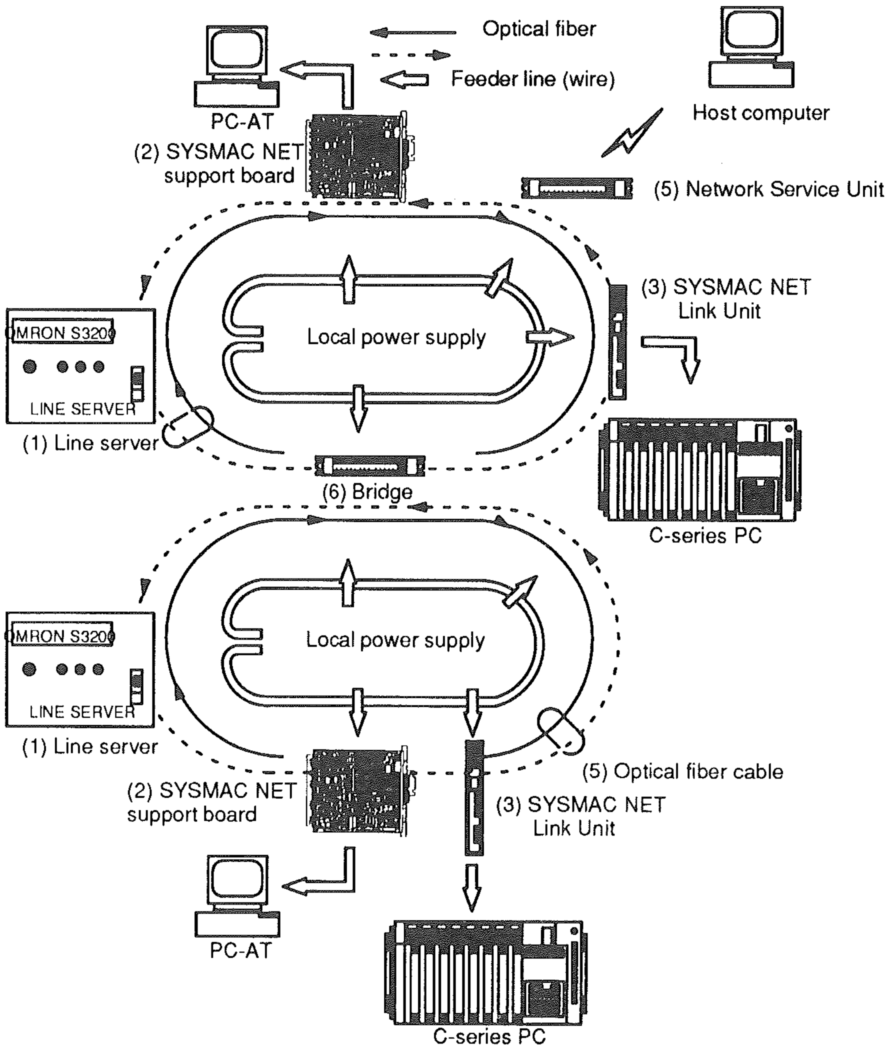
The Network Support Board: Used for connecting AT-compatible computers. This product is packaged with software important for network maintenance. A separate board is available for the FIT Unit.

The Line Server: Used for issuing and monitoring the network's token. The Line Server may also be set to function as a repeater where the distance of the network needs to exceed 1 km.

The Net Link Unit: Used to connect C-series PCs.

The Bridge Unit: Allows nodes on separate network loops to communicate.

A complete network may include any combination of these devices. The following figure shows a possible system configuration using these components.

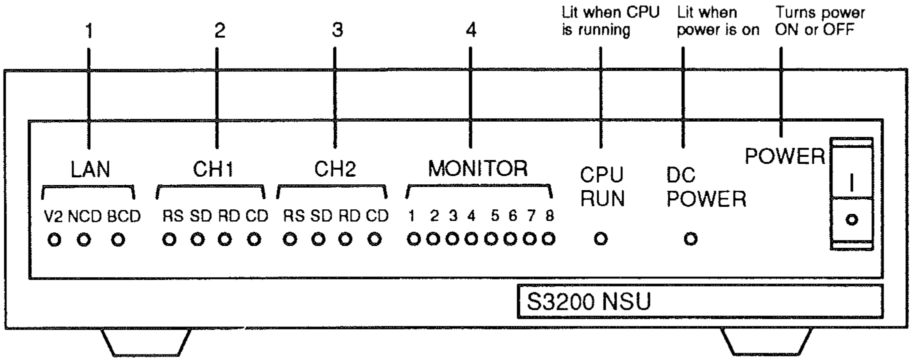


The Optical Fiber Cable used to connect the nodes together has two fibers. The second fiber is used to provide a back loop path in the event of a break in the cable or an error at a node. The Local Power Supply is an optional Unit that allows communication to pass through a node even though its normal power supply is turned OFF. This is called the Node Bypass function. Both the back loop function and the Node Bypass function are features which ensure that the SYSMAC Net LAN remains a reliable medium for communication.

For more information concerning these products, Refer to *their respective Operation Manuals or the SYSMAC Net System Manual.*

1-3 General Appearance and LED Indicators

The following diagram shows the Network Service Unit's front panel.



LAN Monitor LEDs

LAN Monitor LEDs display LAN connection state.

V2	Lit when Local Power Supply is being used
NCD	Lit when normal loop is operating
BCD	Lit when back loop is operating

CH 1 Monitor LEDs

CH 1 Monitor LEDs monitor line signals.

RS, SD	External device-to-NSU
RD, CD	NSU-to-external device

CH 2 Monitor LEDs

CH 2 Monitor LEDs monitor line signals.

MONITOR LEDs

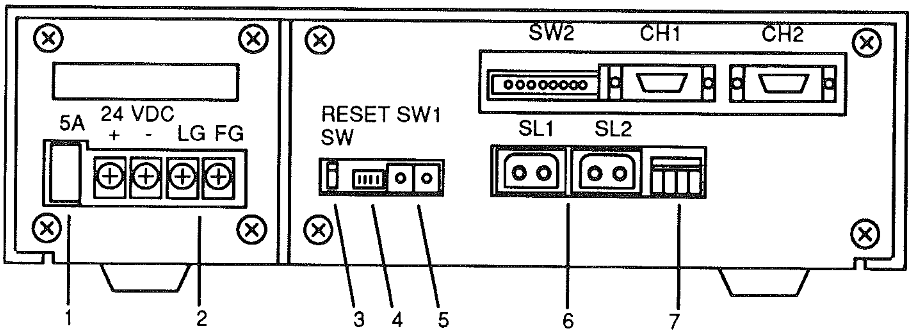
MONITOR LEDs display the status of the Serial ports.

LED 1	Blinks when serial port 1 is in use
LED 2	Blinks when indicates that serial port 2 is in use
LEDs 3, 4, 5	Controlled by software programming

LED Number		**Display Meaning**
6	7	
OFF	OFF	Normal
OFF	ON	I/O error
ON	OFF	General error
ON	ON	System error

The LED indicators also are used to display error status. If they are lit and their status does not change, refer to *Section 4 Troubleshooting*, to determine what is causing the error.

The back of the Network Service Unit is used to connect cabling and access DIP switches. It has the following appearance:



1. Fuse: Slow-blow 5 A fuse.
2. Terminal block: Ground the FG terminal at a resistance of less than 100 Ω to prevent electric shock. Ground the LG terminal at a resistance of less than 100 Ω to improve noise immunity or prevent electric shock.
3. RESET switch: Resets the CPU when pressed
4. SW1: General-purpose input switches (down is ON)
5. Node No. SW: Used to set the NSU node number (0AH to 7EH hexadecimal)
6. SL1, SL2: Used for Optical Fiber Cable connections (Each has normal and back loop paths for sending and receiving data. These are abbreviated NSD, NRD, BSD, and BRD.)
7. CN2: Local Power Supply Connector. Used when Local Power Supply Unit is used to provide Node Bypass feature.

1-4 DIP Switch Settings

On the Network Service Unit's back panel are two banks of DIP switches. The pin are in the ON position when they are down.

1-4-1 SW1

Pins 1 and 2 set the Unit's baud rate. The following table shows pin settings for each baud rate.

Pin Number		Baud Rate (bps)
1	2	
OFF	OFF	1200
ON	OFF	2400
OFF	ON	4800
ON	ON	9600

Pin 3 is used to select either EBCDIC (ON) or JIS8 (OFF).

Pin 4 initializes the Unit's settings. Set this pin to ON to initialize.

1-4-2 SW2

Determines the type of handshaking used with the serial device(s).

Pins 1 through 4 are used for CH1.

Pins 5 through 8 are used for CH2.

Most devices use asynchronous communication, so set the pins accordingly.

The ST1 and ST2 signals, are Send Timing signals. The RT is a Receive Timing signal. When a modem will be connected to the Unit set ST1 to ON. The software will provide all necessary information for ST and RT signals.

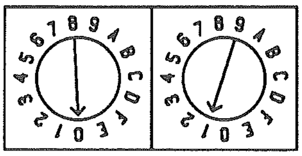
When a modem is not used, as when a device is connected locally, the ST and RT signals are provided by the Network Service Unit. Therefore, in this situation ST2 and RT should be set to ON.

Pin	Channel	ON	OFF
1	1	Synch.	Asynch.
2	1	ST2	ST1
3	1	RT1 enabled	RT1 disabled
4	1	Not used	--
5	2	Synch.	Asynch.
6	2	ST2	ST1
7	2	RT1 enabled	RT1 disabled
8	2	Not used	--

1-5 Node Number Setting

Each device on the network needs to have a unique node number set so that it can receive data. The node number is set using the rotary DIP switches on the Unit's back panel. Hexadecimal notation is used to select one of the 126 valid numbers 0AH through 7EH. The left switch sets the left-most digit while the right switch sets the digit to the right. The following diagram is an example showing the node address set to 01H:

RSW1 Left digit RSW2 Right digit

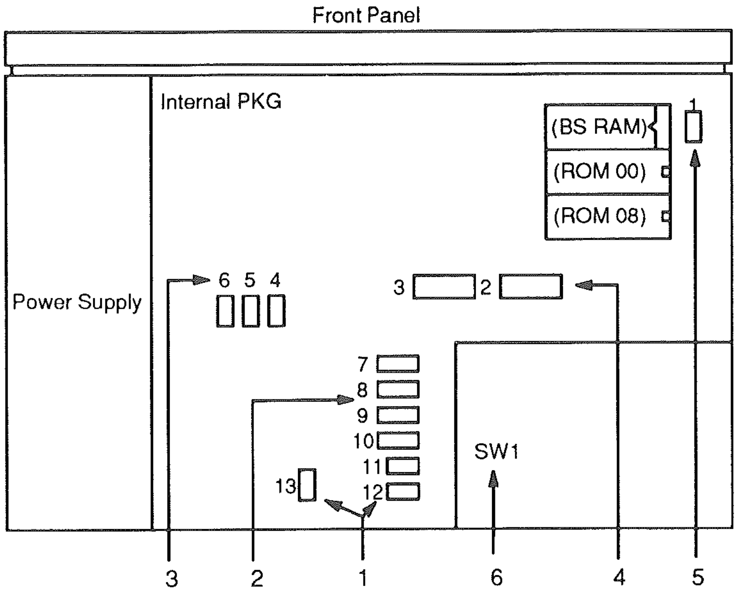


After setting this address, record it so that no other nodes will be set to the same address.

The network address is set to 0 when the Unit is shipped from the factory. When only one network loop will be established, this network address is fine. When two or more network loops will be connected with Bridges, then a unique network address must be established for each loop. When the Network Service Unit will be added to a network other than the loop addressed 0, it must be initially set up on loop 0 and then have it's network addressed changed by issuing a command from an NSB equipped computer. There is no provision for setting a Network Service Unit's network address with hardware switches. Reference the Network Support Board Operation Manual or the SYSMAC Net Overview for details on setting addresses with software.

1-6 Internal Settings

If the top cover is removed from the Network Service Unit, several more settings can be made. These are normally not changed once the Unit has been shipped from the factory.



1. SP11, 12, 13: Power supply jumpers

SP11: Pin for power supply to SL1 (shorted when using upstream optical module).

SP12: Pin for power supply to SL2 (shorted when using downstream optical module).

SP13: Pin for power supply to RS-422 interface (shorted when using twisted pair cabling instead of SYSMAC Net's optical fiber cabling).

Note Short only those pins corresponding to equipment being used with the Unit. For example, if using both the upstream and downstream optic modules, SP11 and SP12 should be shorted, but not SP13.

2. SP7, 8, 9, 10: Transmission Path Selection jumpers.

SP7: Normal Send Data (NSD).

SP8: Back Receive Data (BRD).

SP9: Back Send Data (BSD).

SP10: Normal Receive Data (NRD).

The three terminals on each switch, from right to left, are labeled 2, C, and 1 respectively. When using Optical Fiber Cable, 1 is shorted to C; when using twisted pair cabling instead of SYSMAC Net's optical fiber cabling, C is shorted to 2. If using the Network Service Unit for a non-SYSMAC Net application requiring twisted pair cabling, be sure to change the jumpers in section (1) also. Normally however, all four of these should have jumpers between 1 and C.

3. SP4, 5, 6: Message Length and Receive Buffer Count jumpers.

The following table shows how these three switches are used to vary the maximum buffer size and number of buffers. For SYSMAC Net applications message size should be set to 2K bytes and 15 buffers. Pins SP4 and 5 should be shorted.

Pin Name				
SP4	**SP5**	**SP6**	**Max Message Length**	**Receive Buffer Count**
o	o	o	2048 bytes	3 messages
s	o	o	2048 bytes	7 messages
s	s	o	2048 bytes	15 messages
o	o	s	4096 bytes	3 messages
s	o	s	4096 bytes	7 messages

s: shorted
o: open

4. SP2, 3: Receive Data Timing Adjustment jumper.

SP2: normal use; SP3: back use normally shorted with 1.

5. SP1: Battery Back-up SRAM Setting Pin.

When C and 8K are shorted, SRAM is 8K bytes. When C and 2K are shorted, SRAM is 2K bytes

6. SW1: Switch for opening and closing Power Output to Line Connector.

7. 1: Ch 1, 1 pin FG, ON/OFF
   2: Ch 1, 12 V output, ON/OFF
   3: Ch 1, -12 V output, ON/OFF
   4: Ch 1, 5 V output, ON/OFF
   5: Ch 2, 1 pin FG, ON/OFF
   6: Ch 2, 12 V output, ON/OFF
   7: Ch 2, -12 V output, ON/OFF
   8: Ch 2, 5 V output, ON/OFF

The 5 V output can handle up to about 300 mA per channel. The 12 V and -12 V output gives a total of about 100 mA per channel. Normally, only pin 1 for the frame ground should be shorted, while others open (OFF).

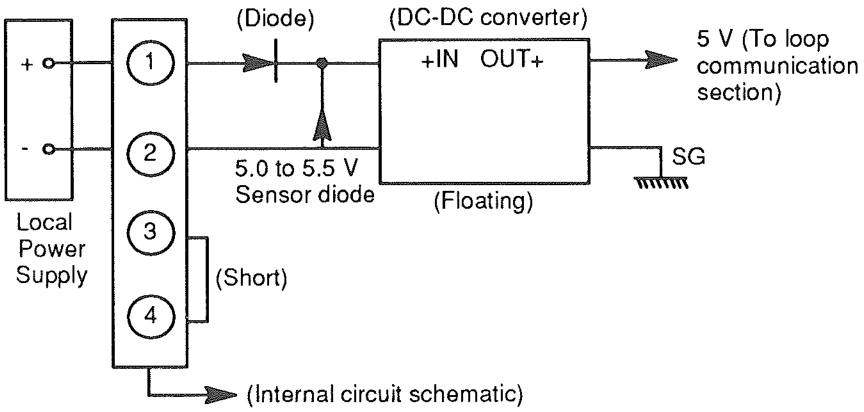
1-7 Connecting the Network Service Unit

The Network Service Unit may be connected to either one or two serial devices and onto the SYSMAC Net LAN. This section explains how to make these connections.

If a SYSMAC Net LAN is being assembled for the first time, and not simply adding the Network Service Unit to an existing LAN, refer to the *SYSMAC Net System manual* for assembly details. It is suggested that assembly of the network loop begin with the Line Server Unit. Each additional Unit is then added sequentially after verifying proper network transmission status. Troubleshooting is decreased significantly. If adding the Network Service Unit to an existing network loop, follow instructions below.

All SYSMAC Net devices have two optical fiber ports, one labeled SL1 and the other labeled SL2. SL1 from an adjacent node should be connected to SL2 of this Unit. Likewise, SL1 of this Unit should be connected onto SL2 of an adjacent node. If SL1 from a node is connected directly to SL1 of another node, then errors will occur. This is a common mistake.

The Network Service Unit can use either its own power supply or the Local Power Supply Unit. The Local Power Supply is an option that allows this node to be powered OFF without disrupting the normal path of data through this network node. When using a Local Power Supply, refer to the following diagram.



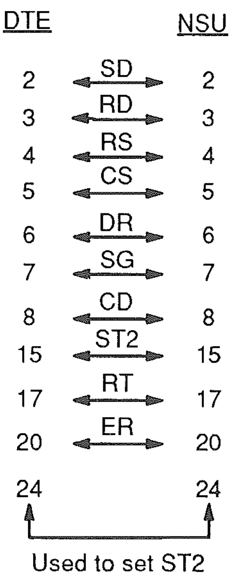
Power is supplied to the Unit preferentially from the Local Power Supply Unit, but if this fails, then the Unit's own power supply will supply power.

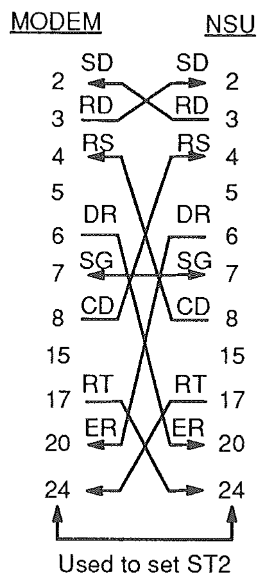
Cable Construction

The two DB-25 ports on the back panel allow serial devices to be connected to the Network Service Unit. The following table shows pin assignments.

Pin	Signal Abbrev.	Signal Name	Signal Direction	Notes
7	SG	Signal ground	<-->	Reference level for data signals
2	SD	Transmitted data	>-->	Serial bit stream sent to Unit
3	RD	Received data	<--<	Serial bit stream received by the DTE from the Unit
4	RS	Request to send	>-->	--
5	CS	Clear to send	<--<	High level indicates the Unit is ready to accept data from the DTE
6	DR	Dataset Ready	<--<	Software dependant
20	ER	Equipmet ready	>-->	Hardware-wise usually III
8	CD	Carrier detect	<--<	Software dependant
15	ST2	Send timing 2	<--<	When communications control device directly attached, ST2 and RT are provided by the NSU
17	RT	Receive timing	<--<	--
24	ST1	Send timing 1	Modem RT	Used when modem connected
9	V1	12 V	<--<	Selected by internal (about 50 mA)
10	V2	-12 V	<--<	Selected by internal (about 50 mA)
18	V3	5 V	<--<	(About 300 mA)
25	RT1	Receive timing	Modem ST2 >-->	Used when modem connected

The following diagrams are examples of how a cable should be assembled if the Unit is connected to DTE (data terminal equipment) or a modem.





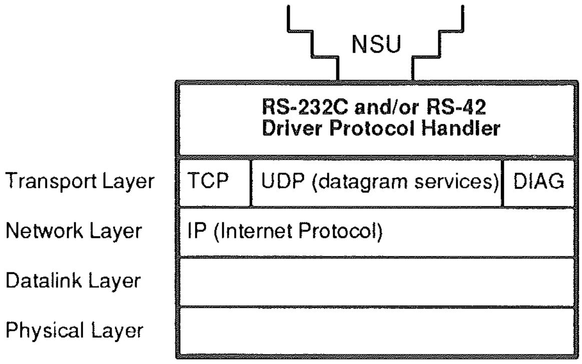
SECTION 2
Communication

Introduction

This section will discuss the setting of protocols required for data transmission. Also discussed here are the commands that can be issued to the Network Service Unit from a computer on the SYSMAC Net network.

2-1 Data Protocol and Settings

The Network Service Unit communicates in accordance with the ISO model of OSI as shown in the following diagram:



Layers in the NSU

When communicating with other nodes on the SYSMAC Net, standard datagram communication is used. Datagrams are 2K-byte packets of information passed between nodes of the network loop composed of a header and data. The address of the destination is included in the header of each packet. The packet will then be received by the proper node. The 2000-byte data portion of the datagram may be in either ASCII or binary. Datagrams have the advantage of being largely independent of the network connection protocol or speed of the node. The disadvantage is that even if the data is not received for some reason, the sending node has no way of knowing this. For more information, refer to the *SYSMAC Net System Manual*.

The Unit permits communication between many kinds of serial devices and SYSMAC Net nodes, but transmission protocol must be set before transmission.

Transmission protocols include asynchronous (HDLC/SDLC) and synchronous (1200, 2400, 4800, 9600 bps). The specifics of the data format differ depending on the protocol, but as a general rule a request portion and data is sent Through the network when transmitting, and an answer portion and data from the network is received.

Timing Notes

A computer equipped with a Network Support Board can communicate with a serial device connected to the Network Service Unit. Communication from the computer to the Network Service Unit can cross network bridges. Time required for a message to be sent from a computer, across a network Bridge, to the Network Service Unit's serial device is determined as follows: A 2K-byte message from the computer to the Bridge requires 8 ms. Crossing the Bridge from LAN1 to LAN2 requires 20 ms, and this time does not vary with the size of the message. From the Bridge to the Network Service Unit then takes another 8 ms. It takes 10 ms to convert the signal to serial code. Transmission time from the Network Service Unit to the serial device is then dependent on the baud rate chosen. A 2K-byte message at 9600 baud requires about 2 seconds across a Bridge.

DMA (direct memory access) is used to direct messages through the Unit. Serial communication is generally the slowest part of SYSMAC Net transfers. It is best to send a few messages, wait for a response, and repeat this process until finished transmitting. The Unit's SYSMAC Net side has 1 send buffer and 15 receive buffers, and messages are processed one at a time. On the serial port side, messages are transferred in 8-byte units.

2-1-1 General Settings

An asynchronous/no-protocol setting uses start and stop bits to determine where characters start and stop. A "character" could be a letter, space, digit, or other symbol used to represent data. This asynchronous/no-protocol setting is typically used between PCs and low-speed printers, between two PCs, or in some cases between a host and its terminals. When using the "no-protocol" setting, delimiter characters, such as carriage return, must be defined to indicate the boundary between strings or lines.

The Network Service Unit accepts seven commands, and has a function similar to DGIOX on the Network Support Board software. SET is used to establish settings for the communication parameters used at the Unit. It has the following format:

Format: SE[t] parameter 1 parameter 2

Parameters

Parameter 1

F:	flow control
N:	port name
R:	communications mode
S:	speed
I:	initialization
L:	number of bits, parity, stop bits
T:	monitor timer
H:	device output delimiter
C:	device input delimiter

parameter 2

S=	9600:	Speed
L=	8N1:	Number of bits, parity,stop bits
F=	X:	Flow control
N=	SUM02 00001101:	Port name and address
R=	I:	Communications mode
T=	60:	Monitor timer
H=	CR:	Device input delimiter
C=	2F:	Device output delimiter

For more information concerning SHOW command refer to *Section 2-1-3 The SHOW Command.* Other available commands are shown in the following diagram:

Command	Abbr.	Function
Mail	M	Transmit data
Show	SH	View this node's parameters
Set	SE	Set this node's paramerters
Quit	Q	Enter idle mode
?	?	Help
Examine	E	Query any name's address
Diagnostic	D	Diagnose nodes attached to the loop

The following examples show settings for establishing protocol on the Network Service Unit. When the CRT from which these commands are being sent displays a > prompt, this indicates that the Network Service Unit is in the receiving state. When the * shows, this indicates that the Unit is in a transmitting or idle state. (When the Unit is set to the full-duplex mode instead of the half-duplex mode, then no prompt appears.)

The Unit will not transmit while it is receiving, so the * works for both states. This ensures that the display of the device will not be corrupted by data coming in over the network. For more information concerning the transmitting and receive states, refer to *Section 2-1-2 Half-duplex or Full-Duplex Settings.*

Examples of using SET to establish communication protocol follow.

Setting Flow Control

This determines if XON/XOFF or a delay between transmissions is used. With XON/XOFF flow control, the characters XON (11H) and XOFF (13H) are used to indicate ability and inability to receive, respectively. In this case, those characters are NOT sent to the destination.

It is also possible to specify a delay between transmissions as a means of flow control. This delay value, which is part of the configuration information held in RAM, can range from 0 to 5 minutes. More about these flow control commands can be found in *Section 2-1-4 Flow Control.*

```
>SET F X
 *OK
>
```

Change Port Name

Names are assigned to each of the Unit's two serial ports using SET. Names are composed of up to eight characters with the first character being a letter. The same name may be given to different ports.

```
>SET N SUM03
 *OK
 >N
```

For information on setting the port's addresses, refer to *Section 2-1-5 Names and Addresses.*

Set Communications Mode

The communication mode may be set to either half-duplex (I, for interactive) or full-duplex (N). For more information refer to *Section 2-1-2 Half-duplex or Full-Duplex Settings.*

```
>SET R N
*OK
>
```

When the parameters are in error, the following is displayed:

```
>SET BAD INFO
*PARAMETER ERROR
>
```

Note The L and S commands do not take effect until reset or next power-up. By setting parameter 1 to I, the system can be re-initialized.

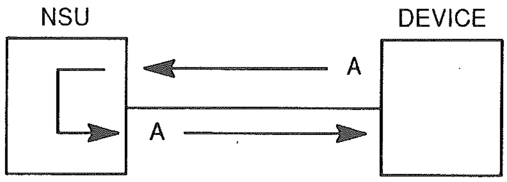
```
>SET I
```

2-1-2 Half-duplex or Full-Duplex Settings

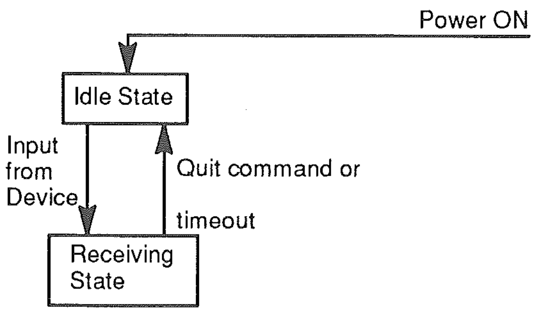
The Network Service Unit can be attached to interactive devices like terminals, or full-duplex devices such as host computers. Modems are generally full-duplex. The SET command is used here to specify which of these two transmission modes is to be used. The R command of the second SET parameter specifies whether a half-duplex or full-duplex mode will be used.

Half-duplex Mode

In this mode, input from the device is echoed back. An echo is a feature that causes characters entered at a keyboard to be displayed locally on your screen.



The transmit and receive states for the Unit are indicated by a > or * prompt. Transition between the two states are shown below.



In the receive state, the prompt ">" is output by the NSU. In this state the Unit will respond to commands issued to it by other network devices. For instance, the user might enter the command:

```
>M 00001002 SEND-DATA001
```

The input is echoed back to the terminal from which it was issued.

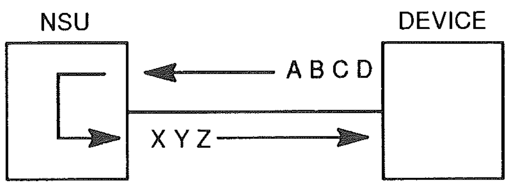
>Q

This command puts the NSU back into the idle state. The following message shows data coming in from the NSU:

*M 00000101 RECEIVE-DATA0001

Full-Duplex Mode

Input from the device is not echoed in this mode. The following diagram shows the Network Service Unit and serial device communicating in full-duplex.



2-1-3 The SHOW Command

SHOW is used to view the parameters currently set on the Network Service Unit. When issuing this command from a computer on the network, type SH after the > prompt. For example:

>SH
*S=9600: Speed
*L=8N1: Number of bits, parity, stop bits
*F=X: Flow control
*N=SUM02 00001101: Port name and address
*R=I: Communications mode
*T=60: Monitor timer
*H=CR: Device input delimiter
*C=2F: Device output delimiter

These commands are further explained below:

1. Speed
   One of the values 1200, 2400, 4800 and 9600 is displayed.

2. Number of Bits, Parity, Stop Bits
   Number of bits is 7 or 8; Parity is E for even, O for odd, or N for none; and stop bits is 1 or 2.

3. Flow Control
   X for XON/XOFF flow control, or N for no flow control.

4. Port Name and Address
   The port's name is displayed as a character string, and its address as an 8-digit number.

5. Communication Mode
   I for interactive, or N for full-duplex.

6. Monitor Timer
   When in receive mode, if no input is received for the number of seconds specified by this option, then the system automatically will revert to idle mode. The maximum setting is 32,767 seconds.

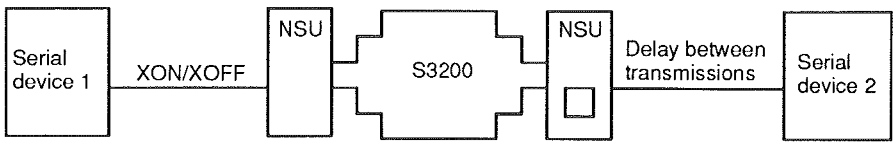
7. Device Output Delimiter
   Specifies the code treated as a delimiter for purposes of transmission to the device.

   CR: carriage return
   LF: line feed
   CL: .carriage return and line feed
   LC: line feed and carriage return

8. Device Input Delimiter
   Gives the character which acts as delimiter for information transmitted from the device to the Network Service Unit. When two characters are specified, the first is thrown away whenever it occurs; then if the next character input from the device matches the second, it is considered to be the end of the line.

2-1-4 Flow Control

Networks are often established with serial devices connected to two Network Service Units. The Network Service Unit provides the ability to communicate between devices using different flow control, speeds, and coding. This is accomplished by a buffer internal to the Network Service Unit. This function is limited by the size of the buffer, but in principle this means the sender can ignore the flow control settings of the destination serial device.

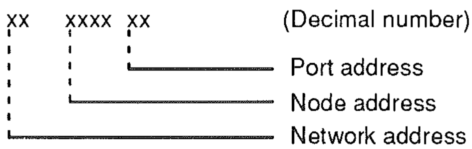


2-1-5 Names and Addresses

Names and addresses are assigned to the Network Support Unit's ports. The name is specified with the SET command. The address is determined by the Net Service Unit's node address and port address.

Names are composed of up to eight characters, and the first must be a letter. Examples include: NSU01, TTY100, or JEAN.

Addresses are 8-digit numbers unique within a given network. The 8 digits are composed of the network, node and port numbers as shown below.



An address can be any decimal number from 00 to 99. The Unit is set at the factory to network 00. Settings must be initially made from within the Unit's own network, but can then be changed from a computer located on another network loop. Sending data to other networks via a bridge requires a routing table. Settings for the Network Service Unit are stored in SRAM, so they are saved even after power has been turned OFF. For more information on routing tables, refer to the *SYSMAC Net System Manual.*

The node address is set by the rotary DIP switches on the back of the Unit. The port address is always 01 or 02.

Examples:

00010001	Network 00, node 0100, port 01
00000502	Network 00, node 0005, port 02

2-2 The MAIL Command

This command is used to send data to a specified network address. There is no confirmation of the transmission with this command. Its format is as follows:

M[ail] parameter 1 parameter 2

Parameters

parameter 1: address; destination address
parameter 2: data; data to transmit (up to 2000 bytes)

For example, inputting >"M 00000102 HELLO!" would send the message HELLO! to the destination with network address 00, node address 1, and port address 2.

If the parameters are specified incorrectly, the following error message is displayed: *PARAMETER ERROR

In idle state (as indicated by the *), data received over the network will be sent from the Network Service Unit to the device:

*M 00001301 WILLKOMMEN

The message WILLKOMMEN has been received from the station with network address 00, node address 13, and port address 1.

2-3 The QUIT Command

This command is used to quit the receiving mode, indicated by the > prompt, and enter the idle/receive mode, indicated by the *. The Q command has no parameters.

The half-duplex mode enters the receiving mode whenever there is an input, and it then displays the > prompt. However, in full-duplex mode no prompt is sent and consequently, this command is not applicable in the full-duplex mode.

An example of the command: >Q.

2-4 The EXAMINE Command

This command is used to query the address of some node based on its node address. Its format is as follows:

E[xamine] parameter

Parameters

parameter: name

For example, inputting >"E SUM01" would return this message:

*N=SUM01 00000101

This indicates that the address of the node named SUM01 is on network address 00, node address 0001, and on port 01. If multiple nodes on the loop have the same name, only the address of the first one found will be displayed.

When EXAMINE has been accepted in full-duplex mode, no additional EXAMINE commands can be accepted until the first is complete. If other commands are given they will be ignored.

2-5 The HELP Command

This command is used to display a list of commands available to the Network Service Unit. The format of the Help command is "?". There are no parameters with this command.

2-6 The DIAG Command

This command is used to diagnose other network nodes with one of three tests. These tests are;

1. status read.
2. memory read.
3. echo back.

The command works by sending the desired test to a specified node. TheNetwork Service Unit should then be returned to the idle (*) mode. The response to the diagnostic request is then returned. "LOOP ERROR" will be displayed if the network cannot transmit the data.

The format of this command is as follows:

D[iagnostic] parameter 1, parameter 2, data

Parameters

Parameter 1:

Address of node to be diagnosed.

Parameter 2:

DIAG subcommand as follows:

01: status read request
03: memory read request
05: echo back request

Data: (when parameter 2 is a:)

status read request:	none
memory dump request:	segment, address offset, number of bytes; format is hexadecimal; number of bytes less than 100H (256)
echo back request:	data to be echoed (up to 2000 bytes)
memory write request:	segment, address offset, number of bytes, and data to write,where number of bytes must be less than 100H (256)

Status Read

Assume we want to perform a status read to address 00000100. The command is input with the address and the code for this test, 01.

command: >D 00000100 01
response: *D 00000100 02 XX.00.02 ---

The "02" shows the response to the status read. "XX" is the return status. Next comes 50 bytes of status information displayed in hex.

The return status is represented for all diagnostic tests with the following values:

00........Normal
01........Node address error
02........Invalid command
03........Maintenance read error
04........Status read error
05........Memory write error

Memory Read

Assume we want to read 10H bytes of memory at segment 0020H, offset 0010H from node address 00000100. The following is input:

command: >D 00000100 03 0020.0010.0010
response: *D 00000100 04 XX.0020.0010.0010.05.A3.F0...

The 04 is the response to the memory read. The XX is the return status. Next comes the segment, offset, and number of bytes requested, followed by the data itself.

The segment, offset, and number of bytes are all given as 4-digit hexadecimal values. The maximum number of bytes that may be read is 100H, or 256.

Echo Back

The following session shows an echo back request issued to node address00000100:

>D 00000100 05 ABCDEF
*D 00000100 06 ABCDEF

The 06 represents the response to the echo back request. The information following is the echoed back data.

SECTION 3
Memory Configuration

Introduction

This section will explain how the Network Service Unit's memory is allocated and accessed. The internal operations of the Unit will be explained.

3-1 Memory Map Overview

The Network Service Unit's available memory is divided into nine areas. Each of these areas is shown below with their hexadecimal addresses:

Address	Description
000000 through 00FFFF	ROM 64k bytes, 32 kW (270256 x 2, 32K bytes x 2)
010001 through 010FFF	Battery back-up RAM 2K bytes
020001 through 020007	Optical LAN
030001 through 030007	I/O LSI, 8255
040001 through 040007	Timer LSI, MSM 82C53 - 5GS 2 µs, 131 ms pulse max. 1: same 2: input clock, 31.25 kHz 32 µs pulses, 2.1-second pulses max.
0D0000 through 0D001F	CCU2 - R6 8561P High-speed CH - DMA operation only
0E0000 through 0E001F	CCU1 - R6 8561P High-speed CH - DMA operation only
0F0000 through 0F00FF	DMACLSI - HD68450 CH 0: optical LAN receiving CH 1: optical LAN sending CH 2: CCU1 receiving CH 3: CCU1 sending
100000 through 17FFFF	DRAM 512K bytes, 256 kW

Operation Architecture

The operation of the Unit is managed by an 8 MHz Motorola 68000 chip. Three types of memory are available:

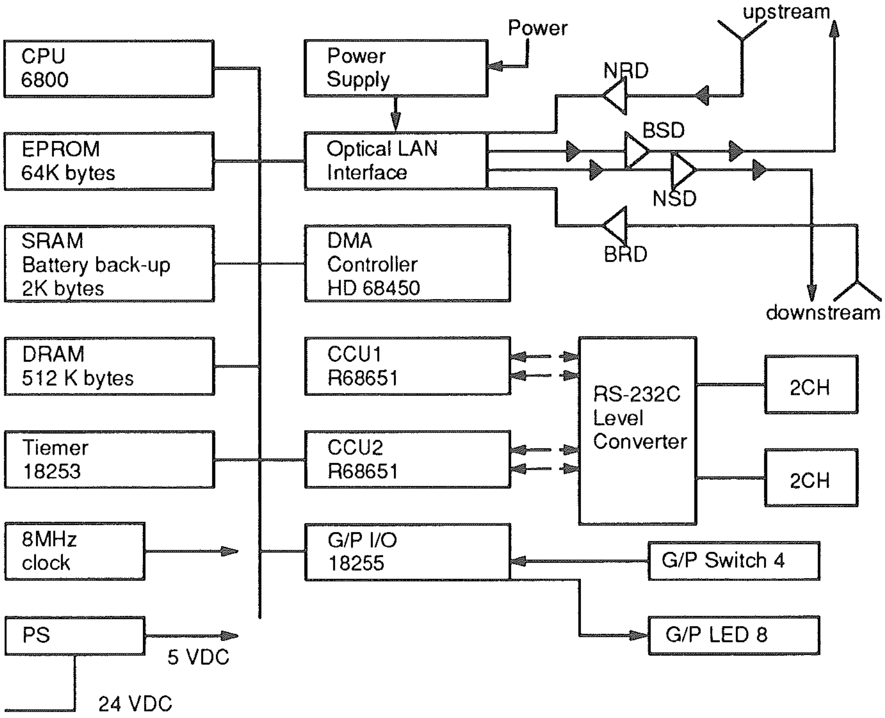
1. EPROM 64K bytes (Two 270256 chips),
2. SRAM 2K bytes (battery backed-up)
3. DRAM 512K bytes

Direct memory access (DMA) is available for communication passing through the Unit's channel 1 serial port. The second serial port does not have DMA access. The DMA controller** manages 4 channels:

1. Channel 0=LAN receiving
2. Channel 2=CCU1 receiving
3. Channel 1=LAN sending
4. Channel 3=CCU1 sending

There are three timers operating in the Unit via use of an i8255 timer. Timers 0 and 1 have an input clock frequency of 0.5 MHz, yielding 2 ms pulses. Timer 2 is used as the watchdog** timer. Timer 2 has an frequency of 31.25 kHz, yielding 32 ms pulses. It is normally reset every 1 second, but may be adjusted to be reset every 2 seconds.

Finally, there is a second i8255 chip responsible for I/O which the user may determine. Pin 4 of SW1 and LED indicator 8 are used for this purpose. This switch could be used as follows: When power is turned ON, if the switch is ON, increment data would be written into a particular area of RAM. Normally, with the switch OFF, that area would be checked to make sure the data was correct. If the data is not correct, one of the general-purpose LEDs would light. The responsibility for ensuring correct operation of the SRAM lies with the software. These components work together to manage operation as indicated in the following diagram:



Note that both the optical LAN interface and serial channel one have direct access to DMA.

3-2 Memory Map Details

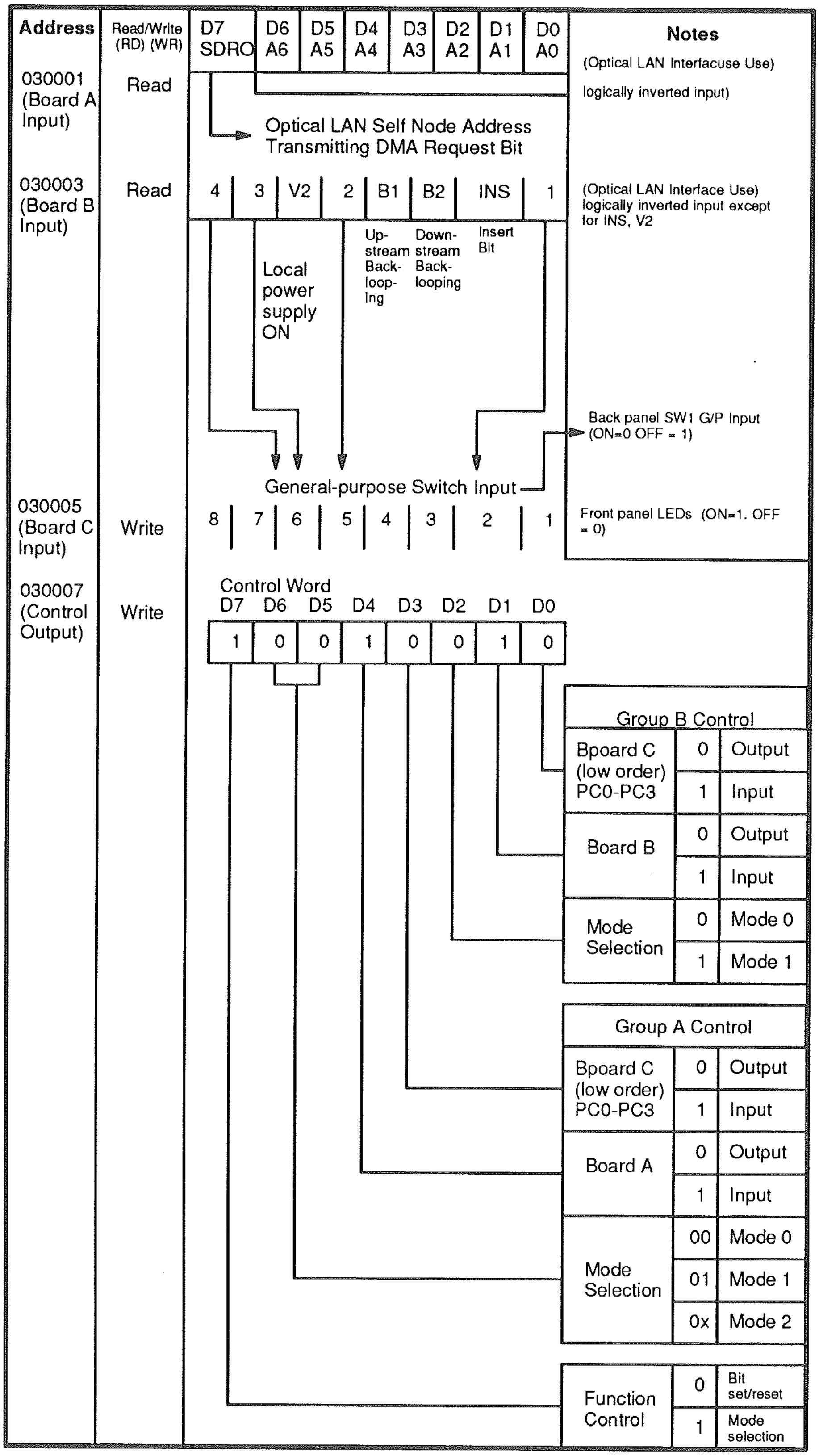
Information is processed by the CPU in a hierarchy. Different pieces of hardware have different CPU interrupt levels to access the CPU. In the chart below, hardware priority 1 is defined to have the highest priority.

Interrupt Level	Hardware Priority	Description
Level 7	1	Timers 1 & 2 are used as general purpose, watchdog timers. In normal processing reset every 1 second, but can set to a maximum of 2 s.
Level 6	5	Same as above.
Level 5	4	Timer 0. Input clock of 0.5 MHz, maximum internal is 130 ms.
Level 4	6	Interrupt from optical LAN is finished
Level 3	3	Interrupt from CCU2
Level 2	2	Interrupt from CCU1
Level 1	7	Interrupt from DMA controller
Level 0	-	No interrupt

Levels 4, 5, 6 and 7 use automatic CPU-internal vectoring, while levels 1, 2 and 3 require each LSI to generate the interrupt vector.

3-2-1 G/P I/O Word and Bit Assignments

The general purpose I/O circuit is managed by an i8255. The eight bits of the four odd words between 030001 and 030007 are assigned as shown in the diagram on the following page.

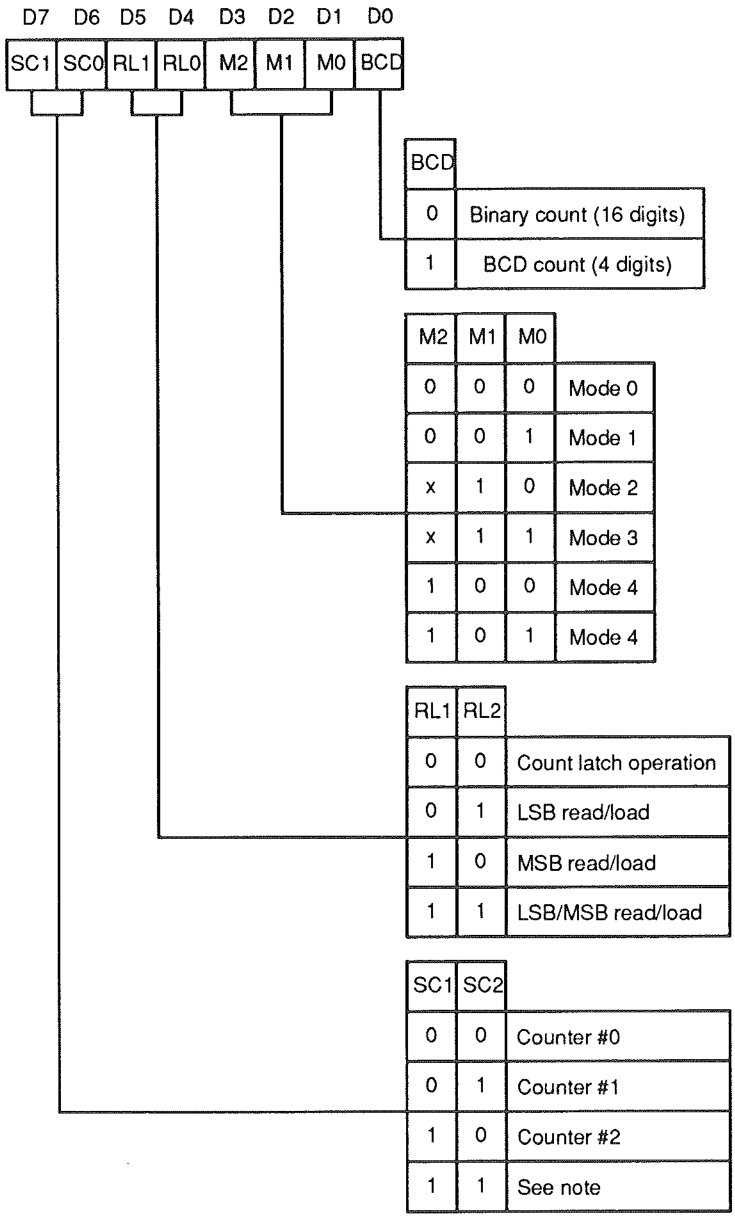


3-2-2 Timer Word and Bit Assignments

The two general purpose timers and the watchdog timer are managed by an i8255. Timers 0 and 1 are general purpose timers. These timers use words 040001 and 040003 respectively.

Timer 2 is the watchdog timer, with the non-maskable interrupt. This timer occupies word 040005.

Word 040007 is responsible for timer control. Its eight bits are allocated as shown in the following diagram.



The diagram indicates that modes other than 0 are possible, but the Unit uses only mode 0 and its level interrupts described in *Section 3-2 Memory Map Details.*

3-2-3 DMA Word and Bit Assignments

The DMA controller manages address 0F0000 through 0F00FF. It has an interrupt level of 1.

Control is managed by the Motorola HD68450 chip, with registers assigned as described below:

READ WRI	Word Length	Regi-ster	Add-ress	Regi-ster	Add-ress	Regi-ster	Add-ress	Regi-ster	Add-ress
R/W	1 BYTE	CSR0	F0000	CSR1	F0040	CSR2	F0080	CSR3	F00C0
R	1 BYTE	CER0	F0001	CER1	F0041	CER2	F0081	CER3	F00C1
R/W	1 BYTE	DCR0	F0004	DCR1	F0044	DCR2	F0084	DCR3	F00C4
R/W	1 BYTE	OCR0	F0005	OCR1	F0045	OCR2	F0085	OCR3	F00C5
R/W	1 BYTE	SCR0	F0006	SCR1	F0046	SCR2	F0086	SCR3	F00C6
R/W	1 BYTE	CCR0	F0007	CCR1	F0047	CCR2	F0087	CCR3	F00C7
R/W	1 WORD	MTC0	F000A	MTC1	F004A	MTC2	F008A	MTC3	F00CA
R/W	2 WORD	MAR0	F000C	MAR1	F004C	MAR2	F008C	MAR3	F00CC
R/W	2 WORD	DAR0	F0014	DAR1	F0054	DAR2	F0094	DAR3	F00D4
R/W	1 WORD	BTC0	F001A	BTC1	F005A	BTC2	F009A	BTC3	F00DA
R/W	2 WORD	BAR0	F001C	BAR1	F005C	BAR2	F009C	BAR3	F00DC
R/W	1 BYTE	NIV0	F0025	NIV1	F0065	NIV2	F00A5	NIV3	F00E5
R/W	1 BYTE	EIV0	F0027	EIV1	F0067	EIV2	F00A7	EIV3	F00E7
R/W	1 BYTE	CPR0	F002D	CPR1	F006D	CPR2	F00AD	CPR3	F00ED
R/W	1 BYTE	MFC0	F0029	MFC1	F0069	MFC2	F00A9	MFC3	F00E9
R/W	1 BYTE	DFC0	F0031	DFC1	F0071	DFC2	F00B1	DFC3	F00F1
R/W	1 BYTE	BFC0	F0039	BFC1	F0079	BFC2	F00B9	BFC3	F00F9
R/W	1 BYTE	GCR0	F00FF	--	--	--	--	--	--

3-2-4 CCU Word and Bit Assignments

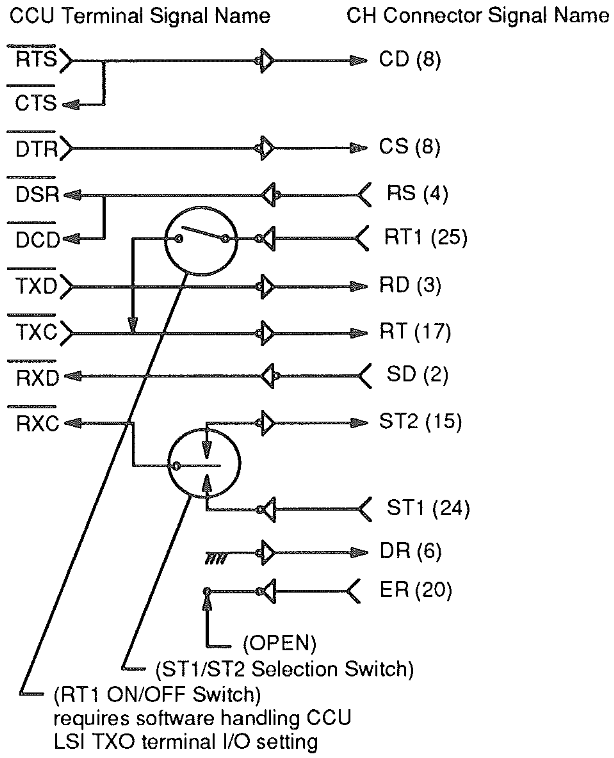
The two CCU chips, Motorola 68561Ps, manage input from the Unit's serial ports. The chip managing the first serial port, CCU1, uses addresses 030000 through 0E001F. It has an interrupt level of 2. Data has access to DMA through this port.

The chip managing the second serial port, CCU2, uses addresses 0D0000 through 0D001F. It has an interrupt level of 3. DMA access is not available for data entering through this port.

Both received and transmitted data is handled on a first-in first-out (FIFO) basis. The following diagram shows MPCC register bit assignments.

HEX ADDR	Address Lines					Bit Number								
	A4	A3	A2	A1	A	7	6	5	4	3	2	1	0	
00	0	0	0	0	0	RDA	EOF	0	C/ PERR	FRE- RR	ROV- RN	RA/B	RID- LE	Receiver Status Register Status
01	0	0	0	0	1	--	RDS REN	DON EEN	PSY NEN	STR SYN	2AD CMP	RAB TEN	RR- ES	Receiver Control Register (RCR)
02	0	0	0	1	0	Received Data (RxFIFO)								Receiver DAta Register (RCR)
04	0	0	1	0	0	Receiver Interrupt Vector Number (RIVN)								Receiver Interrupt Vector Number Register (RIVNR)
05	0	0	1	0	1	RDA IE	EOF IE	--	C/PE-RR IE	FRE-RR IE	ROV-RN IE	RA/B IE	--	Receiver Interrupt Enable Register (RIER)
06	0	0	1	1	0	1	1	1	1	1	1	1	1	(null)
07	0	0	1	1	0	1	1	1	1	1	1	1	1	(null)
08	0	1	0	0	0	TDR A	TFC	0	0	0	TUN- RN	TFE- RR	0	Transmitter Data Register (TSR)
09	0	1	0	0	1	TEN	TDS REN	TICS	THW	TLA- ST	TS- YN	TABT	TRES	Transmitter Control Register (TCR)
0A	0	1	0	1	0	Transmitted Data (TxFIFO)								Transmitter Data Register (TDR)
0C	0	1	1	0	0	Transmitter Interrupt Vector Number (TIVN)								Transmitter Interrupt Vector Number Register (TIVNR)
0D	0	1	1	0	1	TOR- A IE	TFC IE	--	--	--	TUN- RN IE	TFE- RR IE	--	Transmitter Interrupt Enable Register (TIER)
0E	0	1	1	1	0	1	1	1	1	1	1	1	1	(null)
0F	0	1	1	1	1	1	1	1	1	1	1	1	1	(null)
10	1	0	0	0	0	CTS	DSR	DCD	CTS LVL	DSR LVL	DCD LVL	0	0	Serial Interface Status Register (SISR)
11	1	0	0	0	1	RTS LVL	DTR LVL	--	--	--	EC- HO	TEST	NRZI	Serial Interface Control Register (SICR)
12	1	0	0	1	0	x	x	x	x	x	x	x	x	(reserved)
13	1	0	0	1	1	x	x	x	x	x	x	x	x	(reserved)
14	1	0	1	0	0	Serial Interrupt Vector Number (SIVN)								Serial Interrupt Vector Number Register (SIVNR)
15	1	0	1	0	1	CTS IE	DSR IE	DCD IE	--	--	--	--	--	Serial Interrupt Enable Register (SIER)
16	1	0	1	1	0	1	1	1	1	1	1	1	1	(null)
17	1	0	1	1	1	1	1	1	1	1	1	1	1	(null)
18	1	1	0	0	0	--	--	--	--	--	--	CTL- EX	ADD- EX	Protocol Select Register 1 (PSR1)
19	1	1	0	0	1	WD/	Stop Bit SEL		CHAR LEN SEL		PROTOCOL SEL			Protocol Select Register 2 (PSR2)
						BYT	SB2	SB1	CL2	CL1	PS3	PS2	PS1	
1A	1	1	0	1	0	BOP Address/BSC & COP Pad								Address Register 1 (AR1)
1B	1	1	0	1	1	BOP Address/BSC & COP SYN								Address Register 2 (AR2)
1C	1	1	1	0	0	Baud Rate Divider (LSH)								Baud Rate Divider Register 1 (BRDR 1)
1D	1	1	1	0	1	Baud Rate Divider (MSH)								Baud Rate Divider Register 2 (BRDR 2)
1E	1	1	1	1	0	--	--	--	PSC DIV	TCL- KO	PCL KIN	CLK SEL		Clock Control Register (CCR)
												CK2	CK1	
1F	1	1	1	1	1	PAR- EN	ODD PAR	--	--	CTL CRC	CRC PRE	CRC SEL		Error Control Register (ECR)
												CR2	CR1	

The serial ports can be programmed to respond to two switches, most often when a modem is connected. The send timing (ST) and receive timing (RT) signals use the transmit and receive pins as shown in the next diagram.



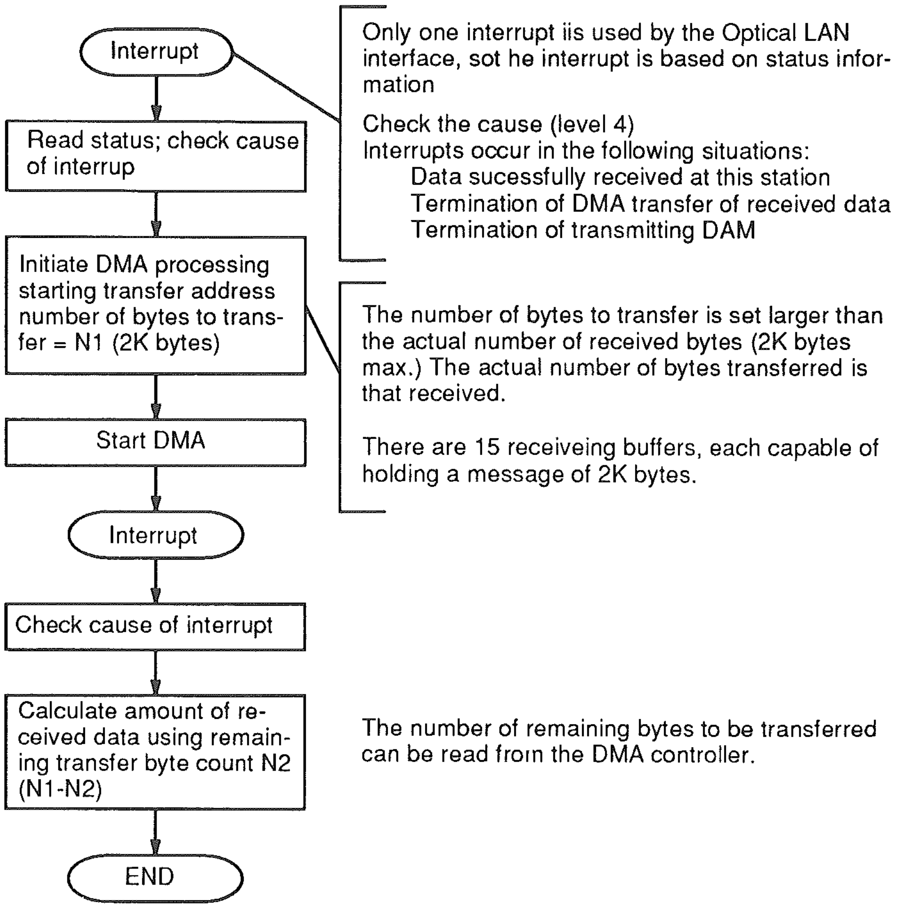
3-2-5 Optical LAN Word and Bit Assignments

The Optical LAN interface is assigned words 020001 through 020007. Inaddition, words 030001 and 030003 are used for self node address and LAN status respectively. The Optical LAN interface does not have a chip to manage its operations; instead it uses DMA.

When data is to be transmitted from the Network Service Unit over the SYSMAC Net optical LAN, three processes occur:

1. The data to be transmitted is made available to the CPU.
2. A DMA command issues the starting memory address and the number ofbytes to transmit.
3. Use of DMA is initiated.

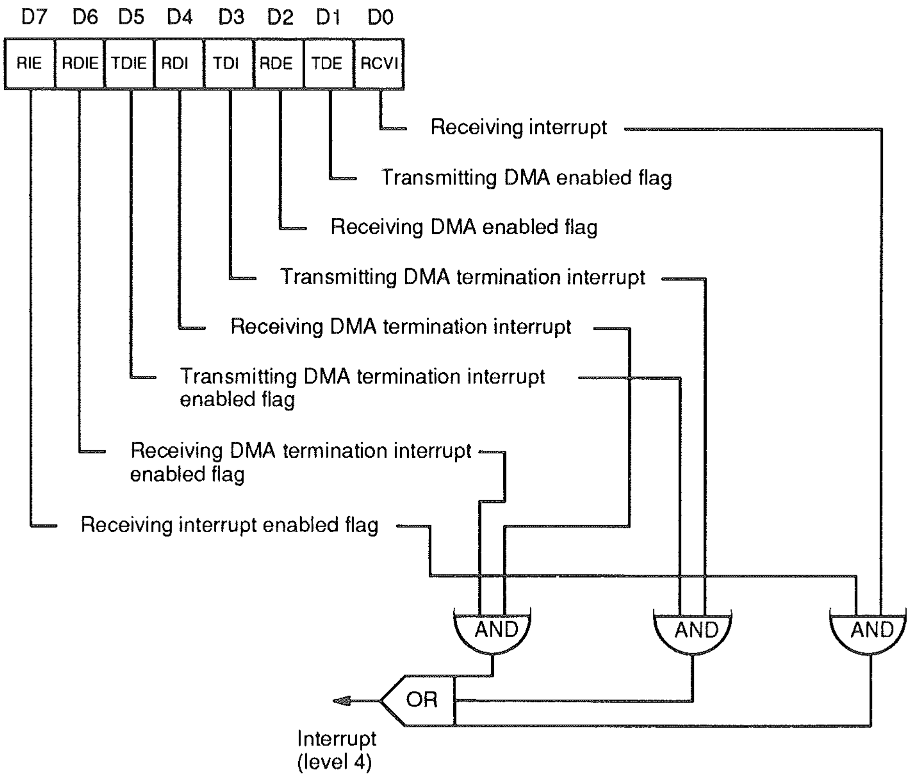
When data is received over the SYSMAC Net LAN to the Unit, fifteen 2K-byte receive buffers are available that have access to the CPU via DMA. The next flow chart indicates the procedure that occurs during reception:



The CPU is accessed on a byte basis with odd addresses; the NSU with the low-order 8 bits of D0 to D7. D8 to D15 are not involved in processing.

Control Status (020001 Read)

The following diagram shows bit assignments for word 020001.



D7, D6, D5, D2, and D1 show the status of flags as set by commands.

The receiving DMA termination interrupt and sending DMA termination interrupt indicate the cause of the interrupt. The receiving interrupt bit is cleared when the receiving DMA enabled flag is set.

An Optical LAN Interface error occurs in the CPU whenever any of the above three items (D6, D5, or D2) is 1 (ON).

When the interrupt enabled flags are 0, interrupts are prohibited, but they are not masked and their status may still be sensed.

The bit responsible for RIE, Receiving Interrupt Enabled, is a flag which enables interrupts to the CPU when the NSU has successfully received or broadcast a message addressed to the current node. A value of 1 implies interrupts are enabled, 0 implies prohibited.

The bit responsible for RDIE, Receiving DMA Termination Interrupt Enabled, is a flag which enables the CPU to be interrupted when a received message to the CPU memory is complete. A value of 1 implies interrupts are enabled, 0 implies prohibited.

The bit responsible for TDIE, Sending DMA Termination Interrupt Enabled, is a flag which enables interrupt of the CPU when a message to be transmitted has moved from the CPU memory to buffer memory. A value of 1 implies interrupts are enabled, 0 implies prohibited.

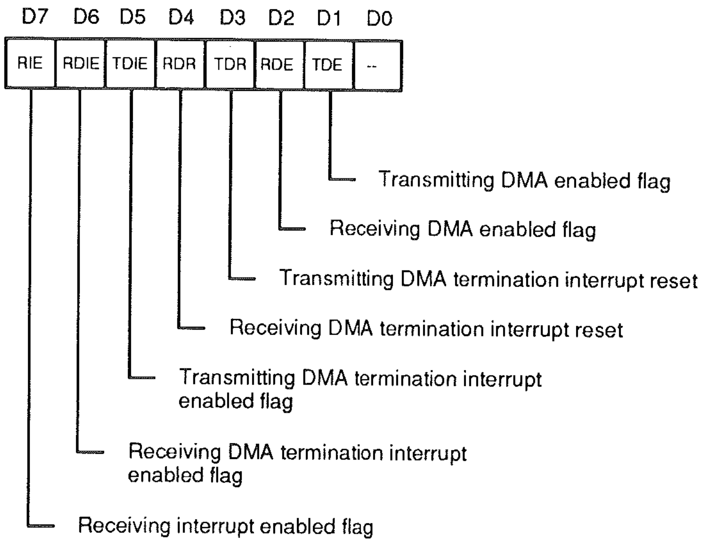
The bit responsible for RDI, Receiving DMA Termination Interrupt Reset, resets the receiving DMA termination interrupt to 1.

The bit responsible for TDI, Sending DMA Termination Interrupt Reset, resets the sending DMA termination interrupt to 1.

The bit responsible for RDE, Receiving DMA Enabled, is a flag which enables received data to be transferred from the Optical LAN Interface buffer to the CPU memory. A value of 1 implies enabled, 0 prohibited.

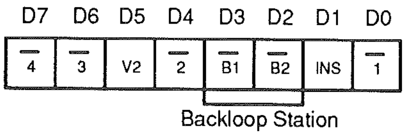
The bit responsible for TDE, Sending DMA Enabled, permits transfer of data from the CPU memory to the Optical LAN Interface's send buffer. A value of 1 implies enabled, 0 prohibited.

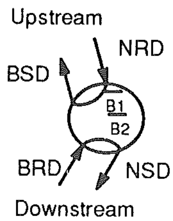
When word 020001 is assigned to write, bits are assigned in the same fashion except D0. The following diagram shows bit assignments for word 020001 write.



Optical LAN Status (030003 Read)

The following diagram shows bit and switch assignments for word 030003.





$\overline{B1}$	$\overline{B2}$	Station Status
1	1	Normal
0	1	Backlooping upstream
1	0	Backlooping downstream
1	1	Loop error

Note that B1 and B2 in the table above are reversed from their traditional NSB meanings.

INS gives the insert status (1 means insert). Also, V2 with the value of 1 indicates that the Local Power Supply Unit is ON. 4, 3, 2 and 1 are the general-purpose switch inputs.

Optical LAN Control Command (020003 Write)

The following diagram shows bit and switch assignments for word 030003.

D7	D6	D5	D4	D3	D2	D1	D0
--	--	--	--	--	--	INS	RST
						Insert	Reset

When the insert flag, INS, has the value of 1 it means that the node is in the loop and communication is possible. It is cleared when the CPU is powered ON.

Setting the reset (RST) bit to 1 resets the send, receive, interrupt enable flags and the DMA enable flags. The INS bit is not cleared however.

Self-node Address (030001 Read)

The following diagram shows bit assignments for word 030001.

D7	D6	D5	D4	D3	D2	D1	D0
SD-RQ	$\overline{2^6}$	$\overline{2^5}$	$\overline{2^4}$	$\overline{2^3}$	$\overline{2^2}$	$\overline{2^1}$	$\overline{2^0}$

The self-node address, with the bits reversed from their NSB meaning, is given by D6 to D0. D7 is treated as masked for this address.

SDRQ (Send DMA Request Signal Input) indicates request ON with a value of 0, OFF with a value of 1.

Receive Data (020007 Read)

Outputting the receive DMA enabled bit of the Optical LAN's DMA control command.

This word receives data without using the DMA controller. The read is performed with the receive DMA enabled flag of the control status after

When all data is read, the receive DMA flag drops, and the receive DMA termination interrupt flag is set.

Only the low-order eight bits of the data are used.

Send Data (020007 Write)

This word writes send data without invoking the DMA controller. The write is performed after outputting the send DMA enabled control bit command of the Optical LAN Interface to the DMA, and confirming that the D7 bit of the self-node address (SDRQ) is 0. On the last send data only, the high-order D8 bit is set to 1, the low-order D0 to D7 bits set to the last data, and 020006 and 020007 word access is performed.

Only the low-order eight bits of the data are used.

SECTION 4
Error Processing

Introduction

This section describes possible error messages and how to respond to them. Errors are divided into three categories: system errors, I/O errors, and general errors.

4-1 Error Type

Refer to the following table of errors to determine the type of error from the LED status.

Error Type	Error	LED Number 1	2	3	4	5	6	7	8
System	Illegal Interrupt	–	–	–	–	–	•	•	–
	Bus Error	–	•	–	–	–	•	•	–
	Address Error	•	•	–	–	–	•	•	–
	Illegal Instruction	–	–	•	–	–	•	•	–
	Zero Divide	•	–	•	–	–	•	•	–
	CKK Instruction	–	•	•	–	–	•	•	–
	TRAP Instruction	•	•	–	–	–	•	•	–
	Privilage Violation	–	–	–	•	–	•	•	–
	Spurious Interrupt	•	–	–	•	–	•	•	–
	System Area Access	–	•	–	•	–	•	•	–
	Watch Dog Timeout	•	•	–	•	–	•	•	–
I/O	CPU Receive Error	–	–	–	–	–	–	•	–
	CPU Transmit Error	•	–	–	–	–	–	•	–
	LOOP Transmit Error	–	–	•	•	–	–	•	–
	LOOP Receive Error	•	–	•	•	–	–	•	–
General	Get Block Error	–	–	–	–	–	•	–	–
	Invalid Data Reception	•	–	•	–	–	•	–	–
	SEND Error (Data Drop)	–	–	–	•	–	•	–	–
	Data Length Error	–	–	•	•	–	•	–	–

Note 1. LED's with • are lit.

2. LED's with – are unlit.

4-2 System Errors

When the NSU detects a persistent error, the system error LEDs are lit and the Unit restarts. In the absence of some hardware malfunction, the Network Service Unit will not stop operation.

When a system error causes a restart, information concerning this error is stored in battery backed–up RAM in a trace buffer. It can then be examined using a memory dump. Odd addresses are used with the format described below:

Offset	Contents
010001	dummy
010002	counter (0 through 63)
010003	dummy
010004	LED information
:	dummy
:	LED information
:	–
	–
0100FFE	dummy
0100FFF	LED information

If the error is not serious enough to cause a restart, it will be stored in a logging buffer. It can then be examined using a memory dump. Address and formats are listed below.

Offset	Word
070150	Vector number
070152	Reserved
070154	Reserved
070158	Reserved
07015A	Access address
07015E	Command register
070160	Status register
070162	Program counter
070166	D0
07016A	D1
07016E	D2
070172	D3
070176	D4
07017A	D5
07017E	D6
070182	D7
070186	A0
07018A	A1
07018E	A2
070192	A3
070196	A4
07019A	A5
07019E	A6
0701A2	User stack pointer
0701A6	Reserved
0701A8	Invalid interrupt counter
0701AA	Reserved
0701AC	Reserved

Clearing the Error Status LED Indicators

The LEDs will retain their error status so that the error can be identified and corrected. To reset the LEDs, the Unit can be re–started, or a memory write can be executed from a remote node, such as a computer somewhere on the loop.

4-3 I/O Errors

When an error occurs in the serial device connected to the Unit, or in the interface to the SYSMAC Net LAN, the LEDs are lit, I/O reset processing executed, and execution continues. The LEDs may be turned OFF in the manner described in *Section 4–2 System Errors.*

4-4 General Errors

Other errors also result in the LEDs being lit, but execution continues. Information concerning the error is stored with addresses and format as shown below:

Offset	Contents
074000	pointer
074004	buffer start address
074008	buffer end address
07400c	overflow counter
074010	a series of 16-byte trace packets:

0: task ID
2: priority
4: error parameter 1
8: error parameter 2
A: error parameter 3

Again, the lamps can be cleared in the manner described in *Section 4–2 System Errors.*

4-5 RAM Check

The Network Service Unit is initialized according to parameters stored in RAM as long as the initialization switch is OFF. As a check on the RAM contents, a check–sum is used. If this check–sum fails to match, all the LEDs will be lit, and the system stops. The solution to this problem is to boot with the initialization switch ON, which bypasses the RAM, and then restore the RAM to its default settings. If this fails to solve the problem, the RAM itself probably needs to be replaced.

Appendixes

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
Net Link Unit for C500, C1000H, C2000H	C500-SNT31-V4
Net Link Unit for C200H	C200H-SNT31
Network Service Unit	S3200-NSUA1-10E
Network Bridge	S3200-NSU-G4-10E
Plastic-Clad Optical Fiber Cable	S3200-FH-L-C22T
H-PCF Optical Fiber Cable for C200H-SNT31 only	S3200-HC#####*
Optical Fiber Cable Connectors	S3200-COCH62M
	S3200-COCF2511
	S3200-COCF62M
	S3200-COCF62F

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

B Specifications

The Network Service Unit has specifications as described below:

General Specifications

Power	Rated Voltage: 24 VDC Voltage Range: 20.4 to 28.8 VDC Rated Current: 1.0 max.
Operating Environment	0° to 50°C at 35 to 85% RH
External Dimensions	435 x 250 x 865 mm
Weight	approximately 6.6 kg

Optical LAN Specifications

Communication Method	Token Ring (n:n)
Data Transmission Speed	2M bps
Transmission Method	Manchester Coding, base-band method
Network Distance	Up to 1 km, extendable with repeaters or quartz cabling
Transmission Method	Two–fiber Optical Fiber Cable
Error Handling	Auto back loop Node by–pass (based on Local Power Supply Unit)
Message Length	2K bytes
Send/Receive Buffer	32K bytes, thus with a message length of 2K-bytes, buffer can hold up to 15 messages
Maximum Number of Nodes	126 per network loop

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 PC 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.

data area
An area in the PC'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 PC Link System.

data link
Allows for the connection of up to 32 PCs 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 PC 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.

PC
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 PC. PCs 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.

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

system configuration
The arrangement in which Units 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 Units comprising a Control System that includes one or more PCs.

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.

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

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

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Manual Revision History

The manual revision code appears as a suffix to the catalog number on the cover of each manual.

Cat. No. W160-E1-2

Revision code

Revision code	Date	Revision content	Ref. Mat.
1	July 1989	Original production	–
2	June 1990	Total revision of text and graphics	–

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Authorized Distributor:

Cat. No. W160-E1-2

Note: Specifications subject to change without notice.

Printed in Japan
1095-0.1M