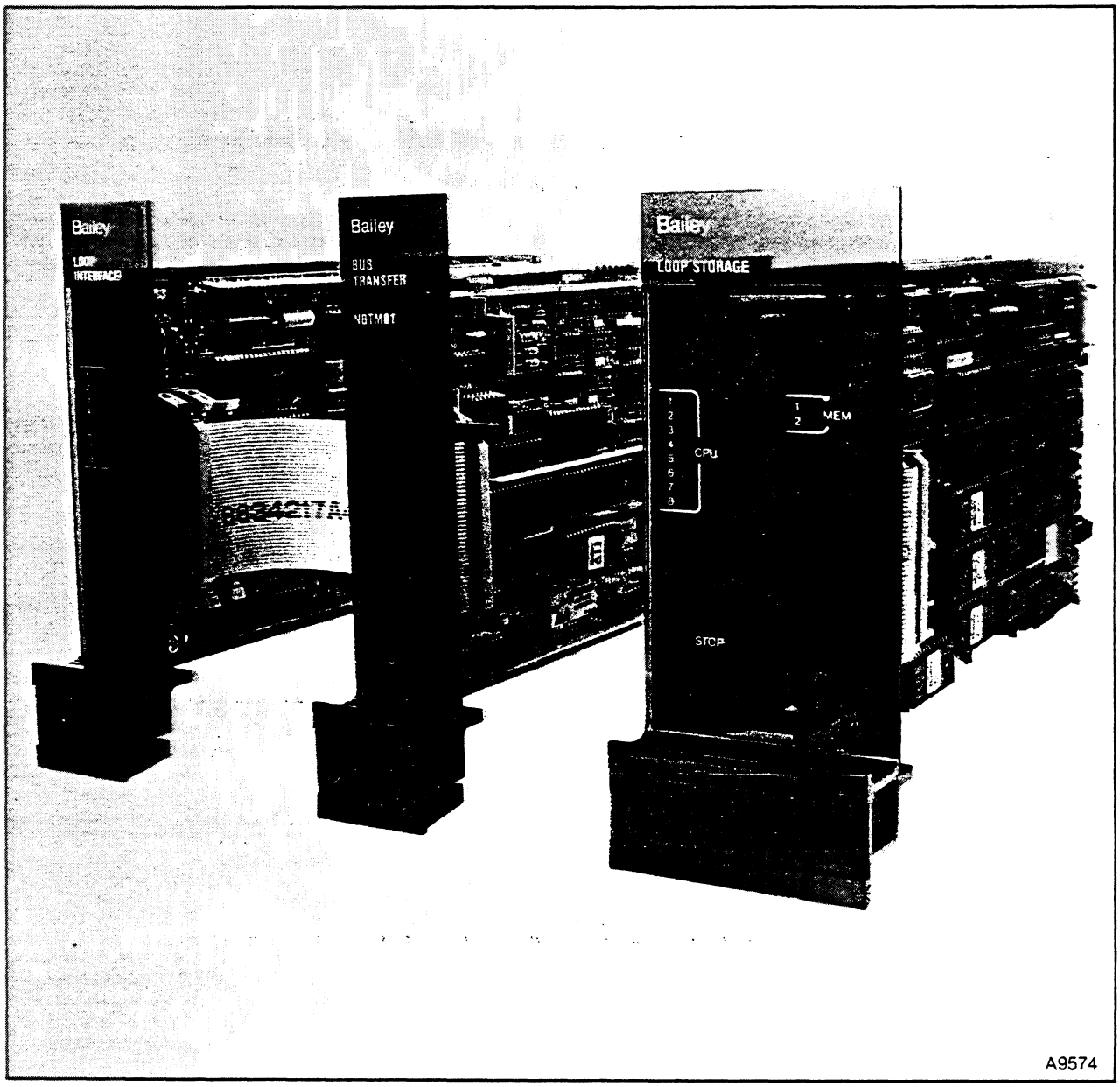
Bailey®
network 90®

Enhanced Computer Interface Unit
NCIU02/03



A9574

Product Instruction

E93-905-7

Bailey Controls
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Preface

The NCIU02/03 (CIU) enables a host computer to interact with the NETWORK 90 system. The CIU receives a command from the host, performs the desired action, then formats and returns a reply to the host. These commands direct interface operation.

Overview

The Enhanced CIU consists of three basic modules with an optional Parallel Bus Slave (PBS) for parallel communications betweeen the CIU and a host.

Use of NCIU01 Software with NCIU02/03 Hardware

Software that runs with NCIU01 also runs with NCIU02/03.

Use of This Document

This product instruction is written as a guide for the Service Engineer in installing the CIU in a NETWORK 90 system. The operator will find the functional descriptions of the various components and indicators and controls helpful.

The text is arranged into three sections by function:

- Section 1 includes a functional description of the various components of CIU hardware.
- Section 2 outlines handling procedures for the service engineer to follow in installing the CIU into a Module Mounting Unit (MMU). Paragraphs in this section are arranged in the suggested order of installation. This section includes dipswitch settings and dipshunt configurations.
- Section 3 provides information on the front panel indicators and controls and LSM operating modes. An operational check at the end of this section describes a CIU checkout procedure after installation. Monitor displays of the Utility menu and TALK90 menu are useful for system diagnostics. This section also includes a discussion of the Parallel Bus Slave Option.
- The appendix contains edge connector pinouts for the Bus Transfer Module (BTM), LIM, and TPL.

Additional Information

Refer to the following publications for additional information:

	Type/ Part No.	Publication Number
Field Termination Panel	NFTP01	E93-910-5
Function Code Reference Manual		E93-900-4
Loop and Bus Interface Module	NLIM02	E93-908-2
Loop Interface Cable	NKLM01-10	E93-911
Module Mounting Unit	NMMU01	E93-910-4
Multifunction Controller Termination Unit	NTMF01	E93-911
NPBS01 to IEEE-488 Cable (optional)	NKPB01	
Parallel Bus Slave Module (optional)	NPBS01	
Plant Loop Termination Unit	NTPL01	
Termination Unit Cable	NKTU01-10	E93-911

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Section 1 - Description

Document Purpose

This Computer Interface Unit document provides the reader with a basic understanding of NCIU02/03 hardware. Included is a functional description of various CIU components with installation and troubleshooting instructions. A brief description of NCIU02/03 firmware provides a working knowledge of the operation of the device firmware. Refer to "Enhanced CIU Programmer's Reference Manual" E93-905-2 for additional information on the CIU firmware.

Hardware

The Enhanced CIU consists of three basic modules:

- Loop Interface Module (LIM)
- Bus Transfer Module (BTM)
- Loop Storage Module (LSM)

An optional Parallel Bus Slave (PBS) can provide parallel communications between the host and the LSM. The PBS operation is described in the Operation Section.

Modules making up the CIU occupy four slots in the Module Mounting Unit (MMU) of a NETWORK 90 cabinet (five when using a PBS). This document describes each of these modules in detail. Figure 1 shows the position of each module in the NCIU02/03 architecture.

The MMU provides power for the modules through the backplane. The backplane also provides two communication channels: the Module Bus for module-to-module communications and the Expander Bus for module-to-slave communications. The CIU must have a dedicated MMU. Modules not part of a CIU may not reside on the same module bus with that CIU. The CIU should not be allowed to communicate over the expander bus to other modules except for operation with a redundant CIU.

The NCIU02/03 must use the Plant Communications Loop (plant loop) for proper communication with other NETWORK 90 system modules.

Functional Overview

The CIU enables a host computer to interact with the NETWORK 90 system. The CIU receives a command from the host, performs the desired action, then replies to the host. There are approximately 60 CIU commands. The commands permit data acquisition, process monitoring and control, and system functions (security, time, and configuration control).

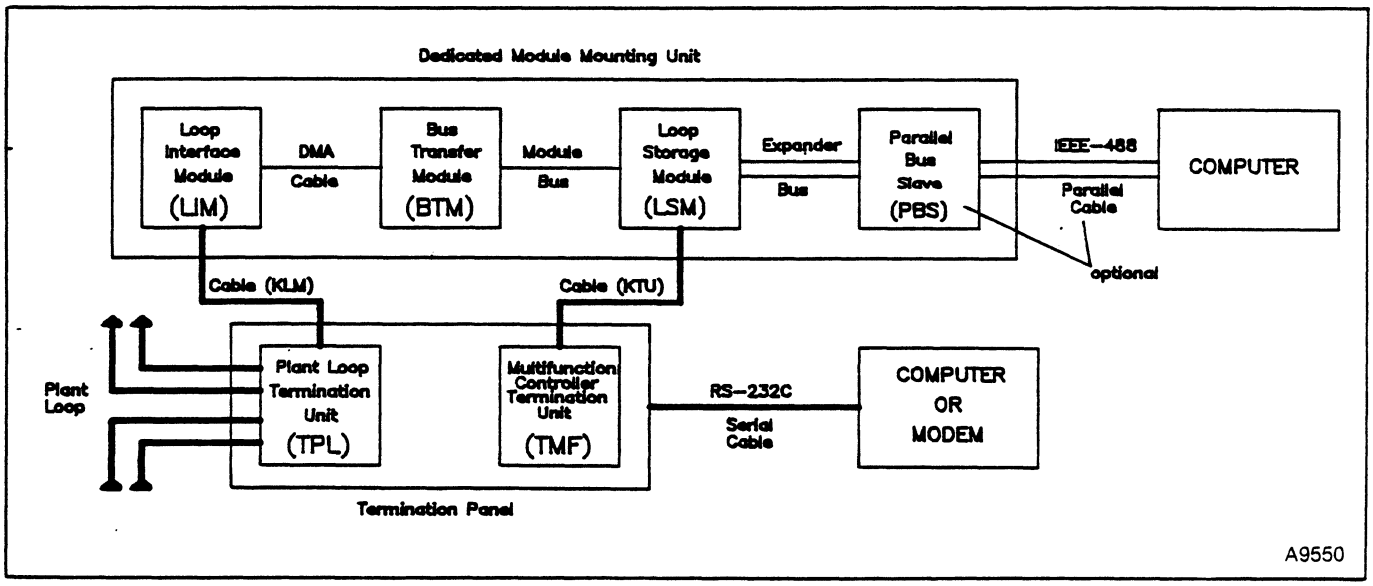

FIGURE 1 — NCIU02/03 Block Diagram

Point Capacities of Computer Interface Units
This manual is intended to be a reference for both the NCIU02 and NCIU03. The difference between the two devices is the LSM version used. The NCIU02 uses the NLSM01 which contains enough memory to allow a maximum point count of 2500. The NCIU03 uses the expanded-memory NLSM02 allowing a point count of 5000. The two enhanced CIU versions are identical other than the difference in point capacity.

Both the NCIU02 and NCIU03 have a NCIU01 compatible mode, which permits then to run software written for the NCIU01. In this mode, the maximum point count is 511 for both the NCIU02 and NCIU03.

Using the NCIU02/03 with NCIU01 Software
The NCIU02/03 is an expanded version of the NCIU01. However, every effort is made to maintain upward compatibility between both CIUs and the NETWORK 90 system. Existing software operating with NCIU01 should also operate with NCIU02/03. A special mode selected at the time of CIU RESTART command permits the NCIU02/03 to appear as an NCIU01 to the host. When selecting this option, none of the new NCIU02/03 features are usable. All new software should be written to take advantage of the NCIU02/03 enhancements. There is one restriction to follow when writing NCIU02/03 software. After issuing the CIU RESTART command the host should wait five seconds before issuing any other command.

Communicating With Other Equipment
The NCIU02/03 can communicate with most other equipment capable of sending commands and receiving replies. Communication occurs over either of two RS-232-C serial ports or through an IEEE-488 parallel port when using a Parallel Bus Slave. When communicating serially, the CIU acts as Data Communications Equipment (DCE).

The CIU communicates with the rest of a NETWORK 90 system using the Plant Loop. The LIM and BTM Modules function together, transferring data between the LSM and the Plant Loop. The LSM maintains the point table and interprets commands coming from the host.

Plant Communication Loop
The Plant Loop is a unidirectional serial data highway operating independently of data users on the loop. The LIM moves data from the plant loop into the BTM through a ribbon cable connecting the two modules. The BTM buffers data, transferring it to the LSM over the Module bus.

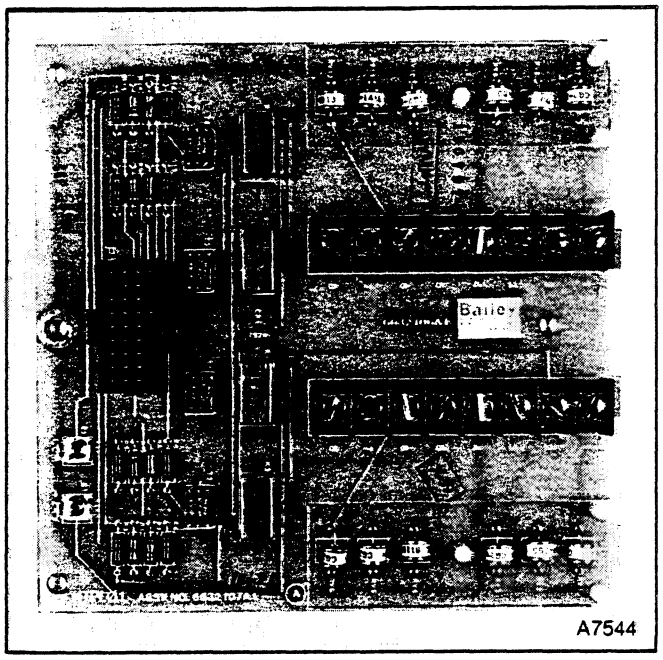

FIGURE 2 — Plant Loop Termination Unit (NTPL01)

Plant Loop Termination Unit
The Plant Loop Termination Unit (TPL) provides LIM access to the Plant Loop. The TPL provides electrical isolation, surge protection, and bypass capability. The LIM connects to the TPL with a plug-in, multiconductor shielded cable. The Termination Unit is located on a standard 7 in. x 7 in. printed circuit board (Figure 2).

Loop Interface Module (LIM)
The LIM and the BTM provide a communication link between the plant loop and the LSM. The LIM converts data into the format necessary for the plant bus, and transmits messages on the loop. It also receives incoming messages from other PCUs. The LIM puts incoming messages directly into the BTM through the Direct Memory Access (DMA) cable connecting the two boards. The LIM also monitors plant loop status, and retries failed messages.

LIM Board Layout
Figure 3 shows the LIM Board layout. The LIM is a standard double-sided printed circuit board assembly sliding into a slot in the MMU.

LEDs mounted behind the LIM front panel display data in memory addressed by option dipswitch SW1. Option dipswitches also provide access to onboard module diagnostics and display the Process Control Unit (PCU) address. A cable connects the LIM direct-

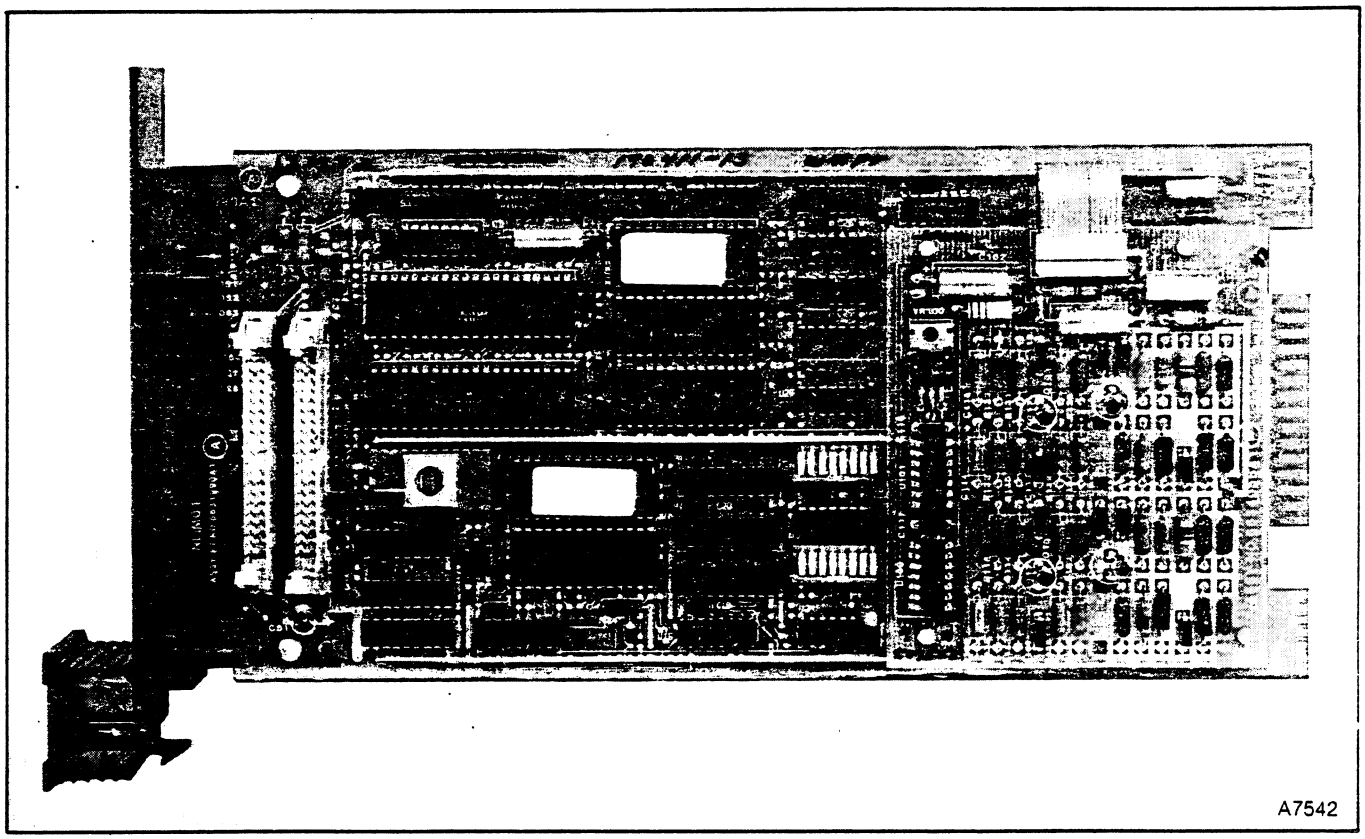

FIGURE 3 — Loop Interface Module

ly with the Termination Unit for access to the plant Loop.

Major LIM Components are:

- 6800 Microprocessor
- ROM Socket, jumper selectable, for 2K, 4K, and 8K memory
- 2K bytes of static RAM
- 6840 Programmable Timer
- 6844 DMA Controller
- 6854 ADLC Loop Controller (two)
- Bidirectional interrupt link to the BIM/BTM
- Interrupt Decoding/Latching Register
- Eight-position switches (two) and eight LEDs
- Loop Data Rate Oscillator
- Loop Interface Assembly
- Reset input from the BIM/BTM

Bus Transfer Module (BTM)

The BTM is a single printed circuit board occupying a MMU slot adjacent to the LIM. The BTM transfers incoming data from the plant loop to the module bus. The LSM captures incoming data from the module bus. The BTM also places outgoing messages in its output buffer enabling the LIM to send them out on the Plant Loop. The BTM monitors Process Control Unit (PCU) and power supply status, cooling fans, and LIM and LSM status.

The BTM hardware is identical to the BIM used elsewhere in a NETWORK 90 system but uses different firmware. The LIM and BTM operate as a module pair connected by a ribbon cable. The BTM obtains data from, and transmits information to the LSM via the module bus. It also exchanges information with the LIM.

Major BTM components are:

6800 Microprocessor
16K bytes of ROM
16K bytes of dynamic RAM
Direct Memory Access Controller
6840 Programmable Timer
LIM/BTM handshaking circuit
One five-pole switch for off-line testing

A single LED mounted on the BTM front plate defines the BTM operating state:

- Green for satisfactory operation
- Red for error operation.

Bus Transfer Module Dipswitch

A five-pole dipswitch (SW1) on the BTM board (Figure 4) provides a combination of off-line tests. The P1 edge connector at the back edge of the BTM board provides power and Module Bus connections. The Installation Section describes SW1 locations and settings.

Loop Storage Module

The primary function of the LSM is to execute commands. Users choose from a library of commands to implement their particular process monitoring and control strategy.

The LSM consists of two printed circuit boards with a connecting ribbon cable. These are the Central Processing Unit (CPU) Board and the Memory (MEM) Board. These boards attach to a single smoked polycarbonate faceplate.

68000 microprocessor on the LSM CPU board controls the LSM. The MEM board contains: Electrically-Erasable Read Only Memory (EEROM). Random Access Memory (RAM), and on-board Read Only Memory (ROM).

Loop Storage Module Indicators

A Status LED at the top, left side of the LSM faceplate indicates operating mode. A column of eight LEDs, visible through the left side of the faceplate, show CPU Board operating and error code information. A column of two LEDs visible through the right side of the faceplate show MEM Board operating and error code information.

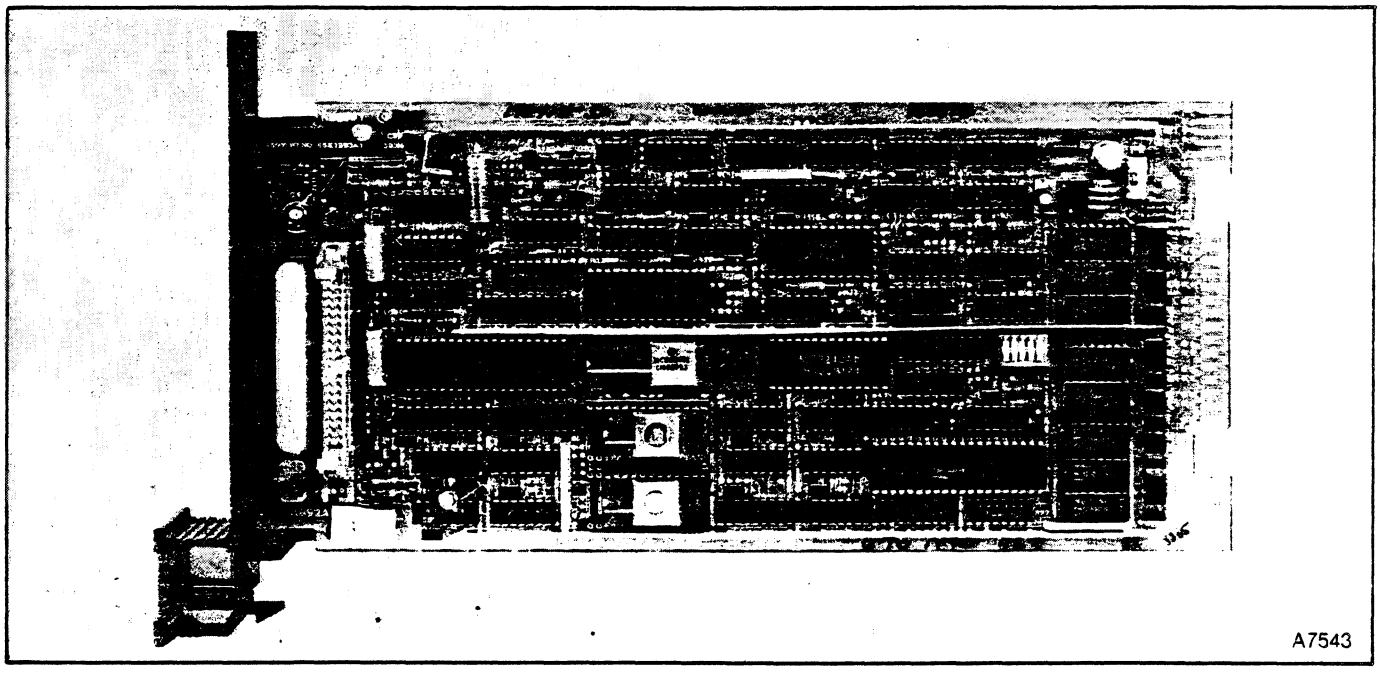

FIGURE 4 — Bus Transfer Module

Loop Storage Module Location
The LSM occupies two slots in the Module Mounting Unit (MMU) of the NETWORK 90 cabinet. See Figure 1 for the LSM position in the NCIU02/03 architecture.

Parallel Bus Slave Option

The Parallel Bus Slave (PBS) provides a parallel data channel between the CIU and a host. The PBS is an IEEE-488 compatible General Purpose Interface Bus (GPIB) device.

Parallel Bus Slave Operation
The PBS module receives CIU commands from the host and transfers them to the Loop Storage Module (LSM) over the expander bus. When the command reply is formulated, the PBS receives the reply from the LSM over the expander bus and makes the reply available to the host. The expander bus, an 8 bit wide parallel data path, is a standard feature of the NETWORK 90 Module Mounting Unit (MMU).

The PBS implements the Talker, Listener, and Service Request functions of the GPIB protocol. The host must implement the Controller-in-charge function and direct all data transfers across the GPIB bus.

The Parallel Bus Slave Option consists of:
NPBS01 - a single width NETWORK 90 module
KPB01 - NPBS01 to IEEE-488 cable

Parallel Bus Slave Performance
The Parallel Bus Slave is capable of handling bursts of data at a transfer rate of 240K bytes/second. The expander bus limits the PBS to a theoretical continuous transfer rate of approximately 80,000 bytes per second.

Module Mounting Unit

The Module Mounting Unit (MMU) houses the CIU modules. The MMU provides module power distribution and contains the Module Bus and Expander Bus (slave module communication path).

To insert a module, slide it into place along the plastic guides of the MMU until the front panel latch 'clicks'. To remove, squeeze the front panel latch and withdraw the module. See Figure 5.

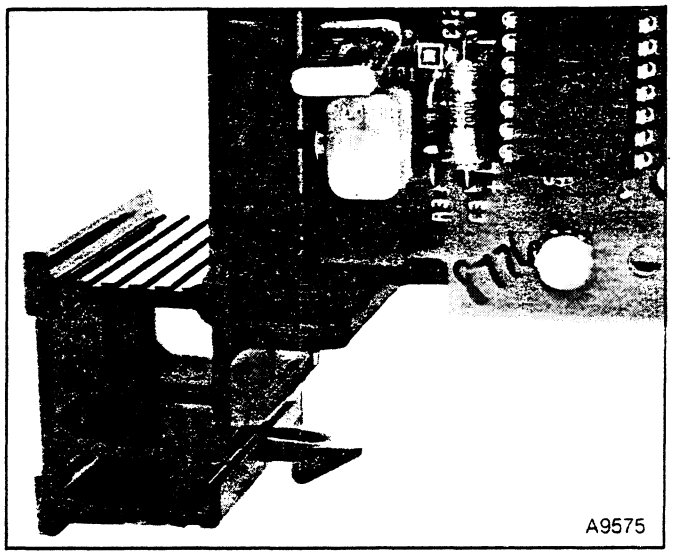

FIGURE 5 - Module Latch

Expander Bus
The Expander Bus provides the communication link between the Parallel Bus Slave and the LSM when the host requires parallel communication. In applications where redundant CIUs are implemented using Method Two, (Redundant CIU02 Paragraph) the backup CIU uses the Expander Bus to monitor the "heartbeat" of the primary CIU.

Connecting the Expander Bus
Connect the Expander Bus by inserting 24 pin dipshunts into sockets on the bottom of the MMU. One dipshunt must be inserted in each socket between the CPU board of the LSM and the slave module in the MMU. This enables communication with the Expander Bus.

NOTE: The dipshunts remain intact. DO NOT CUT THE STRAPS. Be sure to insert a dipshunt in the socket between the CPU and MEM boards of the CIU if the slave is positioned to the right of the LSM.

Accessing the Module Bus
The LSM accesses the Module Bus using the P1 card edge connector on the CPU and MEM Boards, and accesses the Expander Bus using the P2 card edge connector on the CPU board.

The BTM accesses the Module Bus using the P1 card edge connector. Communications between the LSM and BTM do not use the expander bus.

Cabling
The following cables provide interfacing with the LSM, Termination Units, and Displays:

NOTE: ALL cable connections to the LSM attach to the P3 card edge connector of the CPU BOARD. There are no cable connections to the MEM BOARD.

- NTPL01 connects the Loop Interface Module (LIM) to the Plant Loop Termination Unit (TPL).
- NKTU01 - Connects the LSM to the Multifunction Controller Termination Unit (TMF).

NOTE: We recommend a maximum cable length of 10 feet for each NKTU01 cable to ensure baud rate integrity.

- RS-232-C Serial Cable connects the TMF with the host.
- IEEE-488 cable connects the Parallel Bus Slave Module (PBS) to a IEEE compatible host. (PBS and IEEE cables are optional).

Redundant CIU Modules

Two methods are available to implement redundancy in the NCIU02/03. In both methods, two complete NCIU02/03 modules are used and both LIMs are set to the same loop address. Only one CIU is on-line at any one time so that no address conflict occurs. In both methods, separate module busses are necessary for the redundant NCIU02/03.

Redundant Method 1
The host is responsible for determining when fail-over is necessary. In this method, the CIUs do not communicate with each other. The host uses the primary CIU for all functions. If a failure occurs, the host commands the backup CIU to become primary. A watchdog timer in the primary CIU causes the CIU to take itself off-line if it does not receive any communication from the host. This keeps the primary from remaining on the loop when a fail-over occurs.

Redundant Method 2
The CIUs determine when the backup unit should take over as primary. The redundant LSMs are on the same expander bus for this method (but still not on the same module bus). The backup CIU checks for "a heartbeat" from the primary over the expander bus. Actual communication between the two CIUs occurs over a serial link between the two LSMs. If the backup unit cannot detect the primary CIU "heartbeat", fail-over will will occur, allowing the host to access the backup CIU.

TABLE 1 - Specifications

Microprocessor	Motorola 68000 (8 MHz operating speed)
Computer Interface Protocol	Full duplex serial data EIA standard RS-232-C Type Z (a Bailey defined binary interchange)
LSM Memory	UVROM: 128KB RAM: 512KB (NLSM02) 128KB (NLSM01) EEROM: 8KB (NLSM02) 2KB (NLSM01)
Maximum Point Count	NCIU02 - 2500 NCIU03 - 5000
PBS Ports	RS-232-C Serial IEEE 488 Parallel Port (Optional)
Nominal LSM Power Consumption	6A @ +5 V dc (30 watts 37 mA @ +15 V dc (0.55 watts) 18 mA @ −15 V dc (0.27 watts)
LSM DC Power	+5 V dc ±5% +15 V dc +5% −2.5% −15 V dc +2.5% −5%
Mounting	Occupies four slots in standard NETWORK 90 Module Mounting Unit (MMU). Occupies five slots with PBS.
Certification	CSA certified for use as process control equipment in an ordinary (non-hazardous) location.
Module Environment	
Ambient Temperature	0°C to +70°C
Humidity:	5% to 90% R.H. (±5%) up to 55°C (non-condensing) 5% to 90% R.H. (±5%) at 70°C (non-condensing)
Atmospheric Pressure	Sea level to 1.86 mi (3km)

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Instruction book E93 - 905 - 2 Page 6 shows two methods for redundancy. The second method does not and will not exist.

The Instruction Book will be corrected.

For Information,

P B Handfield

PBH/jbg

P. B. Handfield.
N90 Technology.

Section 2 — Installation

Introduction

CIU component and module installation features are standard for the NETWORK 90 system. CIU module installations are listed in product instructions listed in the preface.

This section explains the setup procedure for the user CIU application. Information on system variations, switch settings, termination units, and cabling requirements is included.

This section covers only installation related to the NCIU02/03.

Note: The CIU uses metal oxide semiconductor (MOS) devices requiring handling procedures described in the following paragraphs.

MOS devices require attention during shipping and handling to avoid damage from static discharge and improper grounding.

Special Handling Procedures

- Keep the module in its special, anti-static bag until you are ready to install the module in the system. Save this bag for future use.
- Ground the anti-static bag before opening.
- Verify that all devices connected to the module are properly grounded before using the module.
- Avoid touching the circuitry when handling the module.

General Handling Procedures

- Examine the LIM, BTM, and LSM immediately to verify that the modules have sustained no damage in transit.
- Notify the nearest Bailey Controls Sales Office of any such damage.
- File a claim for any damage with the transportation company that handled the shipment.
- Use the original packing material and/or container to store the module.
- Store the module in an environment of good air quality, and free from temperature and moisture extremes.

Radio Frequency Interference

Most electronic equipment is influenced by Radio Frequency Interference (RFI). It is good practice to post a sign near the CIU cabinet that cautions against the use of portable communications equipment in the area.

Termination Unit Installation

Plant Loop Termination Unit (TPL)

Use standard installation and mounting procedures to mount the TPL on the Field Termination Panel (NFTP01). This forms part of the NETWORK 90 cabinet.

1. Place the edge of the TPL into slots at the sides of the Field Termination Panel.

2. Position the TPL mounting holes in line with two stand-off posts on the panel.

3. Secure the TPL to the panel by assembling machine screws to the two stand-off posts.

4. Place a grounding screw and star washer between the two mounting screws for cable shielding and high voltage protection.

Loop Interface Cable (NKLM01)

1. Connect the NKLM01 cable to the LIM slot at the back of the MMU prior to installation.

2. Connect the other end of the cable to the single socket position of the TPL. Table A1 lists LIM connector (P3) pin assignments. Maximum length of the NKLM01 cable is 200 feet.

Plant Loop Cable (NKPL01)

Table A2 lists field wiring assignments for this cable at the NTPL01 termination unit.

Multifunction Controller Termination Unit (TMF)

Installation and mounting procedures are described in the TMF section of the Termination Unit Manual E93-911. Mount the TMF on the Field Termination Panel (NFTP01) which forms part of the PCU cabinet as follows:

1. Place the edge of the TMF into slots at the side of the NFTP01.

2. Position the TMF mounting holes in line with two stand-off posts on the panel.

3. Secure the TMF to the termination panel by assembling machine screws to the two stand-off posts.

4. Place a grounding screw and star washer between the two mounting screws for cable shielding and high voltage protection.

Termination Unit Cable (KTU)

1. Connect the KTU to the LSM slot prior to module installation.

2. Connect the other end of KTU cable to the P1 socket position of the TMF.

Host Connection to the CIU Serial Port

Host connection to the CIU serial port is accomplished by connecting an RS-232-C compatible cable to the DB25-S "Terminal Port" connector on the TMF. The LSM acting as Data Communications Equipment (DCE) provides the data communication circuits decribed in Table 2.

TABLE 2 — CIU Data Communication Circuits

P2 or P3 Pin	RS-232-C CIRCUIT	FROM CIU	TO CIU	DESCRIPTION
1	AA			Protective Ground
2	BA		X	Transmitted Data
3	BB	X		Received Data
4	CA		X	Clear to Send
5	CB	X		Request to Send
				(Not Used)
6	CC			Data Set Ready
7	AB			Signal Ground
8	CF	X		Received Line Signal Detector
20	CD		X	Data Terminal Ready

LIM/BTM Installation

LIM/BTM Modules

1. Connect the LIM/BTM pair with a 40 conductor ribbon cable assembly. The ribbon cable is specified as part of the BTM assembly. Pass the cable through the slot in the printed circuit board and connect with the LIM prior to installation into the MMU.

2. Connect the LIM Cable to the LIM slot position. Insert the LIM/BTM pair into adjacent guide rails of the MMU.

3. Push each module front panel inward until the modules are fully engaged. In this position, engaging the modules automatically connects the BTM to the Module Bus to complete all system connections.

4. Reset the BTM after LIM/BTM insertion to ensure simultaneous startup.

Bus Transfer Module Pin Connections

See Table A3 for pin connections (P1) to the Module Bus.

Loop Storage Module Assembly

The Loop Storage Module occupies two slots in the MMU and may be placed in any open position.

Guide the module into place along the plastic rails. The module is fully inserted when the front panel is flush with the top and bottom of the MMU rack and the securing latch engages the MMU frame. The CPU board of the LSM must occupy the slot that holds the KTU cable.

Indicators and Controls

The LSM front panel (Figure 6) consists of the following:

- Module Status LED
- Central Processing Unit (CPU) LEDs (eight)
- Memory Status LEDs (two)
- Stop pushbutton
- Reset pushbutton

Module Status LED

The Module Status indicator LED is a red/green LED that indicates LSM operating condition. It has one of three states: off, solid green, or solid red.

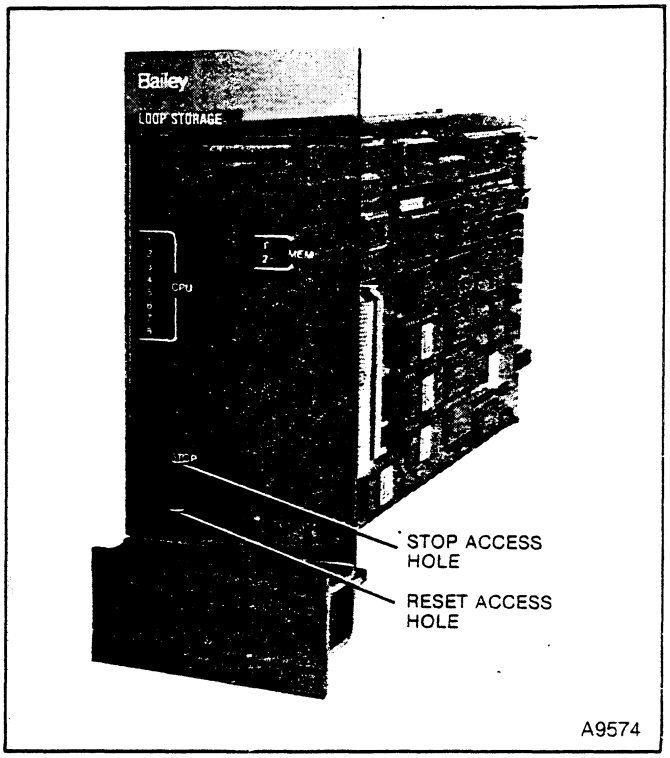


FIGURE 6 — LSM Front Panel

Off - indicates that the LSM is not powered up.

Solid Green - indicates that the LSM is operating normally.

Solid Red - indicates that the Module Fault Timer (MFT) has timed out and the LSM is halted. This occurs when LSM diagnostics detect a hardware failure, improper switch settings, slave problems, or when the LSM is unable to cause the LIM/BTM pair to go on line. In addition to the Status LED going solid red, CPU LEDS 1 through 8 also illuminate to display error codes (see Table 3).

CPU LEDs

During normal operation, the eight CPU LEDs count the messages sent between the host and the LSM. Each message in either direction causes the count to increment. When the LSM has failed, the module status LED is red, the LEDs give an indication of the cause of the failure. Table 3 shows the Error Code LED patterns that are meaningful in the failed mode.

LED 1 is the least significant bit (LSB) and LED 8 is the most significant bit (MSB). The top LED is number 1.

TABLE 3 — CPU LED Displays

LED								MEANING
8	7	6	5	4	3	2	1	
Codes are displayed only when the LSM is halted								
0	0	0	0	0	0	0	1	An error affecting the EEROM checksum has occurred.
0	0	0	0	0	0	1	1	A "bad status" message for a slave module was received on the expander bus (wrong type of slave or the slave not responding).
0	0	0	0	1	1	1	0	Duplicate slave module addresses exist.
0	0	0	1	0	0	0	1	An error occurred while the LSM was writing to its EEROM.
0	0	0	1	0	0	1	0	The LSM was unable to cause the LIM/BTM to go on-line.
0	0	0	1	0	0	1	1	UVROM checksum error detected.
0	0	1	0	0	0	1	0	Redundant LSM address is not the same as the primary LSM.
0	0	1	1	0	0	0	0	The system tried to force control to the redundant LSM while the primary LSM was still functioning.
0	0	1	1	0	0	0	1	A fault in either the CPU or MEM boards exists.
0	0	1	1	0	0	1	0	An address error or a failure on the expander and/or module bus exists.
0	0	1	1	0	0	1	1	Attempt to execute illegal processor instruction.
0	0	1	1	0	1	0	0	The microprocessor has detected a trace/privilege violation.
0	0	1	1	0	1	1	0	A divide by 0 or CHK (check) instruction was encountered.
0	0	1	1	1	1	1	1	The LSM has stopped because the user pressed the Stop pushbutton.

NOTE: 0 = OFF
1 = ON

Stop Pushbutton
The Stop pushbutton performs the following functions:

- Completes data transfers over the expander and module busses.
- In redundant configurations it forces control from a primary to a secondary LSM.
- If CIU redundancy is implemented using Method 2, (see Redundant Modules paragraph) then the stop pushbutton forces a fail-over to the redundant CIU.

Removing an LSM from the MMU:

1. Press the Stop pushbutton.

2. Wait until the Module Status LED goes red before removing the LSM.

Reset Pushbutton
The Reset pushbutton is used to:

- Reset the LSM to power-up status after a stop.
- Recover from an operator-initiated stop or module timeout.

System Setup

LIM Module Board
The LIM module board layout is shown in Figure 7 with locations of dipswitches SW1 and SW2 that require setting. Address dipswitch SW2 sets the Process Control Unit (PCU) address numbers in the system configuration. Option Dipswitch SW1 sets various options and is used primarily for test purposes. A brief description of the address and option settings with dipswitches SW1 and SW2 follows.

LIM Switch Settings (SW2)
Setting of SW2 represents the unique PCU address number of the LIM in the system configuration. Redundant LIMs in a single PCU will have the same address. Pole positions three through eight of dipswitch SW2 are used to set LIM addresses shown in Table 4. The third pole position is the most significant bit. As indicated in LIM address Table 4, the valid PCU address range is 1 through 63. In Figure 8, the PCU address of 21 is shown.

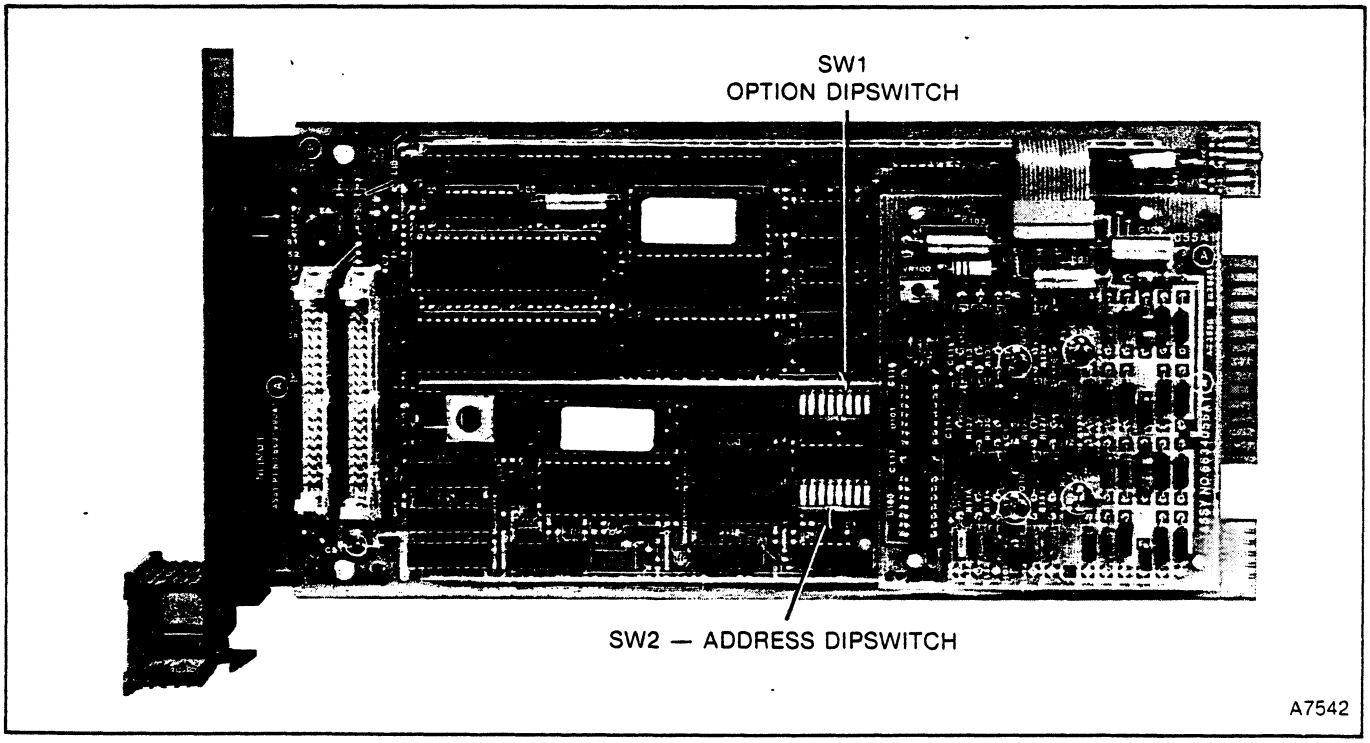


FIGURE 7 — Loop Interface Module Board Layout

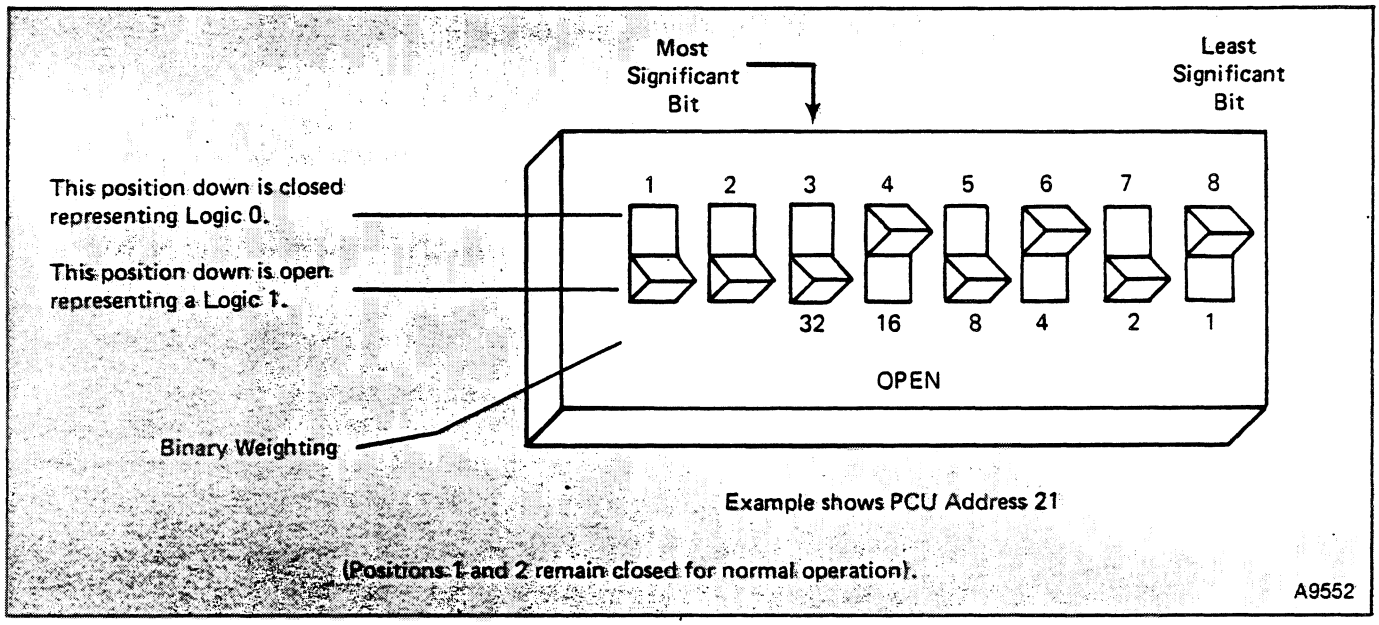


FIGURE 8 — Loop Interface Module Board SW2

Pole positions one and two are test positions and are placed in closed (Logic 0) position. When activated these switches enable off-line internal test routines to verify operation of much of the LIM circuitry. Place pole positions one and two in the open (Logic 1) position for diagnostic tests.

TABLE 4 — LIM Address Dipswitch SW2

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

LIM Front Panel LEDs

The eight front panel LEDs display pass/fail information when running onboard diagnostics with SW1.

LIM Memory Address Switch (SW1)

Eight pole dipswitch SW1 is primarily for test purposes. Information is displayed in binary for various addresses in LIM memory. Dipswitch settings select an address (00 through FF HEX) 0 to 255. For normal operation, set the dipswitch pole positions to 30 HEX, (0011 0000 Binary). This setting allows the throughput counter display of total messages transmitted, including forwarding, by the LIM front panel LEDs.

Use the LIM Memory Address Switch SW1 for event and error counter addresses described in Tables 5 and 6.

TABLE 5 - Event Counter Addresses (Dipswitch SW1)

Counter Address	Hexadecimal Address	Binary Address	Description
		1234 5678	
48	30	0011 0000	Total messages transmitted, including forwarding
49	31	0011 0001	Transmits retries
50	32	0011 0010	Composite BTM RX/TX, 4 bits each, RX on top viewed from front of LIM
51	33	0011 0011	Messages taken from BTM transmit buffer
52	34	0011 0100	Message stored in BTM receive
53	35	0011 0101	IRQs sent by BTM
54	36	0011 0110	HP messages transmitted
55	37	0011 0111	HP messages received
56	38	0011 1000	Commands issued by the BTM
57	39	0011 1001	Missed BTM TX requests
58	3A	0011 1010	Spurious NMIs caused by "address present"
59	3B	0011 1011	HEY message sent
60	3C	0011 1100	Messages discarded when destination is off-line
61	3D	0011 1010	HEY time expirations
62	3E	0011 1110	Passes through IDLE level (2 bytes wide).

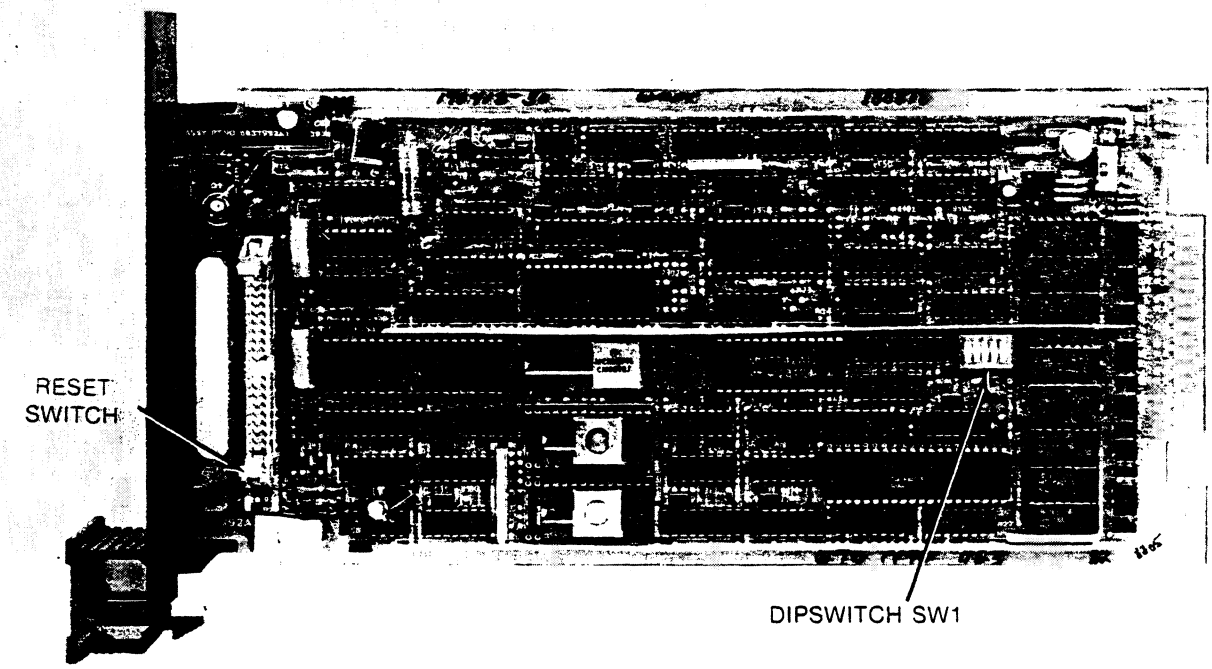
TABLE 6 — LIM Error Counter Addresses (Dipswitch SW1)

Counter Address	Hexadecimal Address	Binary Address	Description
		1234 5678	
64	40	0100 0000	Composite error count developed every handshake period — the summation of all other error counters
65	41	0100 0001	Unresolved NMI interrupts
66	42	0100 0010	Unresolved IRQ interrupts
67	43	0100 0011	Unresolved 6840 (timer) interrupts
68	44	0100 0100	Queue overflow message losses
69	45	0100 0101	Checksum failures
70	46	0100 0110	Unresolved BTM IRQs
71	47	0100 0111	Sequence errors
72	48	0100 1000	Header CRC/OVRN errors
73	49	0100 1001	Data CRC/OVRN errors
74	4A	0100 1010	Messages developing data CRC errors en route to destination
75	4B	0100 1011	Transmission failures
76	4C	0100 1100	Watchdog timer expirations
77	4D	0100 1101	Data length errors
78	4E	0100 1110	Loop - 1 RX failure
79	4F	0100 1111	Loop - 2 RX failures
80	50	0101 0000	Loop - 1 TX failure
81	51	0101 0001	Loop - 2 TX failures

NOTE: Pole position 1 is the most significant bit

BTM Dipswitch

Use BTM dipswitch SW1 for option settings. Set the five positions described in Figure 9. Pole positions 2,3, and 4 define software execution codes for off-line testing. For normal operation pole positions 2,3, and 4 remain in the closed position (000).



1	2 3 4	5
NOT USED	Software Execution Specification Code	NOT USED

NOTE: Positions 1 and 5 are not used by the BTM. Unlike the BIM, redundancy is not provided by a switch setting. The CIU firmware sets the module address of the BTM to 3 rather than using a switch.

A7543

FIGURE 9 — BTM Dipswitch

TABLE 7 — BTM SW1 Settings

Pole Number 1 2 3 4 5	Operating Conditions
0 0 0 0 0	Normal Operation
0 0 0 1 0	Normal BTM operation without LIM/BTM handshaking error detection. As with other off-line testing, the LIM need not be connected to the BTM via the ribbon cable.
0 0 1 0 0	RAM test mode. If front panel Red/Green LED turns red, the module fails the test.
0 0 1 1 0	ROM test mode. If front panel Red/Green LED turns red, the module failed the test.
0 1 0 0 0	Execute IRQ LIM handshake diagnostic. This is used in combination with the LIM off-line diagnostics

Loop Storage Module

CPU Board

The CPU board, Figure 10, has the following switches and jumpers:

- Eight-position dipswitch, U72, sets system functions
- Eight-position dipswitch, U73, sets Baud Rate
- Five-position dipswitch U75, CIU port address
- Three jumper pins, a STOP switch (SW2), and a RESET switch (SW1).

Note: Jumpers are factory-set and MUST NOT be altered. Refer to Figure 10 for dipswitch locations.

Note: Closed = Logic 0, Open = Logic 1 for all dipswitches.

U72 Option Dipswitch

This is an eight-position dipswitch for setting I/O functions. Opening or closing a contact produces a different function:

Position 1 selects ROM checksumming (1 = OFF, 0 = ON). ROM checksumming should be on for normal operation.

Positions 2 and 3 select Port 0 and 1 Data Characteristics:

0 0 - 8 data bits, 1 stop bit, no parity
0 1 - 8 data bits, 1 stop bit, even parity
1 0 - 8 data bits, 1 stop bit, odd parity
1 1 - 8 data bits, 2 stop bits, no parity

Position 4 enables Port 1 option:

1 = ON. This enables Port 1 to serve as a utility port. A terminal may be connected to this port to access the diagnostic and test programs built into the LSM.

0 = OFF. This selects Port 1 to act as a second serial port for connection to a host.

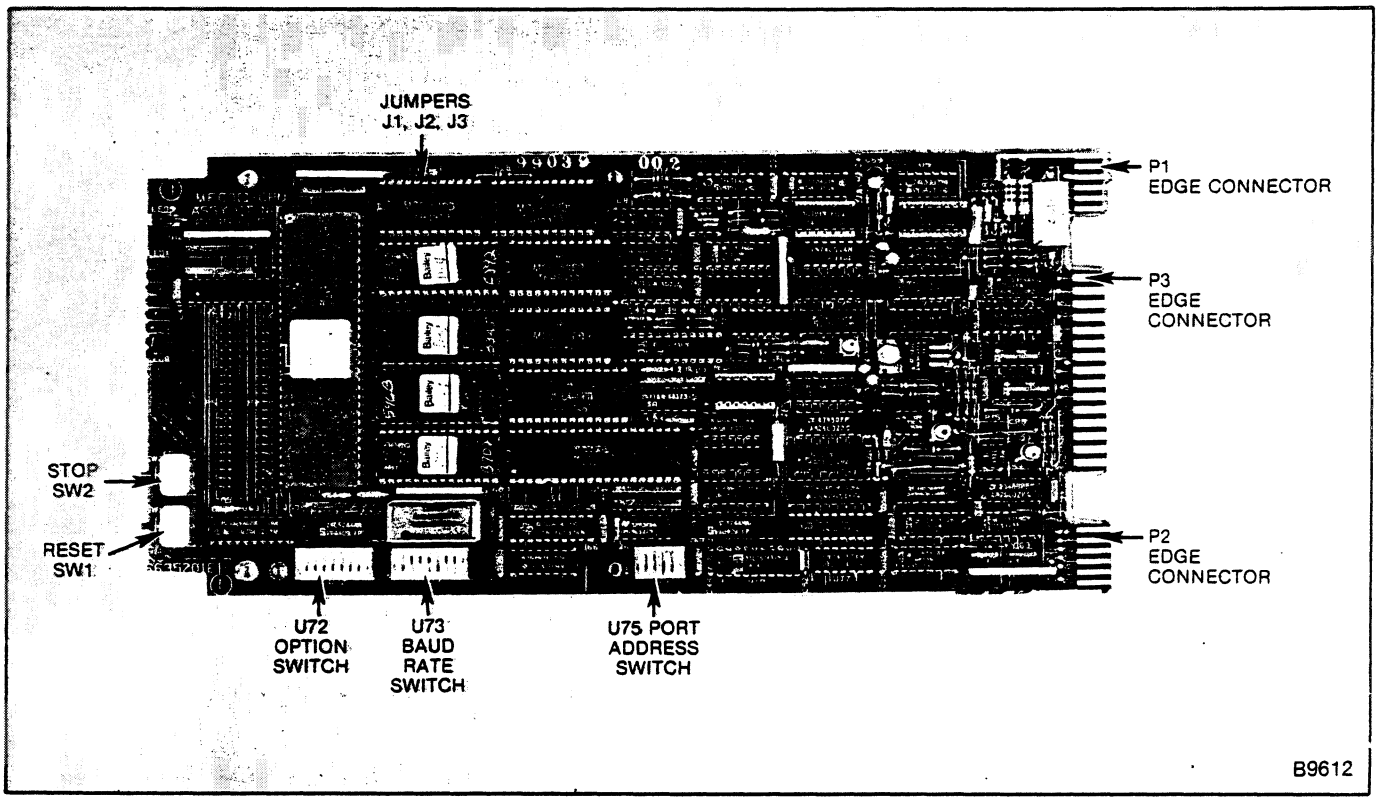


FIGURE 10 — CPU Board

Position 5 enables Modem password protection that applies to each communication channel (1 = ON, 0 = OFF).

Position 6 enables the port addressing mode (1 = ON, 0 = OFF).

Position 7 sets the checksumming option (1 = ON, 0 = OFF). When this option is ON, the LSM will expect all commands from the host to include a checksum byte as the last character before the carriage return. Similarly, the LSM will include a checksum in each reply.

Position 8 defines the primary LSM in redundant configurations. When the switch is closed (Logic 0), it signifies the Master (primary) LSM. When the pole is open (Logic 1), it signifies the Secondary (redundant) LSM.

Switch U73 - Baud Rate

U73, an eight-position dipswitch, sets the transmission rates of the two RS-232-C ports of the NTMF01 Termination Unit. Baud rates of 50 to 19,200 are available by opening and closing different switch contacts. Table 8 lists dipswitch settings for baud rate.

TABLE 8 — Baud Rates

	Terminal Port 0	Printer Port 1	Baud Rate
Binary Weight	8 4 2 1	8 4 2 1	
Contact Number	1 2 3 4	5 6 7 8	
	0 0 0 0	0 0 0 0	50
	1 0 0 0	1 0 0 0	75
	0 1 0 0	0 1 0 0	110
	1 1 0 0	1 1 0 0	134.5
	0 0 1 1	0 0 1 1	150
	1 0 1 0	1 0 1 0	300
	0 1 1 0	0 1 1 0	600
	1 1 1 0	1 1 1 0	1.2K
	0 0 0 1	0 0 0 1	1.8K
	1 0 0 1	1 0 0 1	2.0K
	0 1 0 1	0 1 0 1	2.4K
	1 1 0 1	1 1 0 1	3.6K
	0 0 1 1	0 0 1 1	4.8K
	1 0 1 1	1 0 1 1	7.2K
	0 1 1 1	0 1 1 1	9.6K
	1 1 1 1	1 1 1 1	19.2K

U75 - Port Address Switch U75

This five-position dipswitch sets the CIU port address (see Table 9). Port addresses are shown in binary with their decimal equivalent. The host must send the address as the first byte of a command, otherwise the port will ignore the command. Valid addresses range from 0 through 31. Setting a pole in the open position yields a binary 1. Setting a pole in the closed position yields a binary 0. For the Port Address Switch to be effective SW6 (U72) must be in the ON position.

TABLE 9 — Port Address

Binary Weight	16 8 4 2 1	Binary Weight	16 8 4 2 1
PORT ADDRESS DECIMAL	Pole Number 1 2 3 4 5	PORT ADDRESS DECIMAL	Pole Number 1 2 3 4 5
0	0 0 0 0 0	16	1 0 0 0 0
1	0 0 0 0 1	17	1 0 0 0 1
2	0 0 0 1 0	18	1 0 0 1 0
3	0 0 0 1 1	19	1 0 0 1 1
4	0 0 1 0 0	20	1 0 1 0 0
5	0 0 1 0 1	21	1 0 1 0 1
6	0 0 1 1 0	22	1 0 1 1 0
7	0 0 1 1 1	23	1 0 1 1 1
8	0 1 0 0 0	24	1 1 0 0 0
9	0 1 0 0 1	25	1 1 0 0 1
10	0 1 0 1 0	26	1 1 0 1 0
11	0 1 0 1 1	27	1 1 0 1 1
12	0 1 1 0 0	28	1 1 1 0 0
13	0 1 1 0 1	29	1 1 1 0 1
14	0 1 1 1 0	30	1 1 1 1 0
15	0 1 1 1 1	31	1 1 1 1 1

Memory (MEM) Board
The Memory Board (Figure 11) contains NO user-configurable components.

Parallel Bus Slave Module

Parallel Bus Slave Installation

1. Install dipshunts in sockets provided on the MMU between the connectors to be used by the PBS and the processor board of the LSM.

2. Configure the four-position dipswitch labeled SW1 with the device number to be used by the PBS on the GPIB bus. This module number corresponds to the device number used by the host to access the PBS (see Table 10).

3. Configure the eight-position dipswitch labeled SW2 with the expander bus address of the PBS (see Table 11).

4. Connect the cable (NKPB01) between the computer and the slot in the MMU to be used by the PBS.

5. Plug the PBS module into the MMU.

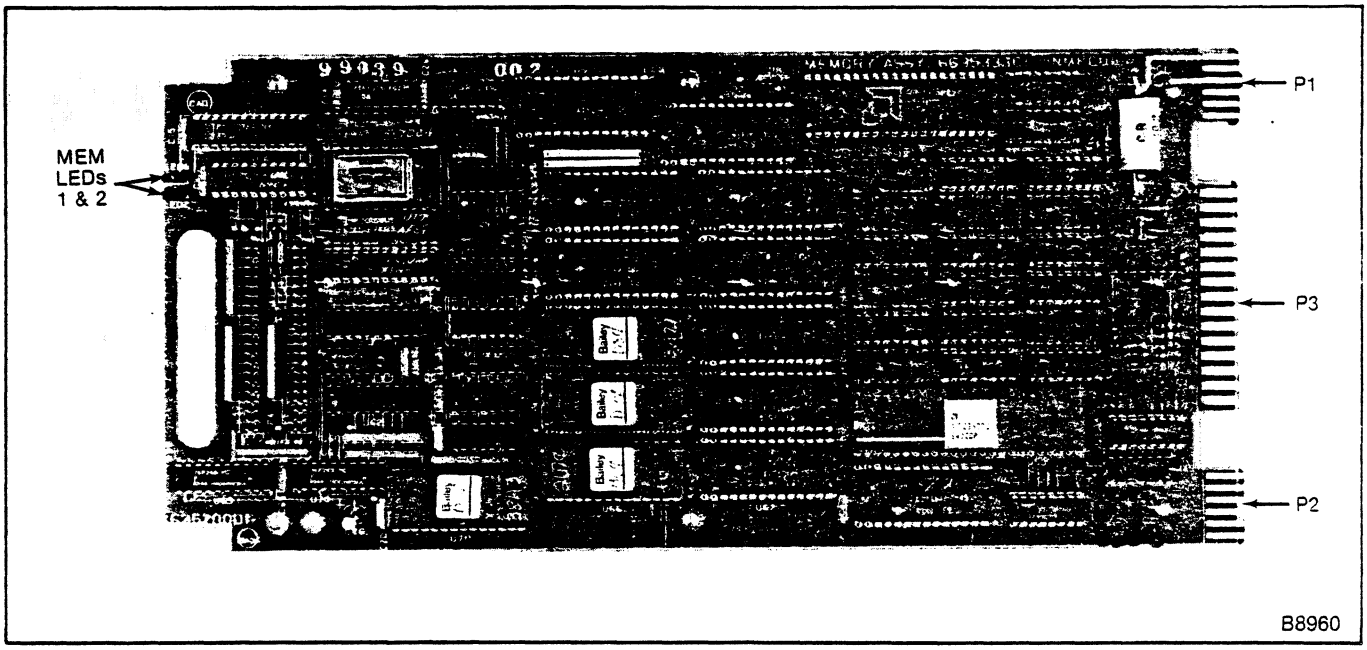


FIGURE 11 — MEM Board LED Indicators

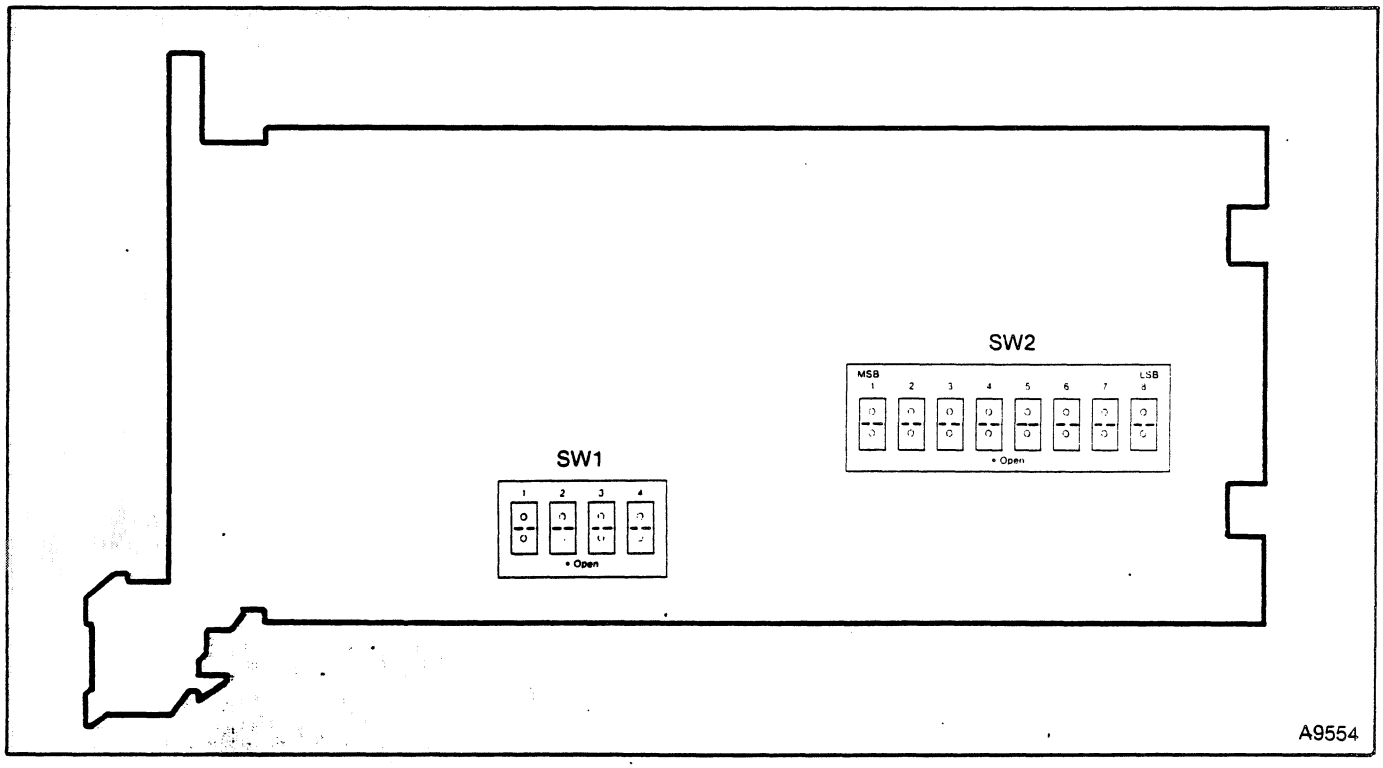


FIGURE 12 — Parallel Bus Slave Module

PBS Switch Settings (SW1)
SW1 settings represent the unique device number of the PBS on the GPIB bus. The four poles of SW1 set the GPIB device number as shown in Table 10. Pole position one is the most significant bit. As indicated in the device numbering table, the GPIB device number range is 0 through 15. The four bits generated by this switch are used internally by the PBS as bits 0-3 of the Talk and Listen addresses of the PBS. The PBS will respond to these addresses on the GPIB Bus. Bit 4 of the Talk and Listen addresses is always 0.

PBS Switch Settings (SW2)
SW2 setting represent the unique Expander Bus address number of the PBS in the system configuration. Pole positions three through eight of dipswitch SW2 are used to set PBS expander bus address as shown in Table 11. The third pole position is the most significant bit. As indicated in the address table, the valid expander bus address range is 1 through 63.

TABLE 10 — PBS Device Number Dipswitch SW1

Device Number	Pole Number 1	2	3	4
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

TABLE 11 — PBS Address Dipswitch SW2

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

Termination Units

The LSM is connected through Cable KLM to a termination unit. The termination unit (NTMF01) supports redundant CIUs and provides connectors for the RS-232-C serial ports. Port 0 is labeled as "Terminal" and Port 1 is labeled as "Printer".

Four ten-strap dipshunts on the NTMF01 are configured to provide the proper handshaking for any particular host or terminal. Figure 13 shows the use of each strap. This signal patching network allows virtually any arrangement of RS-232-C signals at the cable connectors of the termination unit.

Jumpers at the DTE end of this network cross the transmit and receive data lines for connection to data terminal equipment. Jumpers at the DCE end pass

these signals straight through for data communication equipment. Jumpers in the middle of this network allow the rest of the RS-232-C lines to be connected as needed. Sample dipshunt configurations for various computers and terminals are shown in Figure 14.

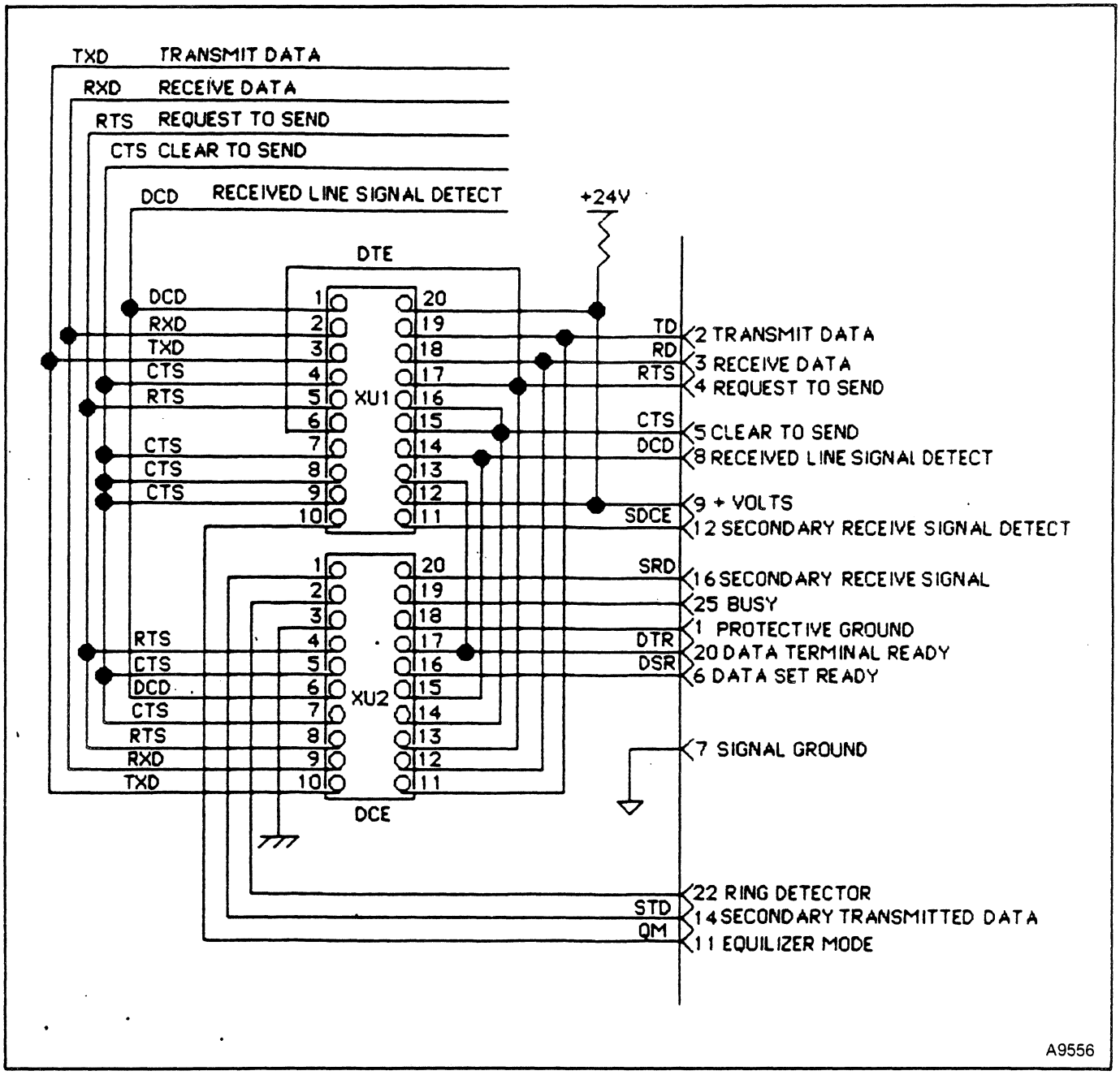
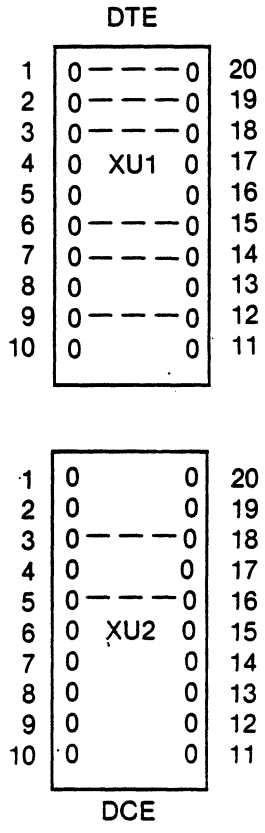


FIGURE 13 — NTMF01 Termination Unit Dipshunt Configuration

Application

IBM PC/COMPAQ and
Compatible Computers

Dipshunt/Straps



Application

Terminals VT1XX,ADM3,
Visual 50, Wyse (WY50),
Televideo

Dipshunt/Straps

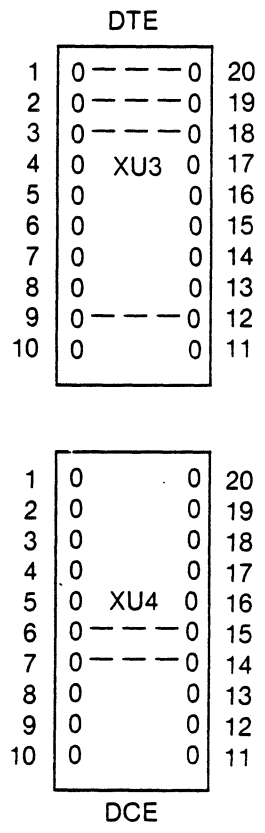
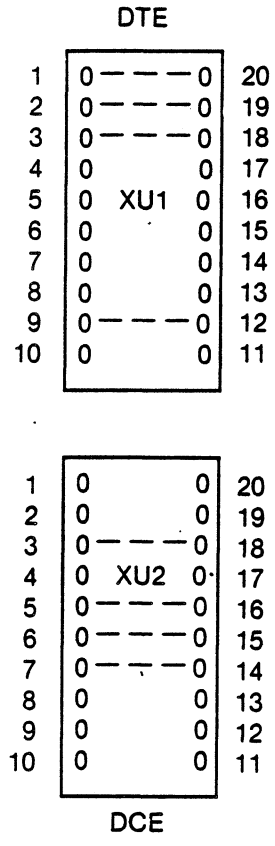


FIGURE 14 — NTMF01 Dipshunt Configurations

Application

Mainframe
(MODCOMP or VAX)

Dipshunt/Straps



Application

Communication through
a Modem

Dipshunt/Straps

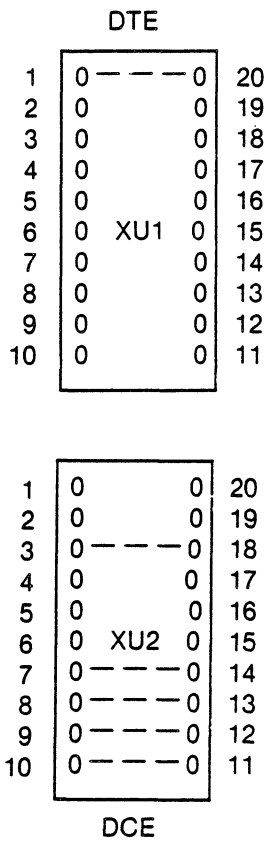


FIGURE 14 — NTMF01 Dipshunt Configuration (continued)

Section 3 –

Operational Check

1. Connect hardware as specified in the Installation Section of this manual. Set switch U72 pole four to access the utility port. Connect a dumb terminal to the NTMF01 "PRINTER " port and connect the dip-shunt straps as necessary. When a physical reset of the LSM is performed, the menu shown in Figure 15 should appear on the diagnostics terminal.

2. Select Item 1, "TALK90" from this menu. A menu of all CIU commands will appear on the screen. See Figure 16.

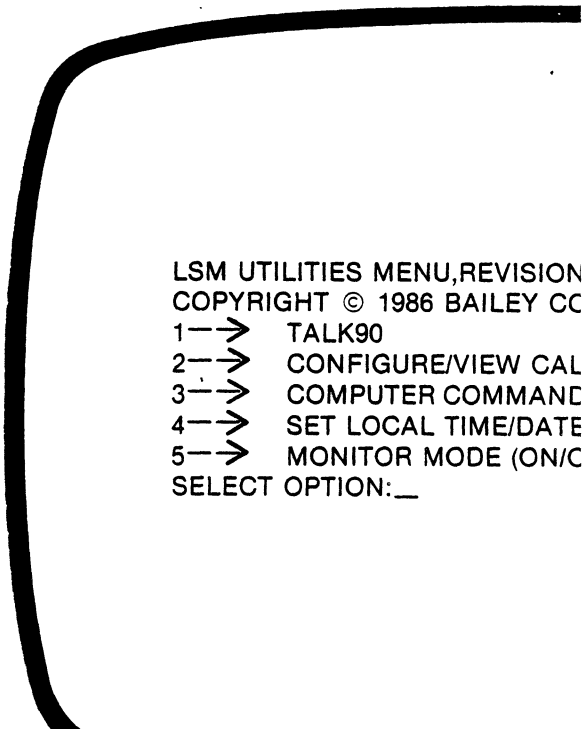


FIGURE 15 — U

*Shows the software revision.

TABLE A1 — LIM Pin Connections (P3)

Pin No.	Signal
1	Loop 2 In (+)
2	Loop 1 In (—)
3	Cable Shield
4	Loop 1 Out (+)
5	Loop 1 Out (+)
6	Loop 1 In (+)
7	Loop 1 In (—)
8	Cable Shield
9	Loop 2 Out (+)
10	Loop 2 Out (+)
11	Cable Shield
13	Loop 2 Bypass Control
14	Cable Shield
A	Cable Shield
D	Loop 1 Output (—)
E	Loop 1 Out (—)
F	Cable Shield
H	Loop 2 Bypass Control
K	Loop 2 Out (—)
L	Loop 2 Out (—)
M	Cable Shield
S	Cable Shield

TABLE A2 — TPL Field Wiring Assignments

Terminal	Signal
TB1-1	Loop In (+) - red terminal of cab with tubing identifier
2	Loop In (—) - red terminal of cab with no identifier
3	Loop 1 Cable Shield - blue termi cable
5	Loop 1 Out (+) - red terminal of with tubing identifier
6	Loop 1 Out (—) - red terminal of with no identifier
7	Loop 1 Cable Shield - blue termi cable
TB2-1	Loop 2 In (+) - red terminal of ca with tubing identifier
2	Loop 2 In (—) - red terminal of ca with no identifier
3	Loop 2 Cable Shield - blue lug o cable.
5	Loop 2 Out (+) - red terminal of with tubing identifier
6	Loop 2 Out (—) - red terminal of with no identifier
7	Loop 2 Cable Shield - blue lug o cable

```
                    TALK90 COMMAND MENU

 1 ESTABLISH POINT          2 ESTABLISH REPORT          3
 4 CONNECT POINT LIST       5 DISCONNECT PNT LIST       6
 7 READ STATUS LIST         8 READ EXCEPTIONS           10
 . . . . . . . . . . . . .  . . . . . . . . . . . . .  .

 . . . . . . . . . . . . .  . . . . . . . . . . . . .  .

55 READ STN GROUP          56 OUTPUT STN VALUE         57
58 READ COMMAND EXCEPT     59 OUTPUT STN REPORT        60
61 DEFINE SYS NODES        97 REPEAT LAST COMMAND      98
99 EXIT

SELECT COMMAND:
```

FIGURE 16 — TALK90 Command Me

See the "CIU Programmer's Reference Manual" for an explanation of these fields. If the hardware is functioning properly, the CIU should return a reply code of 0 followed by the CIU address and a "spare" byte as follows:

CIU RESPONSE—→ 0
NO ERROR

PCU NUMBER: *
SPARE: 0

<RET> TO CONTINUE

If the CIU response is other than 0, the LSM is not set up properly. Check the password protection switch, port characteristics, and baud rate.

*The number displayed should be equal to the LIM address switch setting.

The eight vertical LEDs on the LSM will display the number of messages sent and received.

The LIM sh
able to commu
itself, and the s
diagnostic term

4. The TALK
the monitor an
check out the i

5. From the
COMMAND/RE
selected to sho
adecimal that
Commands rec
"CS" and replie
"RS". Message
mands and repl
mer's Referenc

Note: CS prece
serial por
CP prece
parallel p

See Figure 17 for sample comm
RESTART command is issued follo
DEMAND MODULE STATUS comm

Note: These commands must be is
host.

```
CS  13  00  00  0A  00  0
RS  00  05  00  05  0D

CS  1B  1B  00  00  32  0
RS  00  E1  00  80  00  6
```

*FIGURE 17 - CIU RESTART/DE
STATUS Comman*

Note 1: The top two lines are the
mand and response
The options Byte = 10
All other Fields = 0

2: The second two lines
MODULE STATUS com
PCU = 50
MODULE = 0

3: The Byte stuffing protoc
Reference Manual, Secti
mand code 27 (1B HE
"1B 1B".

Other Utility Options

2—→ CONFIGURE/VIEW
PASSWORD

Password Undefined!
Defining New Password (Y/N)?

If password has been defined t
password will be displayed.