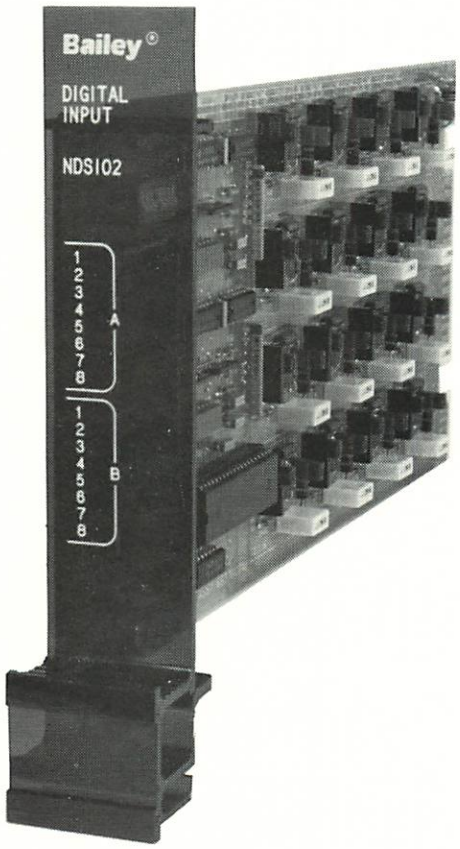
Bailey®
network 90®

Digital Slave Input Module (NDSI02)



Product Instruction

E93-913-20

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WARNING notices as used in this manual apply to hazards or unsafe practices which could result in severe personal injury or death.
CAUTION notices apply to hazards or unsafe practices which could result in minor personal injury or property damage.
NOTES highlight procedures and contain information which assists the operator in understanding the information contained in this manual.

WARNING

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MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

MANUELS D'OPERATION

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LA PLUPART DES EQUIPEMENTS ELECTRONIQUES SONT SINSIBLES AUX PERTURBATIONS DE LA FREQUENCE RADIO. DES PRECAUTIONS DEVRONT ETRE PRISES LORS DE L'UTILISATION DE MATERIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRECAUTIONS A PREDRE DANS CE CAS SOIENT SIGNALEES AUX ENDROITS VOULOUS DANS VOTRE USINE.

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PREFACE

This manual is intended to provide the daily user with instructions for the installation and operation of the NETWORK 90 Digital Slave Input Module (NDSI02).

The contents of this document should be read and clearly understood before this module is put into operation.

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SAFETY SUMMARY

GENERAL WARNINGS

EQUIPMENT ENVIRONMENT
All components, whether in transportation, operation, or storage must be in a non-corrosive environment.

ELECTRICAL SHOCK HAZARD DURING MAINTENANCE
Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.

SPECIAL HANDLING
This module uses Electrostatic Sensitive Devices (ESD).

ENVIRONMENT DE L'EQUIPEMENT
Ne pas soumettre les composants a une atmosphere corrosive lors du transport, de l'entreposage ou de l'utilisation.

RISQUES DE CHOCS ELECTRIQUES LORS DE L'ENTRETIEN
S'assurer de debrancher l'alimentation ou de prendre les precautions necessaires a eviter tout contact avec des composants sours tension lors de l'entretien.

PRECAUTIONS DE MANUTENTION
Ce module contient des composantes sensibles aux decharges electro-statiques.

SECTION 1 – INTRODUCTION

GENERAL DESCRIPTION

The NETWORK 90 system Digital Slave Input module (NDSI02) monitors two independent, identical groups of eight digital inputs (see Figure 1-1). Twelve inputs are completely isolated from each other; the remaining two pairs share common positive input lines. I/O status is indicated by sixteen front panel LEDs.

Input signals are connected to the slave via the 30-pin card edge connector (P3). This connector is cable connected to a termination unit or module (NTDI01 or NIDI01) where the physical terminal blocks are located.

SECTION CONTENT

This manual consists of Introduction, Theory of Operation, Installation, and Operation sections. General introductory material, electronic specifications, and pinouts are provided in the Introduction Section. The Theory of Operation Section explains how the key input circuits operate. Switch and jumper settings, as well as mounting, are discussed in the Installation Section. The Operation Section explains day-to-day use of the slave.

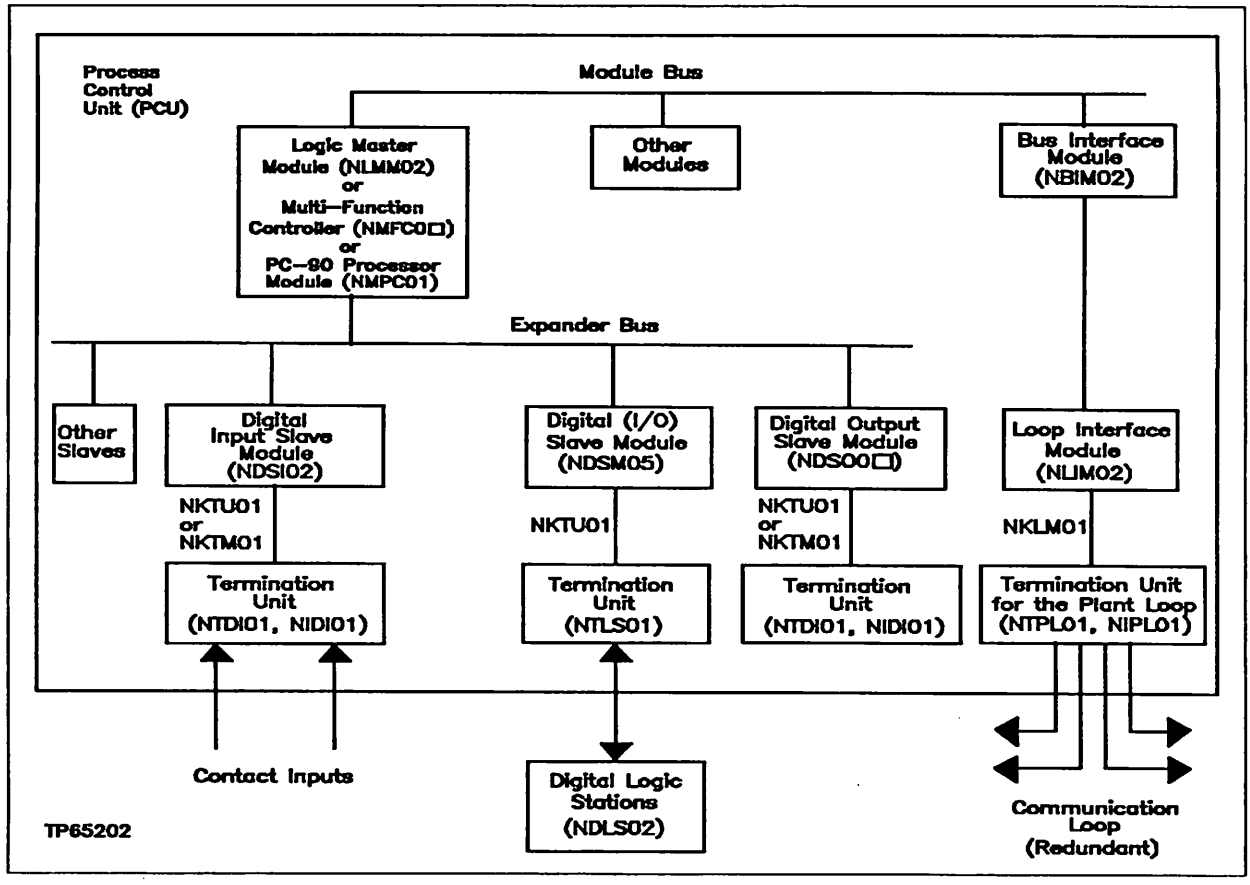

Figure 1-1. Digital Slave Input Application

SPECIFICATIONS

Typical Input Current	4.5 mA @ 24 V dc 5.0 mA @ 125 V dc 7.0 mA @ 120 V rms @ 60 Hz
Logic Power	±5 V dc (±5%)
DC I/O Voltages	24 V dc (±10%) 125 V dc (±10%) 120 V ac (±10%)
Turn-on Voltage (minimum)	
24 V dc	21.4 V dc
125 V dc	95.0 V dc
120 V ac	85.0 V ac
Turn-off Voltage (maximum)	
24 V dc	12 V dc
125 V dc	60 V dc
120 V ac	42 V ac
Maximum Input Current at Minimum Turn-on	
24 V dc	3 mA @ 21.4 V dc
125 V dc	3 mA @ 95.0 V dc
120 V ac	5 mA @ 85 V ac 60 Hz
Off Leakage Current (maximum)	
24 V dc	10 uA (@ Vin ≤12 V dc)
120 V dc	10 uA (@ Vin ≤60 V dc)
125 V ac	1.6 mA (@ Vin ≤42 V ac, 60 Hz)
Isolation	300 volts rms between input and logic circuitry and input to input. CSA approved for 300 volts isolation.
Logic Current Consumption	55 mA @ +5 V dc 79 mA maximum
Response Time	DC "Fast" - 1.5 ms DC "Slow" - 18 ms
Communication Interfaces	Passive contact input interface read by the Logic Master Module , Multi-Function Controller or PC-90 Processor via Expander Bus.
Mounting	One slot in standard NETWORK 90 Module Mounting Unit.
Environmental	
Ambient Temperature	0° to 70°C (32° to 158°F)
Relative Humidity	0 to 95% up to 55°C (131°F) (non-condensing) 0 to 45% at 70°C (158°F) (non-condensing)
Atmospheric Pressure	Sea level to 3 km (1.86 miles)
Air Quality	Non-corrosive
Certification	CSA certified for use as process control equipment in an ordinary (non-hazardous) location

Specifications Subject to Change Without Notice

Table 1-1. P1 Power Pin Connections

Pin(P1)	Connection
1	+5 V dc
2	+5 V dc
3	NC
4	NC
5	Common
6	Common
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC

NOTE: NC = No Connection

Table 1-2. P2 Expander Bus Connections

Pin(P2)	NLMM01	MFC/NLMM02
1	BX1 - Addr. 1, Data 1	Addr. 1, Data 1
2	BX0 - Addr. 0, Data 0	Addr. 0, Data 0
3	BX3 - Addr. 3, Data 3	Addr. 3, Data 3
4	BX2 - Addr. 2, Data 2	Addr. 2, Data 2
5	BX5 - Data/Status, Data 5	Addr. 5, Data 5
6	BX4 - Read/Write, Data 4	Addr. 4, Data 4
7	BX7 - Data 7	Data 7
8	BX6 - Data 6	Data 6
9	Address Strobe	Clock
10	Data Strobe	Sync
11	NC	NC
12	NC	NC

Table 1-3. P3 Input Signal Pin Connections

Group A		Group B	
Pin(P3)	Point	Pin(P3)	Point
A	1+	K	1+
1	1-	9	1-
B	2+	L	2+
2	2-	10	2-
C	3+	M	3+
3	3-	11	3-
D	4+	N	4+
4	4-	12	4-
E	5+	P	5+
5	5-	13	5-
F	6+	R	6+
* 6	6-	* 14	6-
H	7+	S	7+
7	7-	15	7-
H	8+	S	8+
J	8-	8	8-

NOTE: * = Shared Pin

RELATED EQUIPMENT

The DSI uses:

NIDI01	Termination Module - Digital Inputs
NKTM01	Cable - Termination Module
NKTU01	Cable - Termination Unit
NLMM01/02	Logic Master Module
NMFC01/02/03/04	Multi-Function Controller Module
NMMU01/02	Module Mounting Unit
NMPC01	Bailey PC-90[tm] Processor Module
NTDI01	Termination Unit - Digital Inputs

RELATED DOCUMENTS

E93-901-1	Operator Interface Unit
E93-901-21	Management Command System Operation/Configuration Manual
E93-903	Configuration/Tuning Module
E93-906-1	Multi-Function Controller Module (NMFC01/02)
E93-906-7	Multi-Function Controller Module (NMFC03)
E93-906-12	Multi-Function Controller Module (NMFC04)
E93-907	Logic Master Module (NLMM01)
E93-907-5	Logic Master Module (NLMM02)
E93-907-6	Bailey PC-90 Processor Module (NMPC01)
E93-911	Termination Units (includes termination modules and cables)

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SECTION 2 – THEORY OF OPERATION

GENERAL

The NDSI02 acts as a passive contact input interface. Inputs are available to the Logic Master Module, Multi-Function Controller (MFC), or the Bailey PC-90 Processor Module (MPC) on the 12-line Expander Bus (see Figure 2-1). The physical slave address is set with the address select switch S1.

INPUTS

Field input voltages are contact closures of either 24 V dc, 125 V dc, or 120 V ac rms. The dc inputs have two possible propagation (speed) choices. A slow setting (18 millisecond response time) and a fast setting (1.5 milliseconds response time). The voltage level and dc speed for each input is selected by on-board jumpers. The Installation Section contains directions for connecting jumpers.

Input Circuits

The NDSI02 has 16 identical input circuits that go to isolation and buffer blocks. These blocks provide optical isolation between the control logic circuitry (powered from +24 V dc, +125 V dc, or 120 V ac).

> **NOTE:** Due to the number of pins on the P3 connector, 12 inputs are completely isolated; two pairs share a common lead.

Signal Isolation

The input circuits provide 300 V rms signal isolation between input and logic circuitry and other input channels, and is accomplished by PCB trace separation per CSA standards.

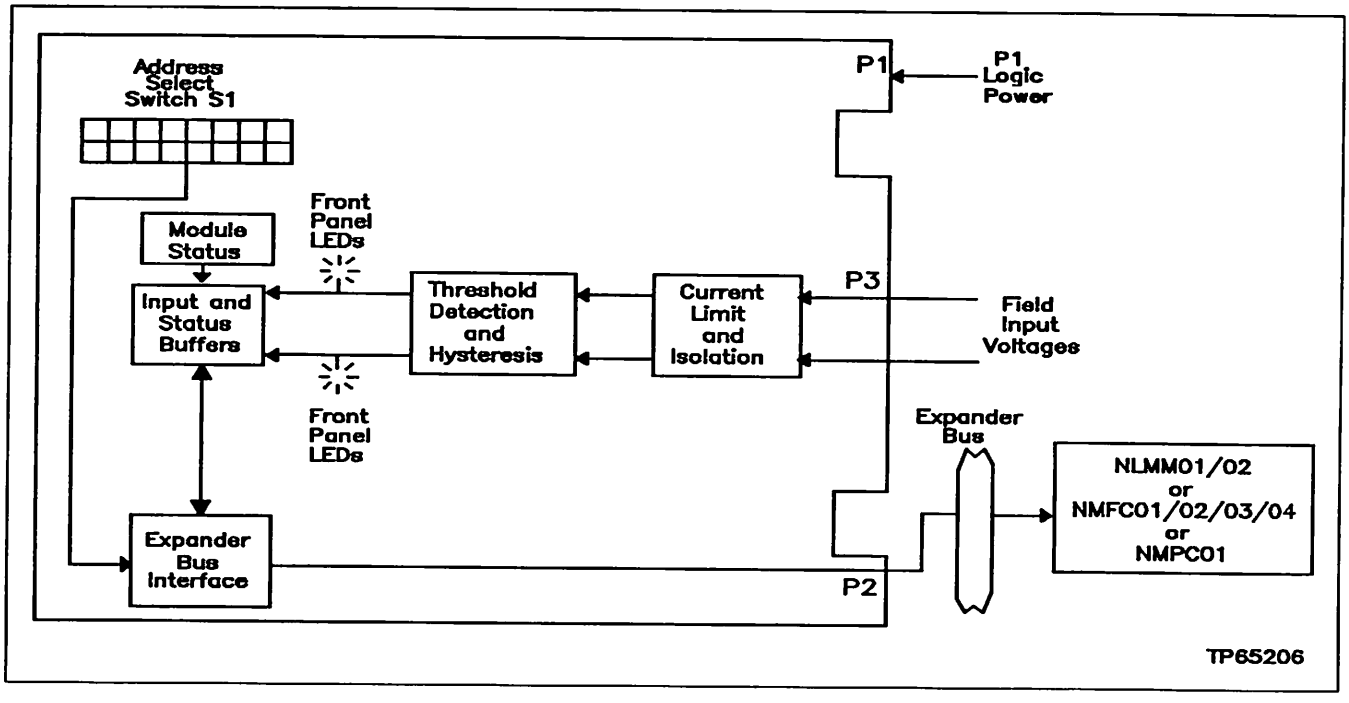

Figure 2-1. Digital Slave Input Block Diagram

Input Circuit Description
When an input signal is present (closed contact), a zener diode turns on at the appropriate voltage level (depending on input voltage selected). This allows current to flow through an optocoupler photo-diode, turning on its phototransistor. This in turn, causes a comparator output to go low, lights a corresponding LED, and indicates a closed contact on the Expander Bus. When the contact is open, no current flows through the optocoupler, the front panel LED is not lit, and the open contact condition is transmitted to the master via the Expander Bus.

Input Circuit Connections
The contact input signals connect to the 30-pin card edge connector (P3) of the DSI using either a Termination Unit cable from the NTDI01 Termination Unit, or a standard ribbon cable from the NIDI01 Termination Module (high density).

CONTROL LOGIC

The Expander Bus Interface block responds to Expander Bus Interface signals to allow the master modules access to the slave. Either point data or status information is read from the slave.

Point Data Byte Information
The input data is read as two bytes with each bit corresponding to one point. The bit value reflects the state of that input.

Status Byte Definition
The status byte insures module integrity, proper expander bus communication, and master module configuration. The status is read and compared against an expected result. If a mismatch occurs the error is flagged and the points are marked bad quality.

LOGIC POWER

Logic power connections are made through the top 12 pin card edge connector (P1) on the DSI board. (Refer to Table 1-1.)

EXPANDER BUS

Expander bus connections are made through the bottom card edge connector (P2) of the DSI board. (Refer to Table 1-2.)

The NETWORK 90 Expander Bus is a high speed synchronous parallel bus used for communication between intelligent Master Modules (LMM, MFC, and MPC) and slaves. The master modules provide control functions. The slaves provide I/O for the master.

The Expander Bus consists of twelve signal lines on the Module Mounting Unit backplane and cable assemblies to connect up to six MMU backplanes together. The Expander Bus is connected on the MMU backplane by 12-position dipshunts inserted in sockets on the backplane. Separate Slave/Master subsystems must have their Expander Busses separated by leaving a socket on the backplane empty or by not connecting the ribbon cable between MMUs. The Expander Bus is connected when the dipshunts are in place. This needs to be accomplished to allow the master to communicate with it's slaves. The P2 connector of the NDSI02 and the master module connects to this parallel bus with a card edge connector at each MMU slot.

The NDSI02 uses a semi-custom gate array to perform the Expander Bus interface function. All the control logic and protocol are built into this IC. Earlier NETWORK 90 systems may have NLMM01 master modules which do not use the standard MFC/LMM slave bus protocol. If communication is required with an NLMM01, a conversion kit must be installed on the slave. The following explains the differences between the two interfaces.

NLMM01 Expander Bus Interface
This earlier protocol was designed to handle up to 8 digital slaves per master. To allow older system's support without the need to completely replace the system, a conversion kit (P/N 258355) can be installed to allow the DSI to communicate with the NLMM01. This kit consists of a piggyback board that mounts in place of the custom integrated circuit (IC). Standoffs are provided and the pins of the piggyback board plug into the same socket the custom IC occupies. Once the conversion is done, the DSI will no longer talk to MFC or NLMM02 modules.

Universal Expander Bus Interface
A semicustom CMOS gate array provides the expander bus interface for the NDSI02. This IC provides the following functions for the NDSI02:

- Address comparison and detection.
- Function code latching and decoding.
- Read strobe generation.
- Data line filtering of bus signals.
- On-board bus drivers.

SECTION 3 – INSTALLATION

INTRODUCTION

This section explains the user setup procedure for an NDSI02 application. Information on system variations, switch settings, termination units, and cabling requirements is included. NDSI02 installation features are standard for the NETWORK 90 system.

The DSI module SHOULD NOT be put into operation until the steps in this section have been completed.

HANDLING

Special Handling
The DSI uses CMOS devices. Follow the special handling procedures below:

1. Use Electrostatic Device (ESD) protective ground strap when installing or removing modules to configure or change switches.

2. Keep the modules in special anti-static bag until you are ready to install them in the system. Save the bag for future use.

3. Ground the anti-static bag before opening.

4. Verify that all devices connected to the modules are properly grounded before using them.

5. Avoid touching the circuitry when handling the modules.

General Handling
1. Examine the modules immediately to verify that no damage has occurred in transit.

2. Notify the nearest Bailey Controls Sales Office of any damage.

3. File a claim for any damage with the transportation company that handled the shipment.

4. Use the original packing material and/or container to store the modules.

5. Store the module in an environment of good air quality, and free from temperature and moisture extremes.

USER-CONFIGURED SWITCHES

Slave Address Selection (Switch S1)
The NDSI02 can have one of 64 addresses on the Expander Bus. This address uniquely identifies the slave to the MFC. The address is set by an 8-position dipswitch (see Figure 3-1).

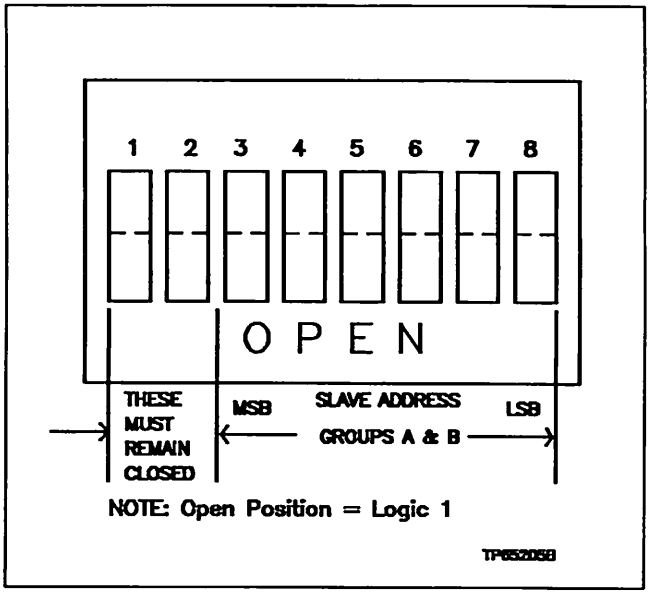

Figure 3-1. Address Select Switch for NLMM01 Operation

Slave Address for Operation with NMFC01-04/ NLMM02/NMPC01
The six right most switch positions of eight position Select Switch S1 sets the 6 bit DSI slave address (see Figure 3-2). Note the significant bit position in the two figures.

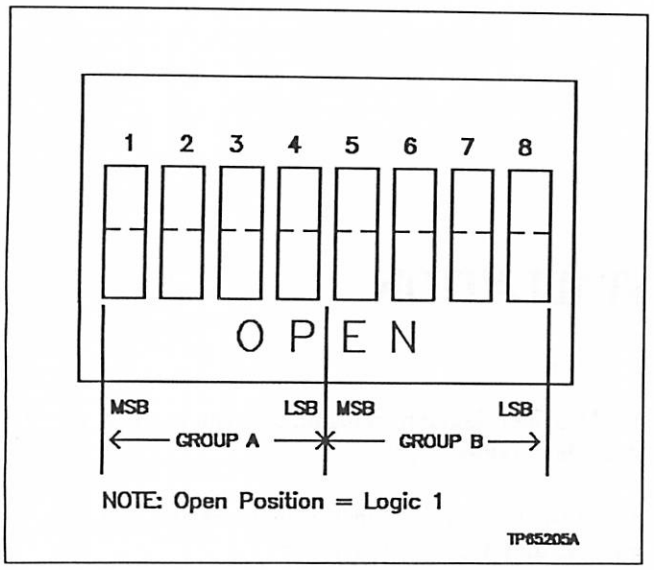

Figure 3-2. Address Select Switch for NLMM02/NMFC0[]/NMPC01

Slave Address for NLMM01 Operation.
When it is necessary to communicate with an NLMM01, the conversion kit (P/N 258355) must be installed. When used in this mode, the slave is now accessed as two individually addressed groups of 8 points each. In this case it is necessary to set both group addresses on switch S1. The possible address range for each group is 0 to 15 (for a maximum of 8 slaves with 2 groups per slave). These addresses are set according to Figure 3-1 with Group A address set with the rightmost four switches and group B set with the leftmost four switches.

SETTING INPUT VOLTAGE LEVELS

Jumpers J-1 through J-32 are used to set the input voltage levels. Refer to Table 3-1 for settings. See Figure 3-3 for switch and jumper locations.

Table 3-1 Input Voltage Jumper Settings

Voltage	J1-J16	J17-J32
120 V ac	1-2	1-2
125 V dc Slow	2-3	2-3
125 V dc Fast	2-3	3-4
24 V dc Slow	3-4	2-3
24 V dc Fast	3-4	3-4

LOGIC POWER

Logic power connections are made through board edge connector P1 on the DSI board (refer to Table 1-3).

MOUNTING

NOTE: Installation instructions pertaining to the slave only are provided here. For complete cable and Termination Unit/Module (NTDI01 or NIDI01) information, refer to Termination Unit Manual, IE93-911.

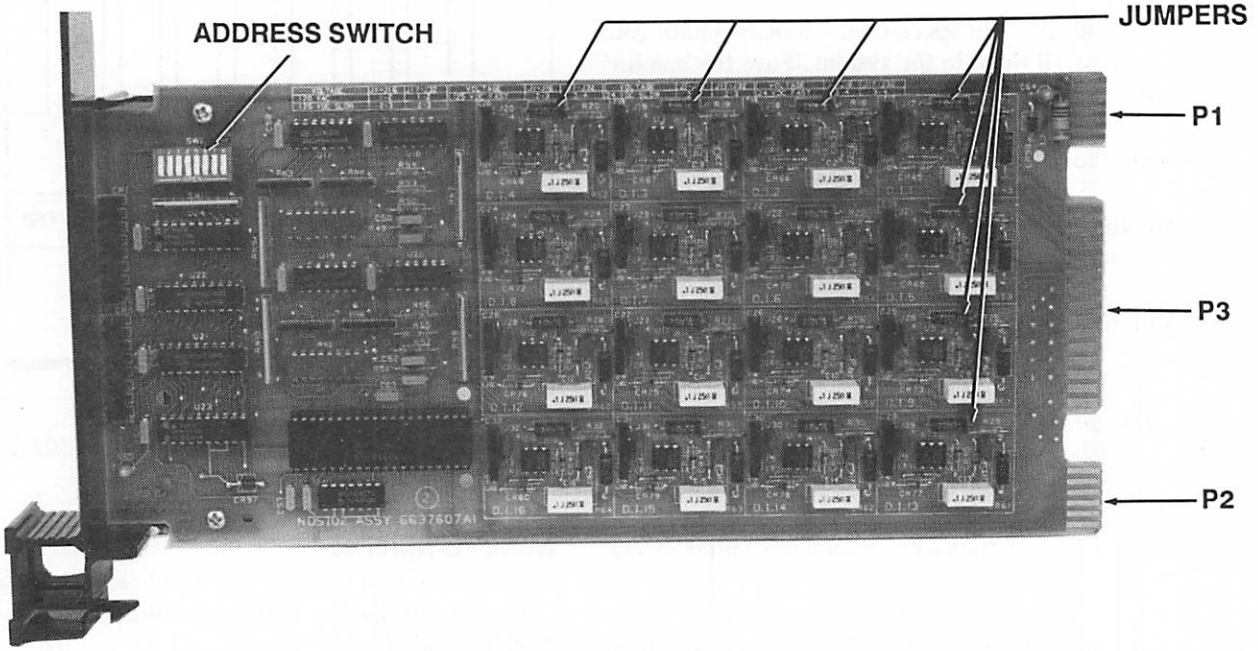

Figure 3-3. Component Locations

The NDSI02 module inserts into a standard NETWORK 90 Module Mounting Unit and occupies one slot. To install:

1. Verify the slot assignment of the module (ensure Expander Bus port can connect to the Expander Bus driven by the master module).

2. Verify that a dipshunt is in the MMU backplane socket between the slave and the master module.

3. Connect the hooded end of the cable from the Termination Unit (or Termination Module) to the P3 card edge connector of the slave module.

4. Align the module with the plastic guide rails in the MMU; gently slide the module in until the front panel is flush with the top and bottom of the MMU frame, and the latch engages the MMU frame.(To remove the module, squeeze the module latch and gently slide out).

SECTION 4 -- OPERATION

GENERAL

The start-up of the Digital Slave Input module is fully automatic and is controlled by the master module. The user need only observe the front panel LEDs during the course of operation.

LED INDICATORS

The Digital Slave Input has input point LED status indicators on the front panel to aid system test and diagnosis (see Figure 4-1). When the input is energized (contact closed), the LED lights red. When the input is not energized (contact open), the LED is not lit.

The status of the DSI is obtained by checking the Master for good quality on input blocks or the slave status block. This is accomplished with any NETWORK 90 operator interface (e.g. Management Command System, Operator Interface Unit, Bailey Work Station, Configuration/Tuning Module).

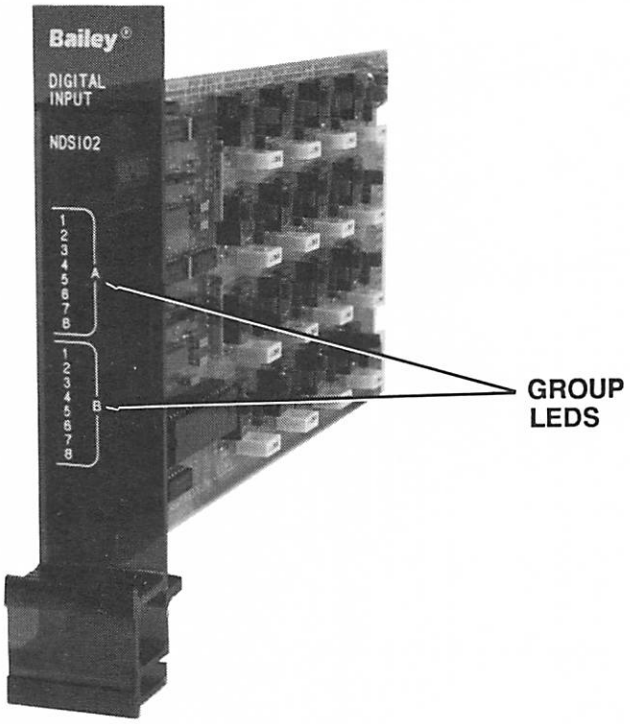

Figure 4-1. NDSI02 Front Panel

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