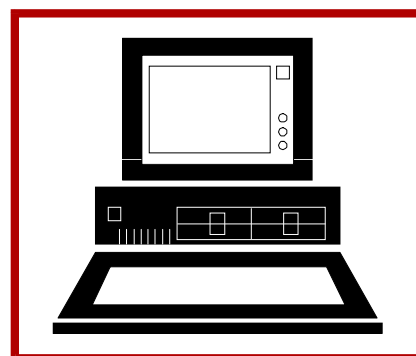
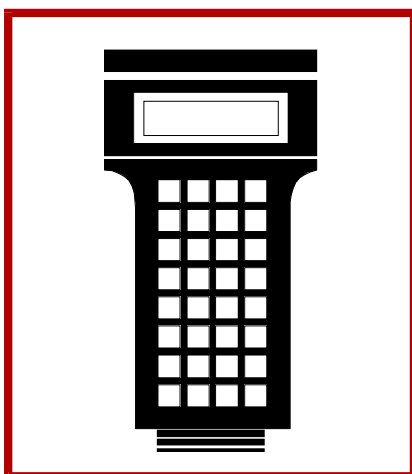
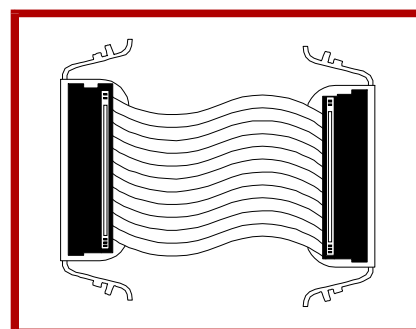
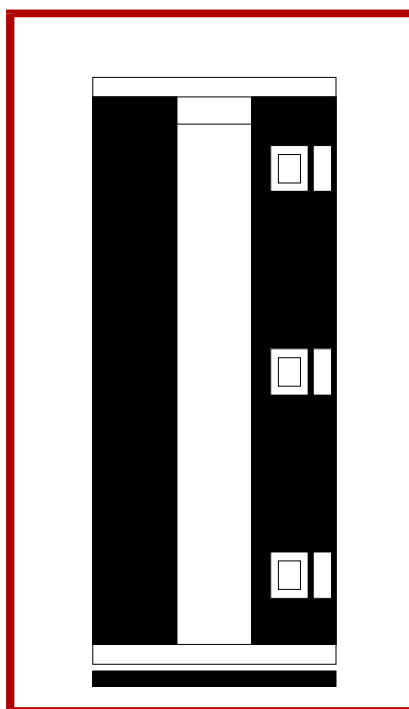
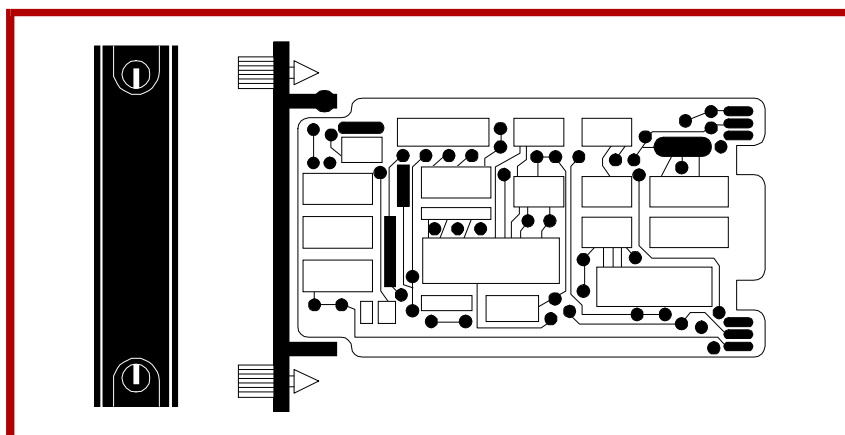
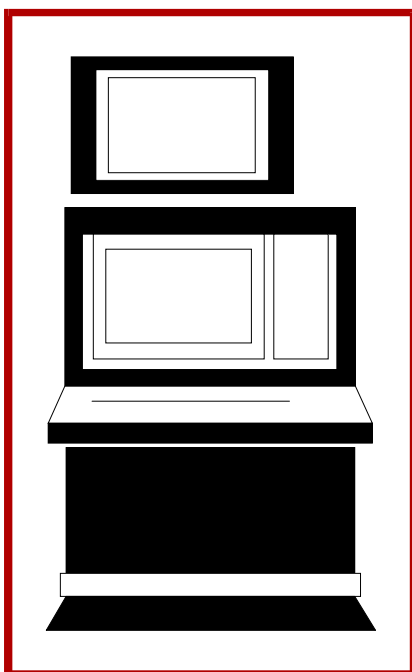


E96-605

Bailey®
infi 90

Instruction

Bus Interface Module/ Loop Interface Module (INBIM02/INLIM03)



WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices that could result in property damage.

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN, OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING, AND FOLLOWING THE PROPER **Elsag Bailey** INSTRUCTIONS AND MANUALS; OTHERWISE, INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS

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'OPÉRATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER L'ÉQUIPEMENT SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS RÉGLEMENTAIRES DE **Elsag Bailey**. TOUTE NÉGLIGENCE À CET ÉGARD POURRAIT ÊTRE UNE CAUSE D'ACCIDENT OU DE DÉFAILLANCE DU MATÉRIEL.

PERTURBATIONS PAR FRÉQUENCE RADIO

LA PLUPART DES ÉQUIPEMENTS ÉLECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS PAR FRÉQUENCE RADIO. DES PRÉCAUTIONS DEVRONT ÊTRE PRISES LORS DE L'UTILISATION DU MATÉRIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRÉCAUTIONS À PRENDRE DANS CE CAS SOIENT SIGNALÉES AUX ENDROITS VOULUS DANS VOTRE USINE.

PERTURBATIONS DU PROCÉDÉ

L'ENTRETIEN DOIT ÊTRE ASSURÉ PAR UNE PERSONNE QUALIFIÉE EN CONSIDÉRANT L'ASPECT SÉCURITAIRE DES ÉQUIPEMENTS CONTRÔLÉS PAR CE PRODUIT. L'AJUSTEMENT ET/OU L'EXTRACTION DE CE PRODUIT PEUT OCCASIONNER DES À-COUPS AU PROCÉDÉ CONTRÔLE LORSQU'IL EST INSÉRÉ DANS UNE SYSTÈME ACTIF. CES À-COUPS PEUVENT ÉGALEMENT OCCASIONNER DES BLESSURES OU DES DOMMAGES MATÉRIELS.

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Preface

The Loop and Bus Interface Modules (LIM/BIM) provide the principal communication interface between INFI 90 Process Control Units and Plant Loop. Plant Loop is a high speed (500 kbaud) serial communication highway that all INFI 90 modules share. A maximum of 63 nodes, in any combination, can be on the Loop.

This product instruction provides you with features, specifications, installation, operation and troubleshooting information.

List of Effective Pages

Total number of pages in this manual is 43, consisting of the following:

Page No.	Change Date
Preface	Original
List of effective Pages	Original
iii through vii	Original
1-1 through 1-4	Original
2-1 through 2-8	Original
3-1 through 3-7	Original
4-1	Original
5-1 through 5-7	Original
6-1	Original
7-1	Original
8-1	Original
A-1 through A-3	Original
B-1 through B-3	Original

When an update is received, insert the latest changed pages and dispose of the superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear beside the page number.

Safety Summary

**GENERAL
WARNINGS****Equipment Environment**

All components, whether in transportation, operation or storage must be in a noncorrosive environment.

Electrical Shock Hazard During Maintenance

Disconnect power or take precautions to ensure that contact with energized parts is avoided when servicing.

Special Handling

This module uses Electrostatic Sensitive Devices (ESD).

**SPECIFIC
WARNINGS**

J1 end of NKLS04 cable must be connected to the NICL01. J2 end must be connected to the LIM module. Failure to do so can damage the modules. (p. 3-7)

Ensure that the end marked J1 is connected to P1 on NICL01, and J2 is connected to the LIM. Failure to do so could result in module damage (see Figure B-1). (p. B-1)

Sommaire de Sécurité

**AVERTISSEMENTS
D'ORDRE
GÉNÉRAL**

Environnement de l'équipement

Nes pas soumettre les composantes a une atmosphere corrosive lors du transport, de l'entreposage ou de l'utilisation.

Risques de chocs electriques lor de l'entretien

S'assurer de debrancher l'alimentation ou de prendre les precautions necessaires a eviter tout contact avec des composants sous tension lors de l'entretien.

Precautions de Manutention

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

**AVERTISSEMENTS
D'ORDRE
SPÉCIFIQUE**

L'extremite J1 du cable NKLS04 doit etre branchee au module NICL01. L'extremite J2 doit etre branchee au module LIM. Sinon, les module pourraient etre endommages. (p. 3-7)

S'assuree que L'extremite identifiee par J1 est reliee a P1 du module NICL01 et que J2 est reliee au module LIM. Sinon, les modules pourraient etre endommages (voir la figure B-1). (p. B-1)

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SECTION 1 - INTRODUCTION

OVERVIEW

The Loop and Bus Interface Modules (LIM/BIM) provide the principal communication interface between INFI 90 Process Control Units (PCU) and Plant Loop. Plant Loop is a high speed (500 kbaud) serial communication highway that all INFI 90 modules share. A maximum of 63 nodes, in any combination, can be on the loop. The INLIM03 and INBIM02 are directly upward compatible with Network 90 NLIM02 and NBIM02.

The basic function of the BIM is to gather data from modules and transfer it to the LIM. The basic function of the LIM is to examine the data and transmit it to the assigned destination on the loop. Detailed theory of LIM/BIM operation is covered in [Section 2](#).

This instruction manual is intended to assist personnel with installation and operation of the Loop Interface/Bus Interface Modules.

INTENDED USER

System engineers and technicians should read this manual before installing and operating the Loop and Bus Interface Modules (LIM/BIM). The modules **SHOULD NOT** be put into operation until this instruction is read and understood. Refer to the **Table of Contents** to find specific information after the module is operating.

MODULE DESCRIPTION

The LIM and BIM each occupy one slot in the Module Mounting Unit (MMU). They are joined together with a ribbon cable. Two captive screws on each module secure them to the MMU. Eight LEDs on the LIM faceplate display messages and error information.

FEATURES

The modular design of the LIM and BIM modules, as with all INFI 90 modules, allows for flexibility when creating a process management system strategy. An optional second LIM/BIM pair can be added to provide a redundancy feature to the system. One pair performs the primary interface function, while the other LIM/BIM pair is on standby. Should a primary failure occur, the secondary pair comes on-line without interrupting the process. Other features include selectable poll rates (the time between module output block checks), on-board

diagnostics, and 32 kbytes of RAM available to the BIM user. Each LIM provides redundant loop interface and the physical media is redundant.

INSTRUCTION CONTENT

This document is divided into ten sections. **Introduction** is an overview of the LIM/BIM pair: features, description and specifications. **Description and Operation** explains the operation of the modules. **Installation** provides precautions and handling information. Procedures are included that detail setup and jumper settings. **Operating Procedures** provides the user with normal, everyday operating instructions. **Troubleshooting** explains possible error situations and corrective measures. **Maintenance** provides a maintenance schedule. **Repair/Replacement Procedures** lists instruction on removal and replacement of modules. **Support Services** provides replacement part ordering information. **Appendix A** and **Appendix B** explain termination unit/module wiring connections.

HOW TO USE THIS MANUAL

Read the introductory material first. Then, proceed to the **Section 2** to get a fundamental understanding of how the modules work. Next, read **Section 3**. This section should be read thoroughly, and all preparatory steps performed, before putting the modules into operation. After installing the modules, read **Section 4** to find out what to look for in the normal and abnormal operating modes. Refer to **Section 5** if any abnormal situations occur after putting the modules into operation.

NOMENCLATURE

Nomenclature	Hardware
NKLS03	Termination Unit Cable
NKLS04	Termination Module Cable
NTCL01	Termination Unit, Plant Loop
NICL01	Termination Module, Plant Loop

REFERENCE DOCUMENTS

Document No.	Document
I-E96-100	Operator Interface Station Operation/Configuration
I-E93-911	Termination Unit Manual

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
Common Database	Data shared by LIM/BIM pairs on the Plant Loop.
EWS	Engineering Work Station; an integrated hardware and software personal computer system for configuring and monitoring INFI 90 modules and systems.
Frame	Valid string of bytes on the Plant Loop.
Hey Message	Request for an interrupt generated by BIM.
LSB	Least Significant Bit; the bit of a binary number that carries the least numeric weight.
MMU	Modular Mounting Unit; a card cage that provides electrical and communication support for INFI 90 modules.
MSB	Most Significant Bit; the bit of a binary number that carries the most numerical weight.
Node	Any drop on the Loop; example, Operator Interface Station, Process Control Unit and Network 90 Interface Units.
OIS	Operator Interface Station; integrated operator console with data acquisition and reporting capabilities. It provides a window into the process for flexible control and monitoring.
PCU	Process Control Unit; rack type industrial cabinet that contains master, slave and communication modules, and their communication paths.
Plant Communication Loop	The unidirectional highway for serial data shared by all nodes on the Loop; also known as the Plant Bus.
Polling Rate	The time interval that the BIM checks the modules for block outputs.
Receive Data	Data received by destination PCU.
Synchronization Time	The time it takes for internal circuitry to readjust when a module goes into or comes out of bypass.
TM	Termination Module; Provides input/output connection between plant equipment and the INFI 90 process modules. The termination module slides into a slot in the termination mounting unit.
TU	Termination Unit; provides input/output connection between plant equipment and the INFI 90 process modules. The termination unit is a flat circuit board for panel mounting.
Transmit Data	Data sent by one PCU to another.

SPECIFICATIONS

Memory	LIM: 2 kbytes RAM, 4 kbytes ROM BIM: 32 kbytes RAM, 16 kbytes ROM
Power Requirements	LIM: +5 VDC @ 2.0 amps; 10 watts nominal ±15 VDC @ 80 mA; 1.2 watts nominal BIM: +5 VDC @ 1.0 amps; 5 watts nominal +15 VDC @ 150 mA; 2.25 watts nominal -15 VDC @ 120 mA; 1.80 watts nominal
System Capability	Maximum of 63 nodes in the system. Any combination of PCU, OIS or NIU.
Communication Rates	500 kbaud. 800 messages/second maximum.
Synchronization Time	100 milliseconds maximum.
Cable Specifications	
Plant Loop (node - node)	LIM: 2000 meters (6561 feet) maximum
Loop Interface (LIM - TPL/IPL)	LIM: 61 meters (200 feet) maximum
Certification	CSA certified for use as process control equipment in an ordinary (non-hazardous) environment.
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% up to 70°C (158°F) (non-condensing)
Atmospheric Pressure	Sea level to 3 km (1.86 miles)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

The Plant Loop is a unidirectional highway for serial data which is shared by all nodes and other data users. The Loop Interface Module (LIM) is the communication interface with the Plant Loop. The Bus Interface Module (BIM) provides Plant Loop access to the module bus where data is being obtained and updated continuously from system instrumentation. Redundant plant communication loop cables carry identical messages.

FUNCTIONAL OPERATION

Start-Up

When the system is initialized (powered up for the first time), each LIM sends a *broadcast* message informing all other LIMs that it is on-line and ready to receive and transmit messages. Message acknowledgment is not necessary for the broadcast. When a broadcast is received, the LIM sends a *node on-line* (NOL) message to its BIM. Once this process is complete, all LIM/BIM pairs *know* that the PCU is on-line and ready to receive communications.

Message Format

As shown in Figure 2-1, the message format for system communication is made up of two time-related data frames or groups. The first group is referred to as the header and the second group provides the message data. A time gap exists between the two message groups which is referred to as the V-Time Gap. This gap allows the LIM to process a substantial part of a message before another segment is received.

The header contains the following bytes of information:

- 0. Destination PCU** - intended receiver of message; range is 1 to 63.
- 1. Source PCU** - sender of message; range is 1 to 63.
- 2. Header Data (Frame Sync)** - the LIM uses this byte to ensure header/data synchronization on the loop, in the event of noise or other signal degradation.
- 3. Sequence number** - a counter in the LIM that indexes in the sequence that messages are transmitted and ensures that messages are received in the same order in which they were sent.

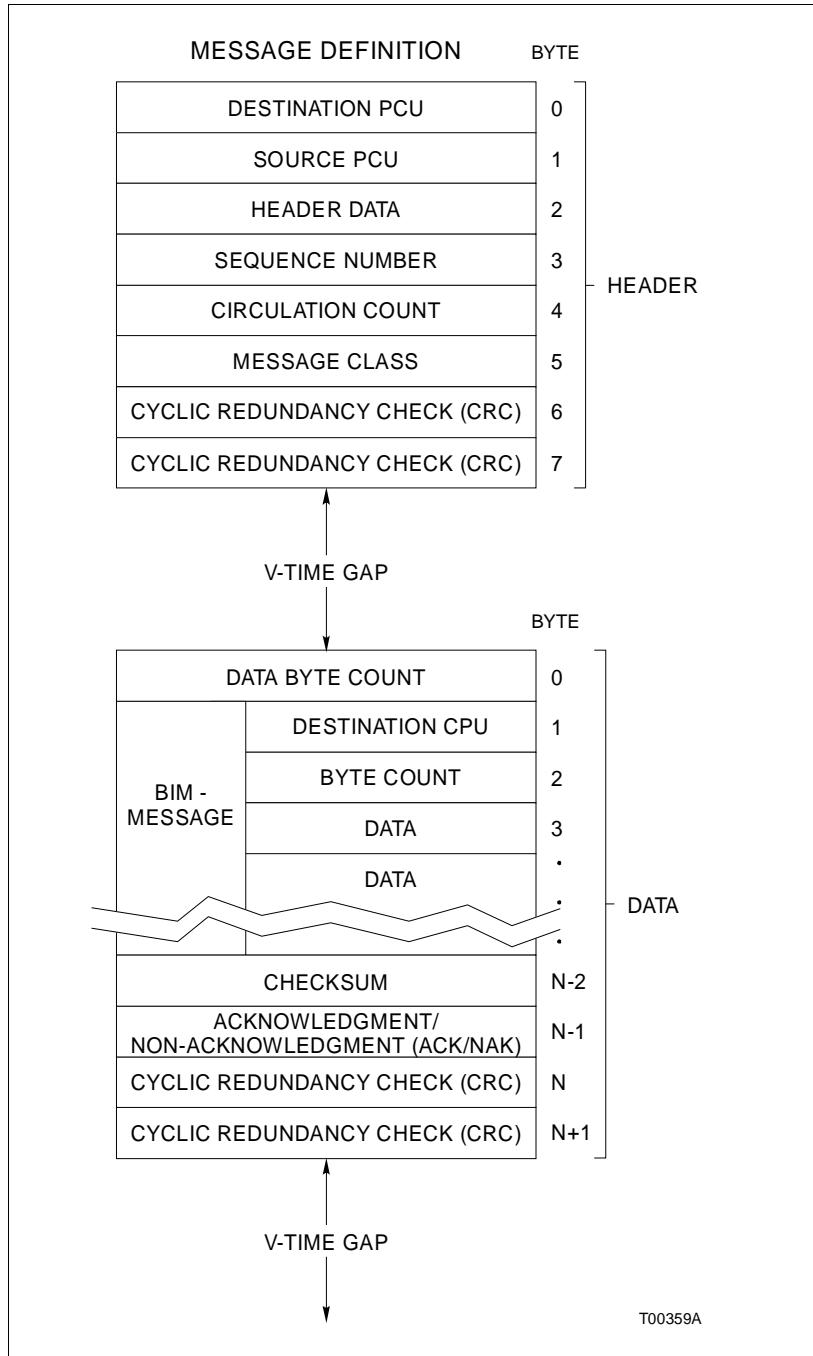


Figure 2-1. Message Format

4. Circulation count - monitors the number of retries a message generates. If this exceeds the number (127), the message is discarded, and the destination PCU is declared off-line.

5. Message class - indicates the type of message initialized by the source PCU. A 00 indicates a normal, BIM-originated message; an FF indicates a Hey message.

6. Cyclical Redundancy Check (CRC) - (two bytes wide) developed and checked by hardware. The CRC code is the complement of the remainder of a calculation employing the polynomial $x^{16} + x^{12} + x^5 + 1$, where x is the binary value of all bits in a frame. The V-Time Gap follows the CRC in the message header.

The next segment to be received is variable length data, constructed as follows:

- 1. Data byte count** - the length of the data message.
- 2. BIM Message** - the exact message as placed in the BIM transmit buffer. It is composed of the **destination PCU, byte count** and **data**. The byte count is used for checksum computation.
- 3. Checksum** - an Exclusive-OR sum developed over the BIM message, computed by the LIM prior to transmission and again after receipt.
- 4. ACK/NAK** - Acknowledgment/Non-acknowledgment of Plant Bus message. All messages are transmitted with a no-response NAK. Valid responses are an ACK, a busy NAK or a no-response NAK. Any other code reflects errors encountered during loop transmit and is cause for retry processing by the source LIM.
- 5. CRC** - same as for header.

Figure 2-2 is a block diagram representation of data flow throughout the system.

Transmission

Any LIM can transmit a message at any time. There is no loop master or traffic director. Each LIM can transmit and receive messages simultaneously. LIM start-up/shutdown is localized requiring no interaction with other LIMs on the Loop. Each LIM receives all incoming messages and transmits a new stream of messages in a *store and forward* fashion to the next LIM. If there are no messages to be transmitted, the LIM transmits null packets as the loop idle condition. When a message arrives and needs to be forwarded, the transmitter stops sending null packets and begins sending the message.

The LIM can also originate a message in its transmit buffer; however, messages usually come from the BIM. Once the transmit buffer is loaded, its content is sent as soon as possible. If the transmitter buffer is not currently busy, the message goes out immediately; otherwise the message waits for the first null packet and is then transmitted. When the transmit buffer sends a message it is marked busy, until the message goes completely around the loop and is returned to the source PCU. If the message reached its destination successfully, the

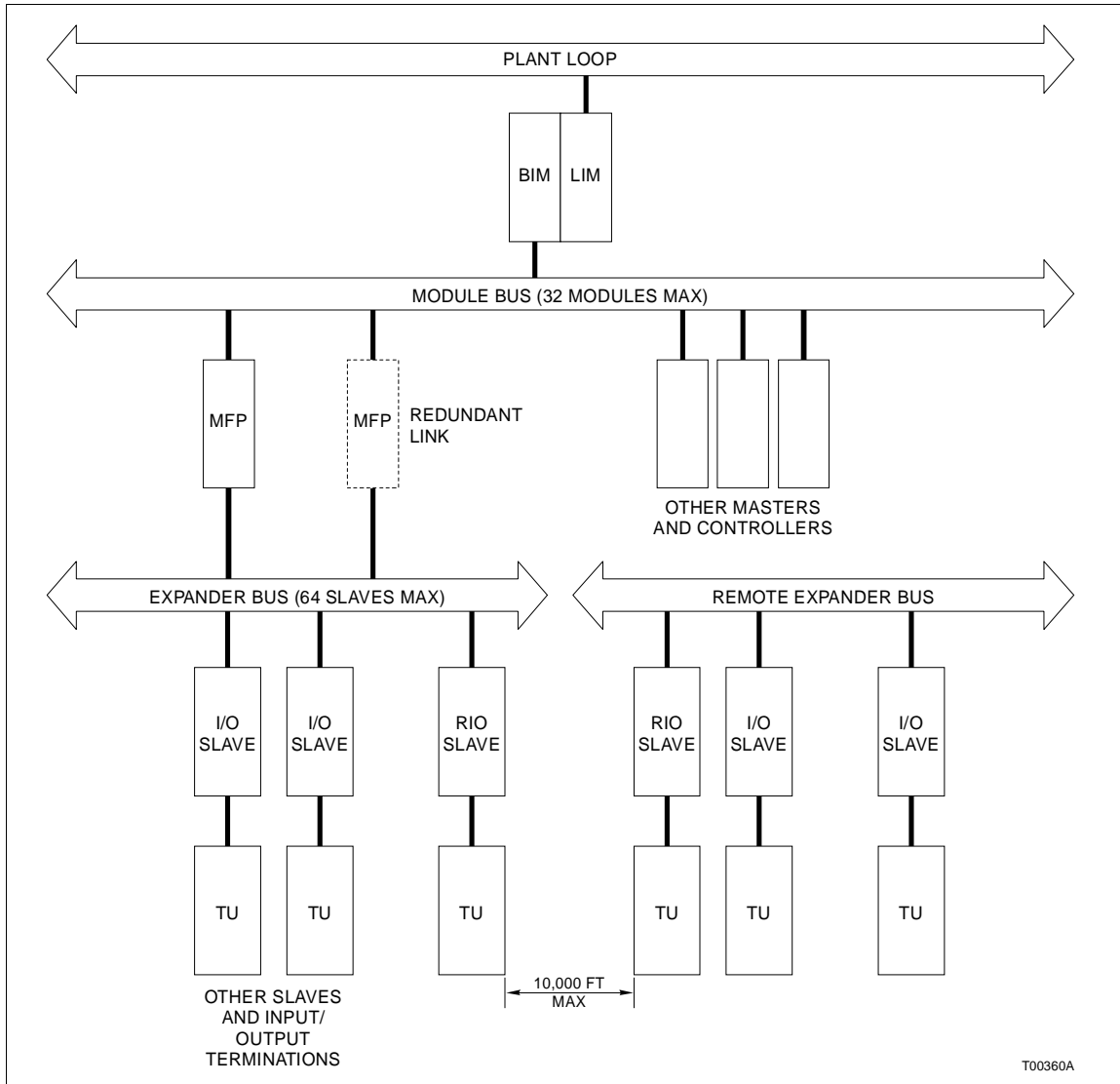


Figure 2-2. Block Diagram of Data Flow

transmit buffer is freed up and can be used for the next message. A FIFO (first in, first out) queue with a depth of six messages is used to keep track of incoming messages. If a message is received during transmission of the LIM's own message, the incoming message is forwarded after its own message is completed.

Security

In the unlikely event of a message error, the BIM responds with message retries up to 127 times. If transmission is unsuccessful after 127 retries, the destination PCU is marked off-line. When the PCU is marked off-line, the LIM informs the BIM that further communications with that destination must be deferred until it responds normally. The LIM then periodically

polls the off-line node, and when it responds to a poll, it is once again marked on-line.

WATCHDOG TIMER

When the LIM transmits a message, it starts a watchdog timer covering the transmit buffer. Whenever the normal transmit buffer is busy, its watchdog is running. Under normal circumstances, the message will return before the watchdog expires and the LIM will disable the time. If the message is lost, the watchdog will expire and the message will be re-transmitted if there are retries left. If there are none, the PCU will be marked off-line.

ACKNOWLEDGE/NON ACKNOWLEDGE CHECK

All messages are transmitted with a no-response negative acknowledge (NAK) inserted in the ACK/NAK field. When a message is returned, the sender examines the ACK/NAK field to determine what to do. The ACK/NAK field is the last byte of the data segment of a message to guarantee that the message is fully received before acknowledgment occurs. If a message returns with an ACK, the transmission is deemed successful and the transmit buffer is freed. If a message returns with a no-response NAK, retry logic is entered. If a message returns with a busy NAK, the sender has confirmation that the intended destination is active, but the message could not be received because the destination's buffer was full. The sending LIM responds by modifying the retry count, allowing up to 64 retries to occur for a busy destination. If they all fail for the same reason, the destination is marked off-line. Because the service time for message receipt is less than the time it takes to get a message around the loop, immediate retransmission is an effective response to a busy indication. If a message returns with none of the three valid ACK/NAK codes, it indicates that an error occurred somewhere on the loop, and retry logic is used for recovery.

CIRCULATION COUNT CHECK

Messages are transmitted with an initial circulation count of zero. Every LIM which forwards the message increments and tests the circulation count. If the count ever exceeds 127, the message is discarded.

SEQUENCE OF TRANSMISSION CHECK

The transmission protocol ensures that messages are received in the same order that the BIM requests them. In addition, each LIM maintains a counter in its transmit buffer which is incremented every time a sourcing transmission occurs. When a message returns to its source LIM, the sequence count is

compared to the sequence count in the transmit buffer and they must match or the message is discarded. This security feature serves to identify messages which may otherwise be identical in content, and can be viewed as a time-stamp.

HEADER DATA ORDER CHECK

Every LIM receives all incoming messages. It uses the frame-sync field to identify the frame as header or data. Whenever the order is wrong, a sequence error is detected. The frame is then discarded and the LIM recovers by always expecting the next frame to be a header.

Message Reception

Each LIM contains one dedicated transmit buffer, one relocatable receive buffer and a circular loop buffer. All incoming messages are put into the loop buffer for processing. A LIM performs the Store/Forward function when its PCU number matches neither the destination nor source PCU fields in the message header and no errors occurred on receipt.

Redundant Module Pairs

Any PCU can be equipped with a redundant LIM/BIM module pair. When so equipped, one pair operates as a primary, the other as a secondary. The Primary/Secondary determination is initially made by the BIM at power on time with each BIM racing to become primary and only one succeeding; thereafter, the primary LIM/BIM pair performs Plant Loop interface functions while the secondary remains idle as a standby. Communication between the primary and secondary over the module bus alert each other of their operating status.

Off-Line Process Control Unit

A PCU is marked off-line if, and only if, a message transmission failure occurs. The PCU is marked off-line by the LIM which attempted the transmission and it is off-line only to that LIM. When a LIM marks a PCU off-line, it sends a *NOL* (node-off-line) message to the BIM indicating that a transmission to the PCU failed. The BIM stops generating messages intended for the failed PCU. The LIM discards any BIM messages for a destination which is off-line and counts the total number discarded.

Each LIM maintains a record of the status of all possible destination PCUs. When the LIM locates an off-line PCU, it sends a *Hey* message to the PCU. If the destination responds to the *Hey* message with an *ACK*, the PCU is placed on-line and a *Node-on-Line* message is sent to the BIM, indicating that messages can again be sent to the PCU.

The LIM has the capability of doing report logic which scans the PCU status table looking for PCU's whose status change needs to be reported to the BIM. The report logic runs when the LIM is idle.

Module Intercommunication

The LIM Interfaces with the BIM through BIM memory. A bi-directional interrupt line between the two processors is used for signaling a change in memory content. The LIM has a byte at a time access to BIM memory via DMA (Direct Memory Access) through a ribbon cable connecting the two boards.

The LIM and the BIM exchange variable-length messages through buffers in the LIM. The BIM provides a 2 kbyte circular FIFO receive buffer, a 512 byte circular FIFO transmit buffer. When the BIM wants to transmit a message, it sends an interrupt request to the LIM. The message is moved to the LIM's transmit buffer when it is free. The LIM informs the BIM that the message was sent.

The LIM and BIM maintain handshakes so that each can tell if the other is operational. There are timers associated with both modules that are set by one module and reset by the other. If the module responsible for reset finds the timer already reset, it is assumed that the other module failed.

The LIM maintains a number of counters in its RAM. This set of event and error counters summarizes LIM status at any point in time.

Interrupts

There are three levels of LIM interrupts: LIM firmware is segregated into 3 asynchronous levels: Non-Maskable Interrupt (NMI) - message routing and disposition, Interrupt Request (IRQ) - signalling purposes, and IDLE - no other active interrupts. Interrupts are generated in the BIM and by loop events.

On power up or hardware reset, the LIM executes start-up logic. The reset signal originates in the BIM, so that a LIM/BIM pair always starts up as a unit. The start-up of one LIM/BIM pair on a loop is independent of other LIM/BIM pairs, requiring no interaction. When a reset occurs, the LIM performs a software reset and executes a wait command. This command halts the LIM processor until an interrupt arrives from the BIM. This interrupt is sent after the BIM initializes its memory.

The BIM channels Plant Loop information that is needed by local modules. It also gathers desired data from the Module Bus and transmits to interested remote PCU's. The BIM also handles the PCU status signal. This signal monitors the power supply and cooling fans.

Module Bus Checks

During sending function, checks are done for: maximum response time, number of retransmits for busy PCU's, and number of retransmits for detected errors. During the receive function, checks are done for recognizable messages and replies to requests are organized.

Exception Reporting

Each point (process inputs) has a set of exception reporting parameters, e.g., high and low alarm limits, minimum/maximum report time intervals, percent of change in span, etc. When a point changes in excess of a given parameter, or an alarm occurs, an Exception Report (XR) is generated. The BIM polls modules for XRs destined for a given PCU. The BIM packs all XRs for a particular PCU into one message. For example, suppose there are 10 XRs going to PCU number 4. The BIM would pack these XRs into one message and transmit one time to PCU number 4.

The exception reporting technique eliminates irrelevant information from the Plant Loop, thereby greatly increasing data throughput. To ensure that relatively static data or rapidly changing data is reported, the parameters minimum/maximum time are used. The maximum ensures that data items are reported even if they do not change. The minimum report time parameter is used to control the amount of XRs generated by a signal rapidly changing point.

NOTE: If a point goes into or out of alarm, the time parameter is ignored.

The BIM has no configuration or database prior to start-up. At start-up or reset, the BIM polls the module bus addresses (2 - 31) to find out which modules are present and what their input requirements are. When a module is acknowledged, a local module record is created in the BIM database and the XR process can begin.

SECTION 3 - INSTALLATION

INTRODUCTION

This section provides information on handling, packing, setup, and installation of the modules. Tables are also included that list address dipswitch settings.

SPECIAL HANDLING

NOTE: Always use Bailey's Field Static Kit (P/N 1948385A2 - consists of wrist strap, ground cord assembly, alligator clip) when working with modules. The kit is designed to connect a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

The LIM/BIM module pair uses electrostatic sensitive devices. Follow Steps 1 through 4 when handling:

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

UNPACKING AND INSPECTION

1. Examine the hardware immediately to verify it has not been damaged in transit.
2. Notify the nearest Bailey Controls Sales Office of any such damage.
3. File a claim for any damage with the transportation company that handled the shipment.
4. Use the original packing material and container to store the hardware.
5. Store the hardware in an environment of good air quality, free from temperature and moisture extremes.

SETUP AND INSTALLATION

Prior to inserting the modules into the Module Mounting Unit (MMU), the following dipswitches on the LIM must be set: S1 -

the Option Dipswitch and S2 - the Address Dipswitch. On the BIM, S1 - the Address/Option dipswitch must be set. Figures 3-1 and 3-2 show the location of these switches.

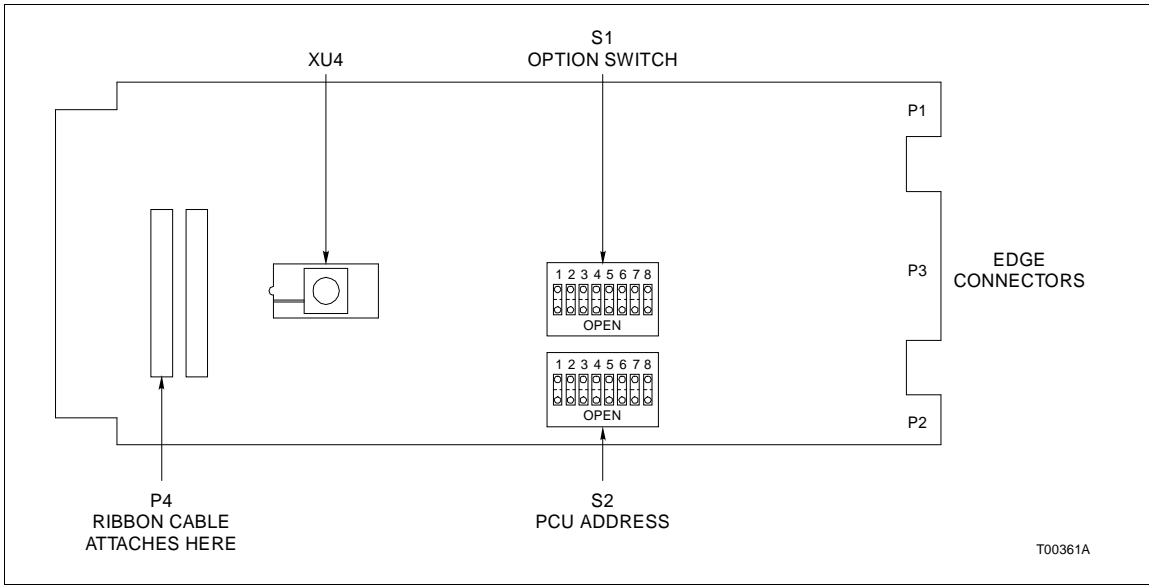


Figure 3-1. Loop Interface Module Component Locations

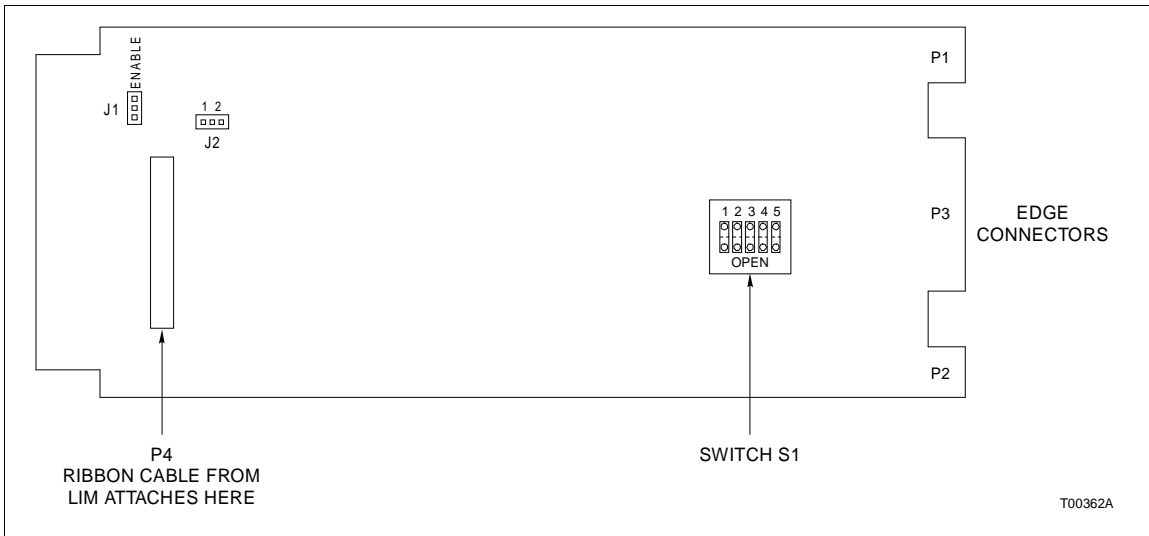


Figure 3-2. Bus Interface Module Component Locations

LIM Option Dipswitch

Switch S1 on the LIM is used for event and error counters and testing purposes. This dipswitch can address up to 255 address locations in memory ranging from \$00 to \$FF. The switch is normally set to Hexadecimal 30. In this setting, the total messages transmitted is displayed on the front panel LEDs. Tables 5-1 and 5-2 in Section 5 provide other event counter and error counter addresses. Each counter is a cumulative byte-wide counter that increments as events or errors occur. Table 3-1 shows two examples of switch settings (record your particular address in the User Setting column).

When a switch is down (open) it represents a logic 1; up (closed), a logic 0. Switch 1 is the most significant bit (MSB); switch 8 the least significant bit (LSB).

Table 3-1. Switch S1 Options - Example

Hexadecimal Address	Pole Positions 1 2 3 4 5 6 7 8	User Setting
30	0 0 1 1 0 0 0 0	
42	0 1 0 0 0 0 1 0	

LIM Address Dipswitch

The Address Dipswitch, S2, is used to set the PCU address in the system configuration. Each PCU must have a different address. The address must be in the range of 1 through 63. Redundant LIMs will have the same address.

Switches 1 and 2 are closed for normal operation, but open for testing. When switch 1 is open and switch 2 is closed, the LIM operates normally, and also continuously monitors the error rates on both incoming Loop channels. If an excessive error rate is found on either channel, the LIM shuts that channel down, flashes its front panel LEDs indicating a problem, and continues operating normally using the other channel. The LIM will NEVER shut down both channels, however, it will continue to flash its LEDs until a RESET. Switches 1 and 2 (both closed) are used for factory testing and field service purposes and should not be moved.

Switches 3 (Most Significant Bit with a binary weight of 32) through 8 (Least Significant Bit with a binary weight of 1) are used to set the PCU address. Table 3-2 defines the PCU address settings.

Table 3-2. PCU Address (S2) Settings

PCU Address	Switch Number 1 2 3 4 5 6 7 8	PCU Address	Switch Number 1 2 3 4 5 6 7 8
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
32	0 0 1 0 0 0 0 0		

BIM Jumpers J1-J2

Because of functional differences, INBIM01s and INBIM02s **CANNOT** exist on the same Plant Loop. The INBIM01 transmits Exception Reports bound for the same destination PCU one message at a time. The INBIM02 packs all Exception Reports bound for the same PCU and transmits them in one message.

Note that INBIM02 will communicate with either the NLIM01 or the NLIM02.

There are two jumpers on the BIM. Jumper J1 is used to ENABLE or DISABLE the Power System Status Message that is sent to an Operator Interface Station. Jumper J2 is used to convert the NBIM02 to a NBIM01. See Figure 3-2.

NOTE: If a INBIM02 is being used as a replacement for a NBIM01, the Jumper J2 must be changed:

Remove jumper from position 2 and install Jumper in position 1. Without this change, the BIM may not operate correctly.

Data loss can result if:

1. You replace a NBIM01 with INBIM02 without making the jumper change, and your operator console does not have the latest communication software (example: the OIU would not be able to unpack the message).
2. Your configuration has redundant INBIM02s and you replace with NBIM01s. The 01 has less memory and less point capability, and you could lose points configured beyond its memory capacity.
3. Jumper J1 is used to ENABLE or DISABLE the status signal monitored by the Power Entry Panel in a hardware cabinet. If the BIM is being used in a Mini-90 enclosure, the jumper should be set in the DISABLE position (lower two posts, Figure 3-2); otherwise leave in the ENABLE position (upper two posts, Figure 3-2).

BIM Address Dipswitch

The BIM Address Switch, S1, is a multi-purpose switch that defines redundant LIM/BIMs, software execution codes and module address. There are five switch positions. Table 3-3 defines the switch settings.

Table 3-3. BIM Address Dipswitch (S1) Settings

Switch Function	Switch					Description
	1	2	3	4	5	
LIM/BIM Redundancy	0					No redundant LIM/BIM pair
	1					Redundant LIM/BIM pair ¹
Software Execution Specification Codes	0	0	0			Execute Normal BIM system software
	0	0	1			Execute Normal BIM system software without termination due to catastrophic errors
	0	1	0			Execute BIM RAM test
	0	1	1			Execute BIM ROM test
	1	0	0			Execute LIM Interrupt Request (IRQ) test
	1	0	1			Not Used

Table 3-3. BIM Address Dipswitch (S1) Settings (continued)

Switch Function	Switch					Description
	1	2	3	4	5	
Software Execution Specification Codes (continued)	1	1	0			Execute BIM software at fast poll rate (.25 seconds) ²
	1	1	1			Execute BIM software at fast poll rate without termination due to catastrophic errors
Module Bus Address					0	Module bus addresses 0 and 1 for BIM ¹
					1	

NOTES:

1. When redundant LIM/BIM pairs are used, unique module bus addresses must be selected for each pair (S5). (i.e., Primary pair = 0, backup = 1)
2. Selectable Poll Rates -The fast rate option allows faster data throughput between BIM and the Plant Loop. This poll rate cannot be used in all configurations and is limited by the following constraints.
 - a. Maximum of 8 modules.
 - b. Maximum of 250 points.
 - c. Maximum of 64 points changing every second.

Physical Installation

NOTE: The installation section provides instructions pertaining to the physical installation of the modules only. For complete cable and TU/TM information, refer to termination unit manual **I-E93-911**.

1. Verify the slot assignments of the modules.
2. Connect the hooded end of the termination cable from the TU/TM to the MMU backplane. To do this, insert the connector into the backplane slot in the same slot as the one assigned to the LIM. The latches should snap securely into place.
3. After setting the switches on both modules, connect the Bailey supplied ribbon cable from the P4 connector on the LIM to the P4 connector on the BIM (see Figure 3-1). You are ready to install the modules. The LIM/BIM are inserted into adjacent guide rails of the Module Mounting Unit (MMU).
4. Align the module with the 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.
5. Turn the two captive retaining screws a 1/2 turn on each module faceplate.

NOTE: The LIM and BIM can be inserted under power. No hazardous voltage levels are present on the LIM. The maximum difference of potentials between low impedance voltage sources is 30 VDC.

Cable Connections

Depending upon your system, you will have a NTCL01 Termination Unit and NKLS03 cable, or an NICL01 Termination Module and NKLS04 cable (see Figure 3-3 for wiring connections). Refer to Product Instruction **I-E93-911, Termination Unit Manual**, for complete installation information.

CAUTION	J1 end of NKLS04 cable must be connected to the NICL01. J2 end must be connected to the LIM module. Failure to do so can damage the modules.
ATTENTION	L'extremite J1 du cable NKLS04 doit etre branchee au module NICL01. L'extremite J2 doit etre branchee au module LIM. Sinon, les module pourraient etre endommages.

FUSING

The LIM/BIM pair do not have any on board fusing requirements.

PRE-OPERATING ADJUSTMENTS

You do not have to make any adjustments to the LIM/BIM prior to operating.

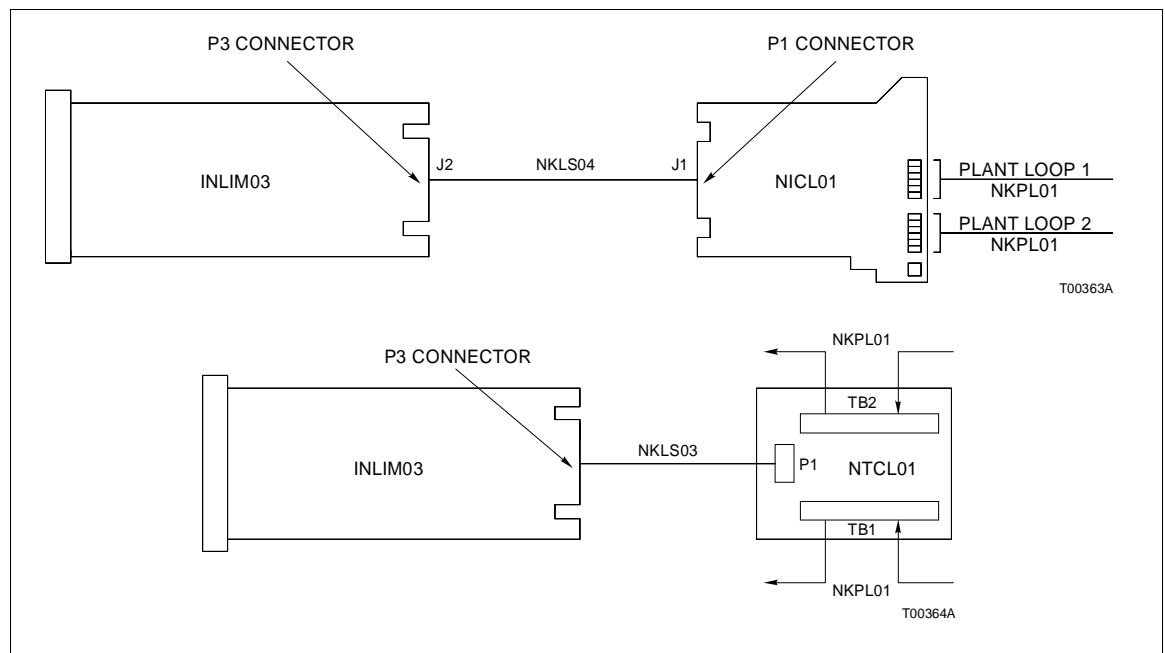


Figure 3-3. INLIM03 Connections and Termination

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

Once the modules are initialized and on-line, they perform their duties. You need only be cognizant of the LIM's counter LEDs and the BIM's status LED.

OPERATOR INTERFACE

Event Counter

The LIM maintains counters to keep track of events such as total messages transmitted, messages taken from BIM transmit buffer, etc. Event counter addresses ranging from (\$30) to (\$3E). To view the contents of a counter, set switch S1 to the counters address. The contents of the selected counter will appear on the front panel LEDs. Refer to the [Section 3](#) for the location of switch S1, and [Table 5-1](#) in [Section 5](#) for counter addresses and switch settings.

Error Counter

The LIM also maintains counters to keep track of errors such as unresolved interrupts, transmit failures, etc. Error addresses range counter (\$40) to (\$51). To view the contents of a given counter, follow the procedure for viewing Event Counters in the preceding paragraph.

NOTE: Error messages are sent to any monitoring device on the Loop (e.g., OIS, NIU, EWS).

Module Status

The operating status of the module pair is determined by observing the status LED of the BIM. If the LED is green, the modules are on-line and operating properly. If the LED is red, the modules have failed.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

The LIM provides Event and Error Counters to assist in diagnosing problems. The Option Switch S1 is used to set the address (\$00 to \$FF) to view events and errors. Table 5-1 lists the Event Counter addresses. Table 5-2 lists the Error Counter addresses. The Error Counter is similar to the Event Counter, except that it represents events caused by hard errors. For switch setting information, refer to the Installation section. Table 5-3 and 5-4 supply pin numbers and their associated signals for the LIM/BIM pair.

Information pertaining to BIM memory utilization is presented for configuration purposes. Methods of memory evaluation are also covered, along with an example and a sample configuration.

Table 5-1. S1 - Event Counter Addresses

Counter Address	Hex Address	Switch Positions (Binary Address) 1234 5678	Description
48	30	0011 0000	Total messages transmitted, including forwarding.
49	31	0011 0001	Transmit retries.
50	32	0011 0010	Composite BIM Receive/Transmit, 4 bits each. Receive is viewed at the top LED.
51	33	0011 0011	Messages taken from the BIM transmit buffer.
52	34	0011 0100	Messages stored in BIM receive buffer.
53	35	0011 0101	Interrupt Requests (IRQs) sent by BIM.
54	36	0011 0110	High Priority (HP) messages transmitted.
55	37	0011 0111	High Priority messages received.
56	38	0011 1000	Commands issued by the BIM.
57	39	0011 1001	Missed BIM transmit requests.
58	3A	0011 1010	Spurious Non-Maskable Interrupts (NMI) caused by "address present."
59	3B	0011 1011	HEY (request for an interrupt; generated by BIM) message sent.
60	3C	0011 1100	Messages discarded when the destination is off-line.
61	3D	0011 1101	HEY time expirations.
62	3E	0011 1110	Passes through the IDLE level (2 bytes wide).

Table 5-2. S1 - Error Counter Addresses

Counter Address	Hex Address	Switch Positions (Binary Address) 1234 5678	Description
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 timer interrupts.
68	44	0100 0100	Queue overflow message losses.
69	45	0100 0101	Checksum failures.
70	46	0100 0110	Unresolved BIM 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 Receive (RCV) failure.
79	4F	0100 1111	Loop - 2 Receive failures.
80	50	0101 0000	Loop - 1 Transmit (TX) failure.
81	51	0101 0001	Loop - 2 Transmit failures.

Table 5-3. LIM P1 Pin Connections

Pin No.	Signal	Pin No.	Signal
1	+5 VDC	6	Common
2	+5 VDC	7	+15 VDC
5	Common	8	-15 VDC

Table 5-4. LIM P3 Pin Connections

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

Table 5-5. BIM P1 Pin Connections

Pin No.	Signal	Pin No.	Signal
1	+5 VDC	7	+15 VDC
2	+5 VDC	8	-15 VDC
3	- open	9	Power Fail Interrupt
4	- open	10	Power Fail Interrupt
5	Common	11	Module Bus
6	Common	12	Module Bus

BIM MEMORY UTILIZATION

The following procedures are designed to ensure that the user's PCU configuration does not overload the BIM's memory capacity. There are two methods to use. The first method is simple, fast and should be used initially. The second method is tedious; however, it is more exact. This method should be used if the first method indicates a potential problem.

Method Number 1 - Quick Evaluation

This method requires weighing the various items in the common database, multiplying the quantity of each item by its weight and summing the products. A result of less than one indicates that a particular configuration will *fit* into the allocated RAM. A result of greater than one implies a potential problem requiring further analysis. The weights in Table 5-6 are conservative and biased on the safe side to account for a minimum of record sharing. It is not uncommon for further analysis to reveal an excess of memory.

Table 5-6. Memory Utilization Weight Table

Use of Memory	Weight
Each module addressable on the Module Bus (except CTM or SIM)	.003
Each transmitted Loop Station Exception Report	.003
Each transmitted digital (Boolean) Exception Report	.002
Each transmitted analog (real) Exception Report	.002
Each transmitted remote switch (PB/OIS) Exception Report	.002
Each remote module that sends Exception Reports to PCU in question	.001
Each received Exception Report (analog or digital)	.002
Total miscellaneous overhead	.06

Method Number 2 - Detailed Evaluation

If Method Number 1 indicates a potential problem, this procedure should be done. This procedure requires detailed analysis of block types, source and destination distributions, and record sizes. The most difficult part is determining the amount of record sharing for a particular PCU configuration.

Table 5-7 lists the names and sizes of all records that can be allocated from free memory. Four rules govern this allocation:

1. A Remote PCU Record must be assigned to each destination of all messages.
2. A Local Module Record must be assigned to each module answering on the Module Bus.
3. Record sharing is done wherever possible except on the Routing Record level (both imports and exports).

Example: A point imported for two distinct local modules shares all records except the Imported Block Local Routing Record.

or

Two analog inputs from the same Analog Master Module (AMM) would share the same Local Module Record, but not the Local Block Record or the Exported Block Remote Routing record.

4. If an OIS is on the Loop, it should be routed to the module status of each module on the Module Bus.

Table 5-7. Data Structure Byte Usage

Name	Number of Bytes
Transmit Data Structures	
Local Module Record	18
Remote Module Status Route Record	3
Local Block Record:	
Digital	7
Device Driver	9
Plant Loop/OIS	9
Remote Manual Set Constant	10
Analog	10
Loop	20
Transmit Block Remote Routine Record	3
Receive Data Structures	
Remote PCU Record	9
Remote Module Record	5
Remote Block Record	
Digital	7
Analog	10
Received Block Local Routine Record	5
Total Free Memory Available	
INBIM02	25,088 ₁₀ bytes

SAMPLE CONFIGURATION ANALYSIS

The following information is a sample configuration using both Receive and Transmit Data Structures. The sample configuration has:

- 3 Controller Modules (COM)

Each COM provides a loop Exception Report for each OIS.

Each COM inputs one digital and one analog, all unique for those modules.

- 2 Logic Master Modules (LMM)

Each LMM has 128 inputs reported remotely.

Each LMM needs 10 digital inputs from the same remote source; 5 of the 10 for each LMM are shared by all and 5 are unique.

- 1 Multi-Function Processor (MFP)

Needs five analog inputs, only needed by it, from a remote source.

- 2 Separate Operator Interface Stations (OIS) requiring all status and block Exception Reports

- The local PCU
Has 1 LIM/BIM pair (no redundancy).
Receives all inputs from the same remote PCU.
- In the remote PCU
All analog imports come from the same remote AMM and all digital imports come from the same remote LMM.

Based on the above information, Table 5-8 provides the guidelines for computing the total amount of memory used.

Column 1 of the table is the record type, column 2 breaks down the record types by component, column 3 is the total of column 2, column 4 is the number of bytes each record type uses (from Table 5-7), and column 5 is the product of columns 3 and 4.

Table 5-8. Evaluation Method Number 2 - Configuration Analysis

(1) Record Type	(2) Composed of	(3) Total Records	(4) Bytes/Records	(5) Total Bytes Used
Receive Data		3	9	27
Remote PCU	2 OIS 1 Remote PCU			
Remote Module	1 AMM 1 LMM	2	5	10
Remote Block	Digital 5 for all LMMs 5 for LMM 1 5 for LMM 2 1 for COM 1 1 for COM 2 1 for COM 3	18	7	126
	Analog 5 for MFP 1 for COM 1 1 for COM 2 1 for COM 3	8	10	80
Local Routing	10 for LMM 1 10 for LMM 2 5 for MFP 1 2 for COM 1 2 for COM 2 2 for COM 3	31	5	155
Transmit		6	18	108
Local Module	3 COMs 2 LMMs 1 MFP			
Remote Module Status Route	6 local modules x 2 OISs	12	3	36

Table 5-8. Evaluation Method Number 2 - Configuration Analysis (continued)

(1) Record Type	(2) Composed of	(3) Total Records	(4) Bytes/Records	(5) Total Bytes Used
Local Block	Digital 128 for LMM 1 128 for LMM 2	256	7	1,792
	Loop 1 for COM 1 1 for COM 2 1 for COM 3	3	20	60
Remote Route	128 for LMM 1 128 for LMM 2 1 for COM 1 1 for COM 2 1 for COM 3 x 2 OIS	518	3	1,554
Total Bytes Used 3,948				

SECTION 6 - MAINTENANCE

INTRODUCTION

The Loop Interface and Bus Interface modules require limited maintenance. This section contains a maintenance schedule.

MAINTENANCE SCHEDULE

Perform the tasks in Table 6-1 at the specified intervals.

Table 6-1. Maintenance Schedule

Task	Interval
Clean and tighten all power and grounding connections	Every 6 months or during plant shut-down, whichever occurs first
Use a static safe vacuum cleaner to remove dust from: Modules Module Mounting Unit Fan Assembly Power Entry Panel	Every 6 months or during plant shut-down, whichever occurs first

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for the Loop/Bus (LIM/BIM) modules. There are no special tools required to replace LIM/BIM modules.

MODULE REPAIR/REPLACEMENT

If you determine that one or both modules are faulty, replace the faulty module with a new one. **DO NOT** try to repair the module; replacing components may affect the module performance. You can remove the module while system power is supplied. To replace a module:

1. Push and turn the two front panel captive retaining screws one half turn to unlatch the module. It is unlatched when the slots on the screws are vertical and the open end of the slots face away from the module.
2. Gently slide the module out of the MMU.
3. Configure the replacement module switch and jumper settings. Ensure they are set the same as the original module.
4. In the same slot assignment as the original module, align the replacement module with the plastic guide rails in the MMU; gently slide it in until the front panel is flush with the top and bottom of the MMU frame.
5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module. (To remove the module, turn the module retaining screws to the unlatched position and gently slide out).
6. Return to normal operation.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls is ready to help in the use, application and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

When making repairs at your facility, order replacement parts from a Bailey sales office. Provide this information:

1. Part description, part number and quantity.
2. Model and serial numbers (if applicable).
3. Bailey instruction manual number, page number and reference figure that identifies the part.

TRAINING

Bailey Controls has a modern training facility that provides service and repair instruction. This facility is available for in-plant training of your personnel. Contact a Bailey Controls sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

You can obtain additional copies of this manual from the nearest Bailey sales office at a reasonable charge.

APPENDIX A - TERMINATION UNIT (NTCL01) CONFIGURATION

INTRODUCTION

The INLIM03 uses the NTCL01 for termination. Table A-1 lists the termination assignments for the loop input/output connections. Table A-2 lists the Baby “N” Connector (BNC) assignments. Table A-3 provides jumper settings associated with cable type. Figure A-1 shows twinax cable connections for the NTCL01. Figure A-2 is a block diagram showing LIM/BIM modules with alternate termination modules (NIPL01).

NOTE: Twinax cables connect to the terminals. Coax cables connect to the BNC connectors.

Table A-1. NTCL01 Terminal Assignments

TB1 Terminal	Assignments	TB3 Terminal	Assignments
1	Loop 1 In, +	1	Loop 2 In, +
2	Loop 1 In, -	2	Loop 2 In, -
3	Loop 1 In, Shield	3	Loop 2 In, Shield
4	No connection	4	No connection
5	Loop 1 Out, +	5	Loop 2 Out, +
6	Loop 1 Out, -	6	Loop 2 Out, -
7	Loop 1 Out, Shield	7	Loop 2 Out, Shield
8	Power System Status 1	8	Power System Status 2

Table A-2. NTCL01 BNC Assignments

BNC Number	Assignments
J1	Loop 1 In
J2	Loop 1 Out
J8	Loop 2 In
J9	Loop 2 Out

Table A-3. Jumper Settings and Cable Types

NLIM03		
JUMPER NO.	TWINAX	COAX
J3, J10		
J4-J7, J11-J14		
J15-J18		

POST
NUMBERS

T00365A

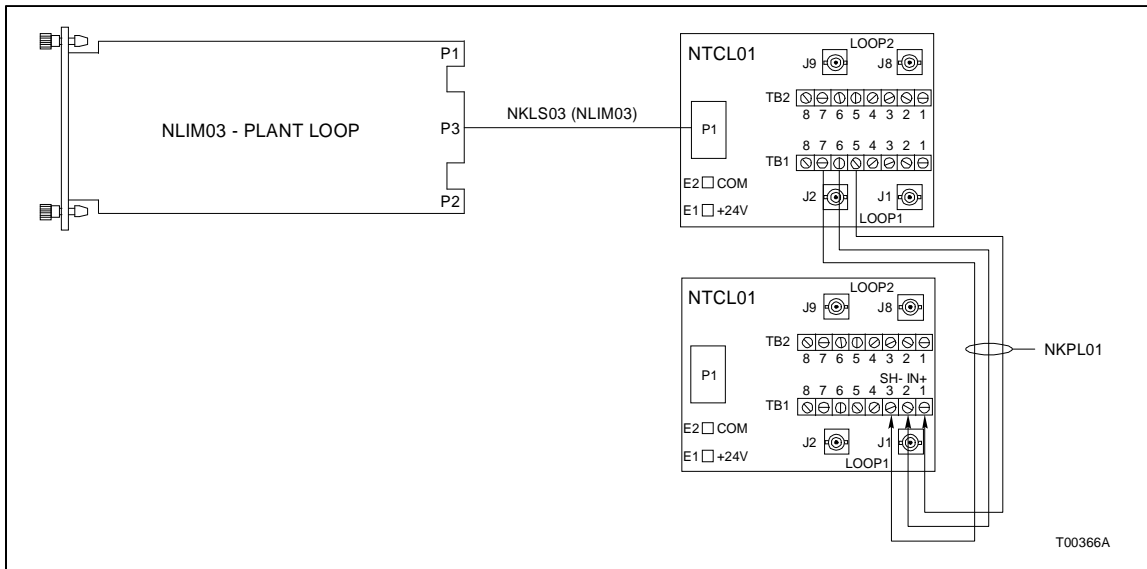


Figure A-1. NTCL01 Termination Unit and Terminal Assignments

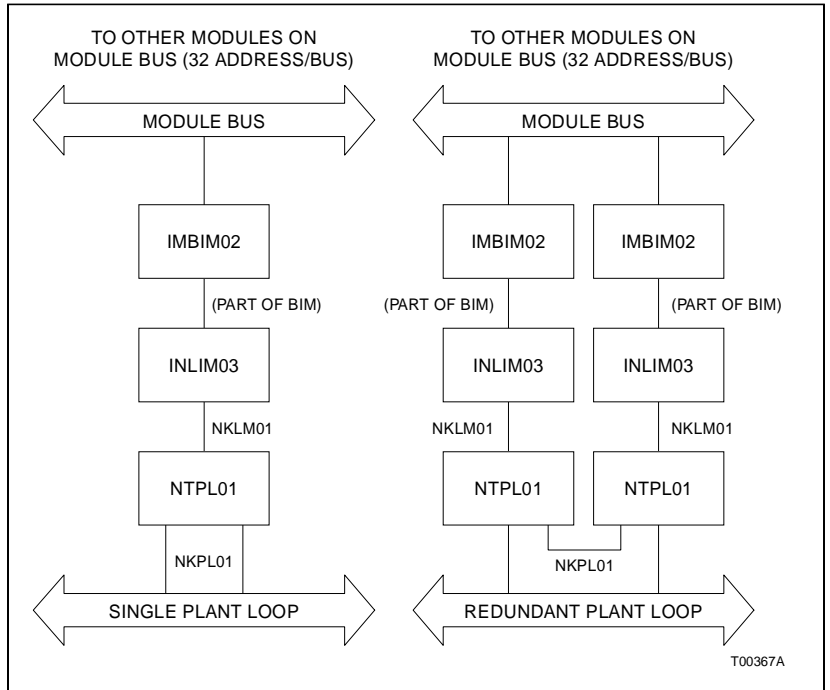


Figure A-2. Communication Modules with Alternate Termination Modules (NTPL01)

APPENDIX B - TERMINATION MODULE (NICL01) CONFIGURATION

INTRODUCTION

The INLIM03 can use the NICL01 for termination. Table B-1 lists the termination assignments for the loop input/output connections. Table B-2 lists Baby "N" Connector (BNC) assignments. Table B-3 provides jumper settings associated with cable type. Figure B-1 shows twinax cable connections for NICL01. Figure B-2 shows a block diagram of LIM/BIM modules using alternate termination module (NIPL01).

NOTE: Twinax cables connect to the terminals. Coax cables connect to the BNC connectors.

Table B-1. NICL01 Terminal Assignments

TB1 Terminal	Assignments	TB2 Terminal	Assignments	TB3 Terminal	Assignments
1	Ground	4	Power System Status 1	25	Loop 1 Out, Shield
2	Common	5	Power System Status 2	26	Loop 1 Out, -
3	+24 VDC	6	Loop 2 In, +	27	Loop 1 Out, +
		7	Loop 2 In, -	28	Loop 1 In, Shield
		8	Loop 2 In, Shield	29	Loop 1 In, -
		9	Loop 2 Out, +	30	Loop 1 In, +
		10	Loop 2 Out, -	31	No connection
		11	Loop 2 Out, Shield	32	No connection

Table B-2. BNC Assignments

BNC Number	Assignments
J1	Loop 1 In
J2	Loop 1 Out
J8	Loop 2 In
J9	Loop 2 Out

CAUTION

Ensure that the end marked J1 is connected to P1 on NICL01, and J2 is connected to the LIM. Failure to do so could result in module damage (see Figure B-1).

ATTENTION

S'assurez que l'extrémité identifiée par J1 est reliée à P1 du module NICL01 et que J2 est reliée au module LIM. Sinon, les modules pourraient être endommagés (voir la figure B-1).

Table B-3. Jumper Settings and Cable Types

NLIM03		
JUMPER NO.	TWINAX	COAX
J3, J10		
J4-J7, J11-J14		
J15-J18		

POST
NUMBERS

T00365A

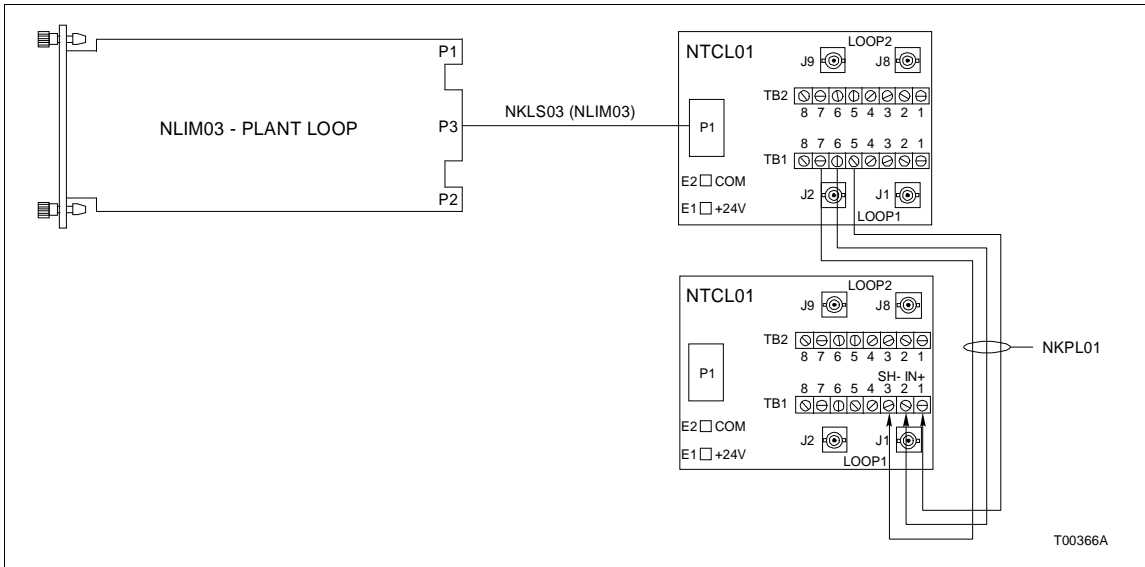


Figure B-1. Typical Twinx Cable Connections for the NICL01

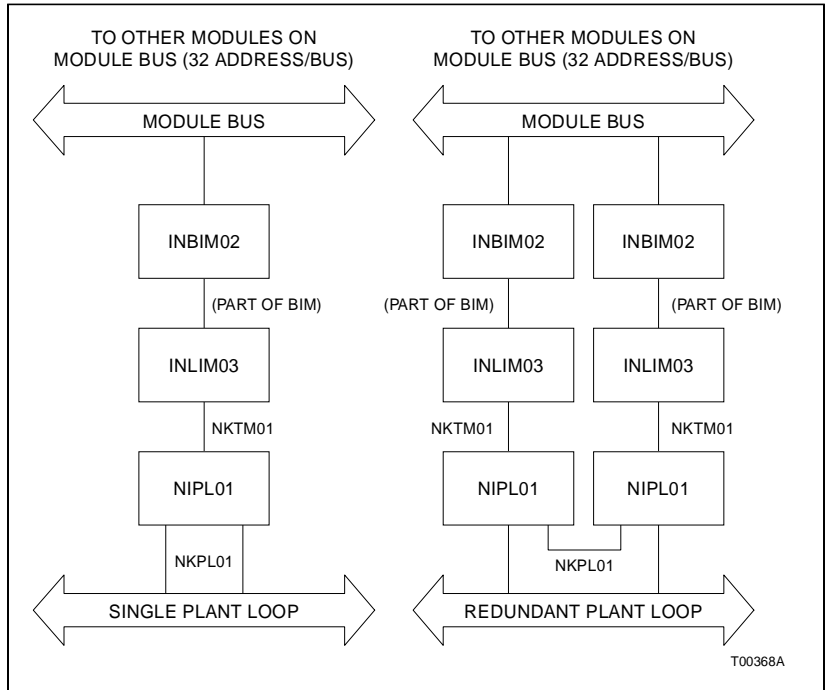


Figure B-2. Communication Modules with Alternate Termination Modules (NIPL01)

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