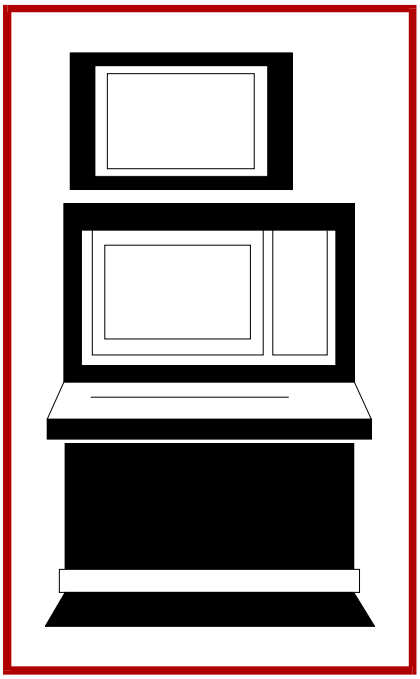
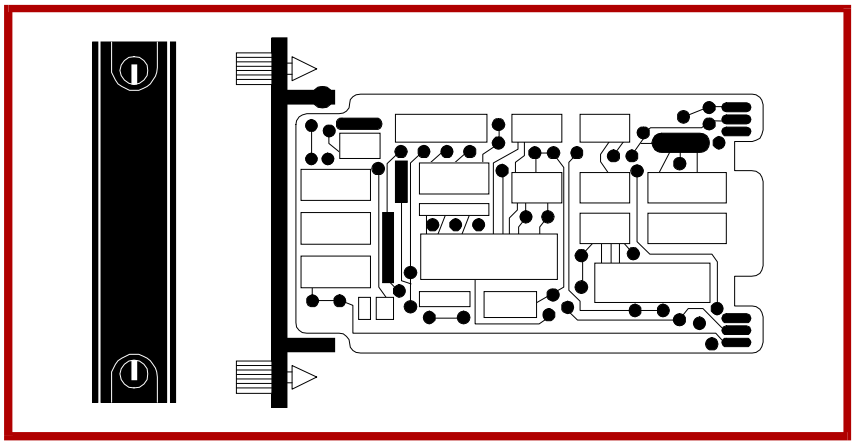
Bailey® infi 90®

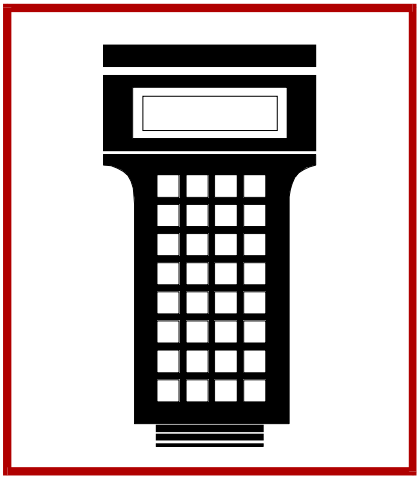
E96-602

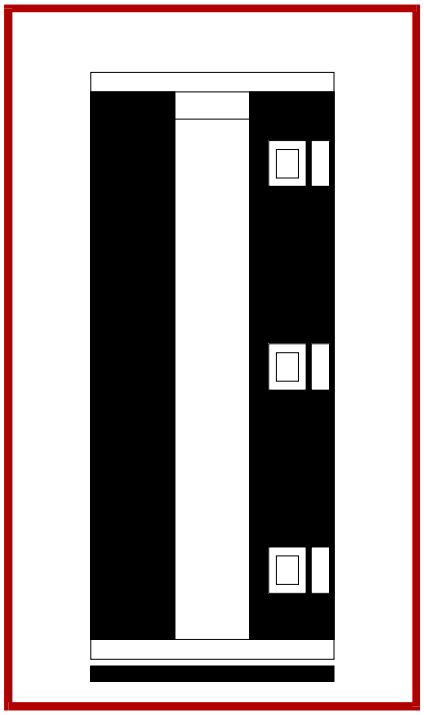
Instruction

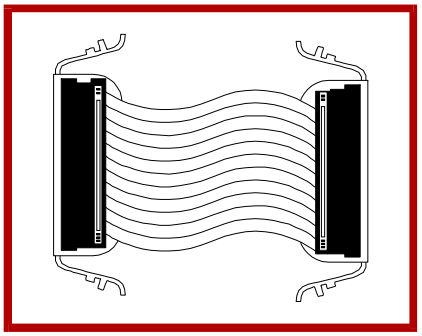
INFI-NET to Plant Loop Gateway
(INIPL01)

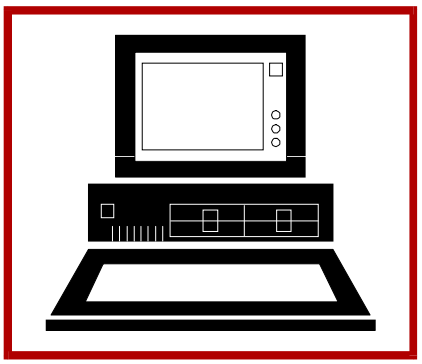












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WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

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.

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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.

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Preface

The INFI-NET®-to-Plant Loop Gateway (INIPL01) provides a link between close proximity Infi 90® and NETWORK 90® loops. It permits the exchange of Exception Reports, Configuration and Control Messages, and System Status data between Infi 90 and NETWORK 90 communication loops.

This product instruction explains the installation, operation, maintenance and troubleshooting procedures for the Gateway Modules. The Gateway user is presumed to have some background in Infi 90/NETWORK 90 master/slave communications and function code configurations.

NOTES:

1. The Infi-Net to Plant Loop Transfer Module requires Function Codes 200 (and 201 depending on data flow requirements) in its configuration for it to be able to perform Gateway tasks. Information for these codes is not covered in this document. Refer to the Function Code Application Manual, I-E93-900-20 for specifics.

2. The first release of this product supports the NETWORK 90 Module Bus. Subsequent releases will support the Control Way.

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List of Effective Pages

Total number of pages in this instruction is 50, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through v	Original
1-1 through 1-6	Original
2-1 through 2-6	Original
3-1 through 3-10	Original
4-1 through 4-7	Original
5-1 through 5-9	Original
6-1	Original
7-1 through 7-2	Original
8-1	Original
A-1 through A-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.

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SECTION 1 - INTRODUCTION

INTRODUCTION

The Infi-Net-to-Plant Loop Gateway (INIPL01) provides a two-way communication interface between close proximity Infi-Net and Plant Loop rings. Exception reports, system status data, and configuration and control messages pass through the Gateway between a central Infi-Net ring and Plant Loop subrings.

The Gateway uses a central ring and subring configuration (see Figure 1-1). The Infi-Net side of the Gateway is the central ring (ring 1) of the system. The Plant Loop side is a subring (or satellite). There can be only one central ring, but up to 249 subrings. The central ring can have up to 249 Gateways, but each Plant Loop subring can have only one Gateway. Plant Loops may be daisy-chained through Plant Loop Gateways, but Infi-Net nodes do not recognize them. Infi-Net rings cannot be daisy-chained. Infi-Net satellite and Plant Loop satellite rings in the same system are permissible and may inter-communicate via the central ring. The maximum distance between the central ring and its subring is 150 feet.

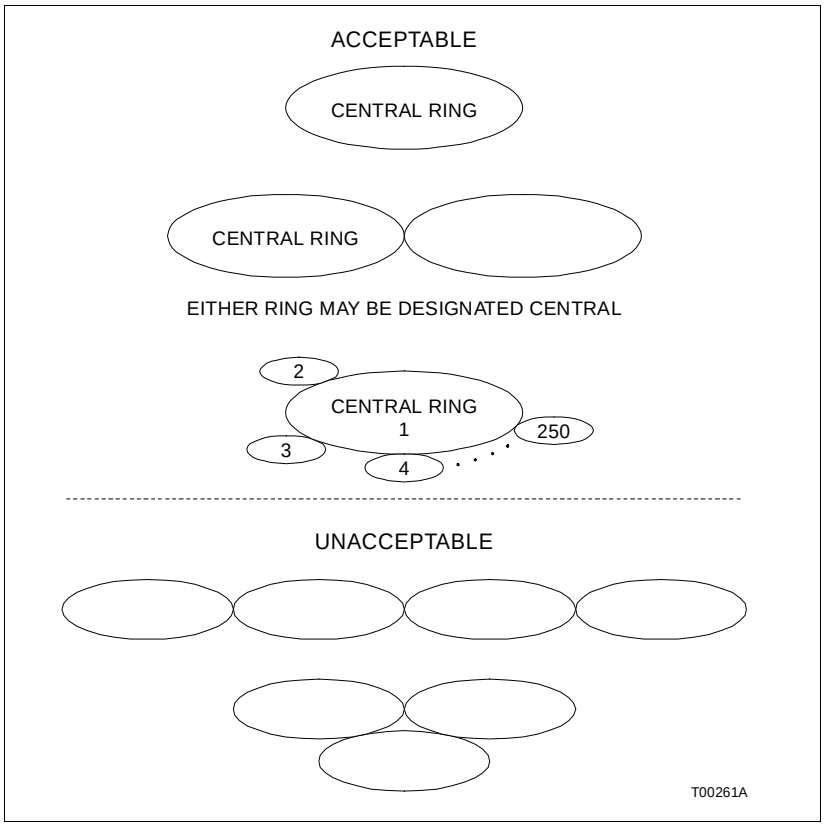

Figure 1-1. Central and Satellite Rings

HARDWARE DESCRIPTION

The Gateway consists of the Infi-Net to Plant Loop Transfer Module (INIPT01) and two Network Interface Slave Modules (INNIS01). See Figure 1-2. A description of each follows.

Infi-Net to Plant Loop Transfer (IPT) Module

The IPT module provides the intelligence for the Gateway. It consists of two circuit boards: CPU and MEM. The CPU board contains the user-configurable switches for setting options, addresses, etc. The MEM board contains memory only. The IPT module communicates with the Network Interface Slave over the Slave Expander Bus. Refer to Section 3 and Section 4 for more information.

Network Interface Slave (NIS) Module

The NIS module acts as the link between the loop and the IPT. It is a single circuit board with on-board intelligence and memory. The NIS module receives messages from other modules on its loop, processes them and sends them to the IPT over the Slave Bus. The Plant Loop and Infi-Net side must each have a NIS Module.

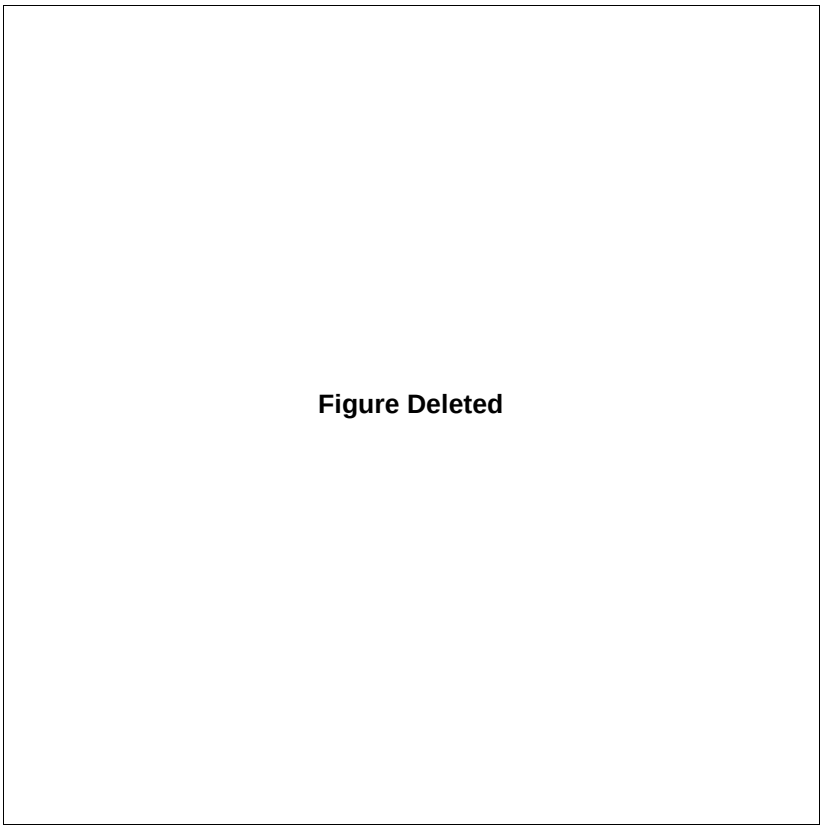

Figure 1-2. The Infi-Net-to-Plant Loop Gateway

USER QUALIFICATIONS

This product instruction is not a tutorial. It is written for the individual who is responsible for the configuration and daily operation of the Gateway. The user needs familiarity in these areas: Function Codes and their configuration, and Infi 90/ NETWORK 90 master/slave communications.

APPLICATION

The Gateway is applicable when there is a need to exchange data between Infi-Net and Plant Loop. It is useful at distances up to 150 feet. Follow these restrictions when using the Gateway:

1. The Infi-Net side of the Gateway must have a ring address of 1.

2. The Plant Loop side of the Gateway must have a ring address from 2 to 250 with a node address of 1 to 63.

3. While the IPT module has a maximum block number of 5,029, the actual number of configurable blocks is limited by memory (refer to Section 4). The Plant Loop side of the Gateway does not support Infi-Net Only functions.

MANUAL CONTENT

This manual provides introductory, installation, operation, calibration, troubleshooting and maintenance information. Read and understand this document before placing the Gateway into service. A summary of section content follows:

Introduction — Provides an overview of the system, description of hardware, glossary of unique terms, reference documentation and specifications.

Description and Operation — Describes the communication channels, data types and data flow.

Installation — Explains how to handle and inspect modules, location and safety considerations, hardware setup (e.g., switch settings), interfacing.

Operation — Discusses the start-up; explains front panel controls and LED indicators.

Troubleshooting — Lists and explains the error codes and corrective actions; provides troubleshooting flowcharts.

Maintenance — Lists the preventive maintenance procedures.

Repair/Replacement Procedures — Describes module replacement.

Support Services Provides information about replacement parts and warranty policy.

HOW TO USE THIS MANUAL

1. Read the introductory material to gain familiarity with the product.

2. Do the steps in Section 3 and read Section 4 before applying power.

3. If you encounter problems during operation, refer to Section 5.

4. Follow the preventive maintenance procedures in Section 6.

5. Before you attempt system repairs, read Section 7.

6. Refer to Section 8 for replacement and warranty information.

7. For quick information about default settings, refer to Appendix A.

NOMENCLATURE

Nomenclature/Hardware	Part Number
Cable, NIS to NICL01 Cable, NIS to NTCL01 Cable, IPT to NIMF01 Cable, IPT to NTMF01	NKLS02 NKLS01 NKTM01 NKTU01
Module, Infi-Net to Plant Loop Transfer Module, Network Interface Slave Module Mounting Unit	INIPT01 INNIS01 NMMU01/02
Termination Module Termination Module Termination Module	NICL01 NIMF01[1] NIPL01
Termination Unit Termination Unit Termination Unit	NTCL01 NTMF01[1] NTPL01

[1]These termination devices are necessary for accessing engineering diagnostics only.

RELATED DOCUMENTS

Number	Title
I-E93-900-20	Function Code Application Manual
I-E93-908-7	Loop Interface Slave Manual
I-E93-911	Termination Units Manual

GLOSSARY

Term	Definition
ACK	Acknowledgment by destination node that a message was received.
CTM	Configuration and Tuning Module. Provides a local means for system configuration, tuning and monitoring.
Central Ring	The Central Ring is the main ring (Number 1), the Infi-Net side of the Gateway.
Executive	The fixed function block that determines module operating characteristics.
IPT	Acronym for the Infi-Net to Plant Loop Transfer Module.
LSB	Least significant bit; carries the least numerical weight.
MCS	Management Command System. Integrated data acquisition system; provides flexible control and monitoring capabilities.
MMU	Module Mounting Unit. Card cage that provides electrical and communications support for Infi 90 modules.
MSB	Most significant bit; carries the most numerical weight.
Module Bus	The serial communication link between process control modules.
NAK	No acknowledgment of message.
NIS	Acronym for the Network Interface Slave.
Node	Any drop on Plant Loop or Infi-Net through which information passes.
Packetizing	The process of grouping messages with a common destination or source and transmitting at one time, instead of individually.
Slave Expander	Parallel address/data bus between the master (IPT) and slave Bus (NIS). Located on the MMU backplane.
Subring	Any ring other than the Central Ring; also known as Satellite ring.
XR	Exception Report. Information update generated when a point change is greater than a specified significant amount.

SPECIFICATIONS

	Infi-Net to Plant Loop Transfer Module	Network Interface Slave
Microprocessor	68020	68020
Memory	512 kbytes ROM 415 kbytes RAM 80 kbytes Battery Backed RAM (79 kbytes available to user)	64 kbytes ROM 80 kbytes RAM buffer 128 kbytes Processor RAM
Communication Ports	(2) RS-232-C - Serial (1) RS-422 Serial Redundancy Link	Redundant Infi-Net
Power Consumption	6.28 amps nominal @ +5 VDC (31.4 watts) 37.0 mA nominal @ +15 VDC (0.55 watts) 18.0 mA nominal @ -15 VDC (0.27 watts)	2.0 amps nominal @ +5 VDC (10 watts) 80 mA nominal @ ±15 VDC (1.2 watts)
Power Dissipation	32.30 watts nominal	11.2 watts nominal
Maximum Configurable Block Range	30 to 5,029 inclusive	N/A
Radio Frequency Interference	Keep system cabinet doors closed. Do not use communication equipment any closer than 2 meters (6.5 feet) from the cabinet.	
Mounting	The Gateway modules occupy four slots in the Infi 90 Module Mounting Unit.	
Environment		
Ambient Temperature	0^{o} to 70^{o}C (32^{o} to 158^{o}F)	
Relative Humidity	0 to 95% up to 55^{o}C (131^{o}F) (noncondensing) 0 to 45% at 70^{o}C (158^{o}F) (noncondensing)	
Atmospheric Pressure	Sea level to 3 km (1.86 miles)	
Certification	CSA certified for use as process control equipment in an ordinary (nonhazardous) location.	

Specifications Subject To Change Without Notice

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section discusses Gateway theory of operation through block diagrams and supportive text. The first part describes the three main areas of the Gateway. These are communications, data types and data flow. Figure 2-1 is a block diagram of data flow. The second part of this section describes the key circuits of the Network Interface Slave and Infi-Net to Plant Loop Transfer Module.

COMMUNICATIONS

The Gateway uses four communications channels. They are the Slave Bus, Module Bus, RS-422 and RS-232 (optional).

All Gateway messages, from either loop, pass to the Network Interface Slave (NIS). The NIS sends messages over the Slave Expander Bus to the Infi-Net to Plant Loop Transfer (IPT) Module. When data goes from the Infi-Net side to the Plant Loop side, the IPT converts the data for recognition by the Plant Loop. The IPT sends the converted data to the NIS module, which sends it to the destination identified in the data's header.

Module Bus use is for redundant configurations and transactions between the IPT and other modules. In redundant configurations, the secondary (backup) IPT module monitors the primary IPT module over the Module Bus. If the primary fails, the Module Bus provides the path for ***cold failover*** to the

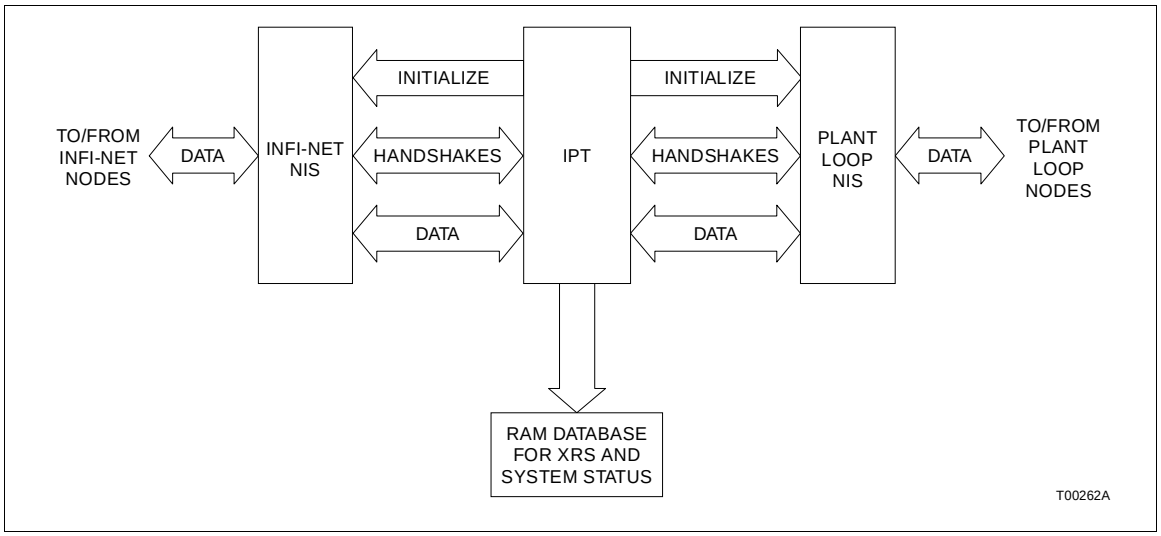

Figure 2-1. Data Flow Block Diagram

backup IPT module. Cold failover causes the flow of data to halt and data points to go into bad quality. The Module Bus also provides access for the Engineering Work Station for system configuration and diagnostic tasks.

The RS-422 communication channel is active in redundant configurations only. It provides the serial data transfer link between redundant IPT modules.

The RS-232 channel is available on the NIMF01 Termination Module and NTMF01 Termination Unit for engineering diagnostics.

DATA FLOW

On system start-up, the Infi-Net to Plant Loop Transfer Module checks its configuration, establishes a database for Exception Reports from Infi-Net and initializes the Network Interface Slave Modules. When the Network Interface Slave receives a message, it determines the destination (in or out of its ring). It then notifies the IPT of an incoming message. The IPT acknowledges and accepts the message. It then determines the message class (Exception Report or Configuration and Control), and stores it in RAM. The message is restructured to a format recognizable by its destination (Infi-Net or Plant Loop). The IPT packetizes those messages going to the Plant Loop side to minimize traffic. This means that messages with a common destination are grouped and transmitted at one time, instead of individually. On the Infi-Net side, Exception Reports can go to multiple destinations, so they are packed by the source. When the IPT transmits a message, it waits for an ACK or NAK from the destination node. If it does not receive an ACK or NAK, it initiates up to 12 transmission retries. If the destination node still does not answer, the NIS marks it NOL (node off-line) and informs the IPT. It is the source node's responsibility to remove messages destined for off-line nodes.

The IPT module repacks exception reports and assumes responsibility for retries. Since the original source is responsible for retries of configuration and control messages, the IPT passes through control and configuration messages.

Node response to message failure depends on the failure type. For example, a communication type failure occurs if the destination node is off-line or busy. In this case, the IPT informs the sourcing node. If the destination node is unable to execute the message, the destination node is responsible for informing the source.

DATA TYPES

The Gateway handles three different data types. These are: Exception Reports, Configuration and Control messages, and System Status data.

Exception Reports

Exception Reports occur whenever a point change exceeds a specified amount. An Exception Report can pass in either direction through the Gateway. Exception Reports are stored in the IPT module's RAM until sent to their final destination.

Configuration and Control Data

Configuration and control data refers to messages a source generates and sends to a destination. The source waits for acknowledgment of message receipt. An example of a configuration type message is a function code download operation. A control message is a command such as Station Setpoint. Control messages are handled the same as configuration messages, except that they cause an Exception Report.

System Status

System status data contains information about overall Gateway and system operating condition. This includes such data as modules that are in error mode, nodes off-line, etc.

Each side of the Gateway treats system status differently. Since Plant Loop is unable to recognize ring versus node, it recognizes the IPT module only as a node. Infi-Net sees Plant Loop as a satellite ring in the system. The Gateway propagates Plant Loop node status onto the Infi-Net side.

NETWORK INTERFACE SLAVE CIRCUITS

Figure 2-2 is a block diagram of the key Network Interface Slave circuits. These circuits are the Microprocessor, Slave Expander Bus Interface, the Buffers, Buffer Control and Transceiver Controller. The following paragraphs describe each of these circuits.

Microprocessor

The Microprocessor directs the slave's support circuits. It is also responsible for verifying the validity of outgoing data sourced by the IPT. When the Transceiver Controller circuit is ready to send data, the processor calculates the checksum of the next message in the TX buffer and compares this value with the checksum received from the IPT. If the checksums match, the processor tells the Transceiver Controller to send the data. If the checksums do not match, the processor directs the IPT to retransmit the message.

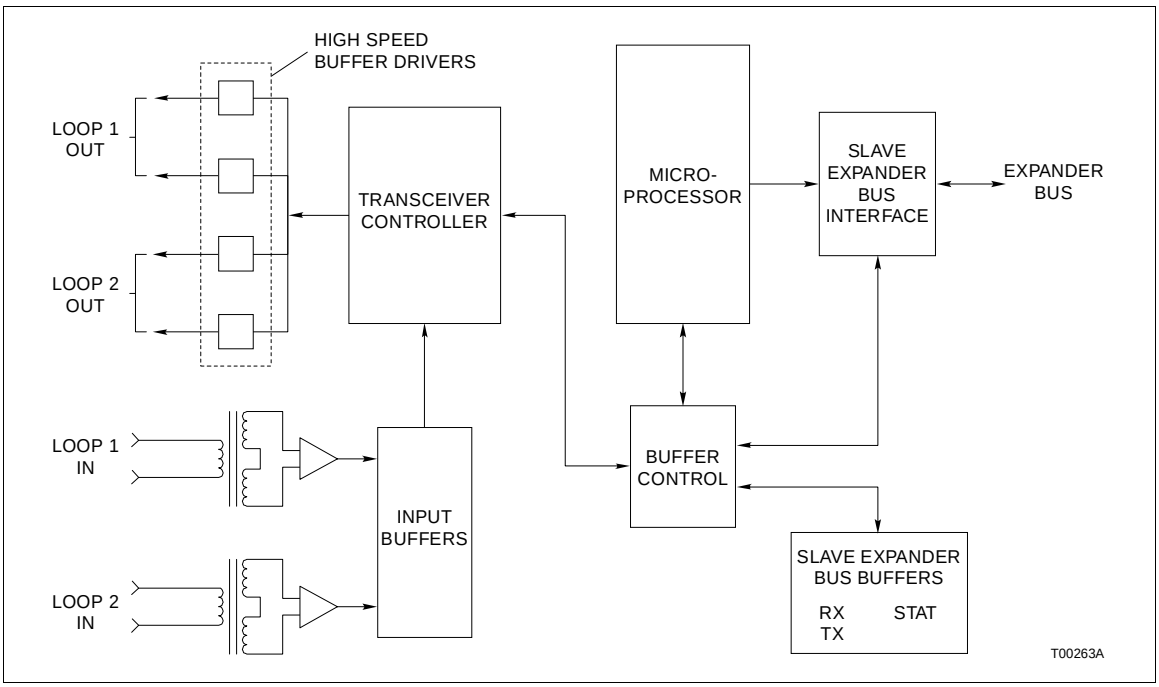

Figure 2-2. Network Interface Slave Circuit Block Diagram

Slave Expander Bus Interface

The Slave Expander Bus Interface provides the communication link with the IPT Module. The IPT receives interrupts, incoming data and transmits outgoing data through this interface. It is through this interface that the NIS receives the handshake signal from the IPT signaling it to begin transmitting incoming data from its buffers.

Slave Expander Bus Buffers

The buffers are: Receive (RX), Transmit (TX) and Status (STAT).

The NIS uses the RX buffer to store incoming messages until it is ready to signal the IPT. When the IPT receives the signal, it transfers whatever messages are contained in the RX Buffer to its own buffers.

Outgoing messages from the IPT are kept in the TX buffer. The NIS constantly checks the loop for an opening. When the loop is not busy, it takes the messages from the TX buffer and sends them to their destination.

The STAT buffer keeps track of responses to messages, the disposition of messages and the status of all nodes. When the NIS sends an interrupt to the IPT over the Slave Expander Bus Interface, it is the IPT's responsibility to check the contents of the STAT buffer and to take the appropriate action.

Slave Expander Bus Buffer Control

The Buffer Control circuit maintains starting and ending pointers to the messages in the circular Slave Expander Bus buffers. As the IPT sources outgoing messages, the Buffer Control circuit queues them in the Transmit Buffer. Under microprocessor control, these messages are removed from the queue and sent via the Transceiver Controller to the loop.

The Slave Expander Bus Buffer Control circuits allow incoming messages from the loop to be maintained as a queue in the Receive buffer. Message transmission results and status information are queued in the Status buffer.

Transceiver Controller

The Transceiver Controller is responsible for sending and receiving loop messages. Cyclic Redundancy Checks and message checksums are used on loop messages to assure data integrity.

INFI-NET TO PLANT LOOP TRANSFER MODULE CIRCUITS

The Infi-Net to Plant Loop Transfer Module's main functional blocks are shown in the block diagram of Figure 2-3. The key blocks are the Microprocessor, ROM, Dynamic RAM, Module Bus Interface and Slave Bus Interface.

Microprocessor and ROM

The Microprocessor provides the Infi-Net to Plant Loop Transfer module with intelligence. It directs the activities of all the support circuits. This includes address decoding, interrupt recognition, wait state generation and management of the Dynamic RAM. ROM contains the general operating instructions and specific operating instructions programmed with Function Codes 200 and 201.

Dynamic RAM

There are 415 kbytes of Dynamic RAM. When the IPT module starts up, it partitions the Dynamic RAM for the Exception Report data base. This data base provides storage required to account for data transfer rate disparity between Infi-Net and Plant Loop. The data base is scanned periodically for updated values sending them to the indicated destination.

Module Bus Interface

The Module Bus interface provides the communication for redundant IPT modules. It is through this interface that fail-over occurs. The Engineering Work Station also uses the Module Bus for IPT module configuration and diagnostics.

Slave Expander Bus Interface

The Slave Bus Interface carries data and commands between the IPT and the Network Interface Slave. The IPT sends data transfer commands over the interface to the Network Interface Slave. When the Network Interface Slave receives the commands, it forwards the data in its buffers to the IPT.

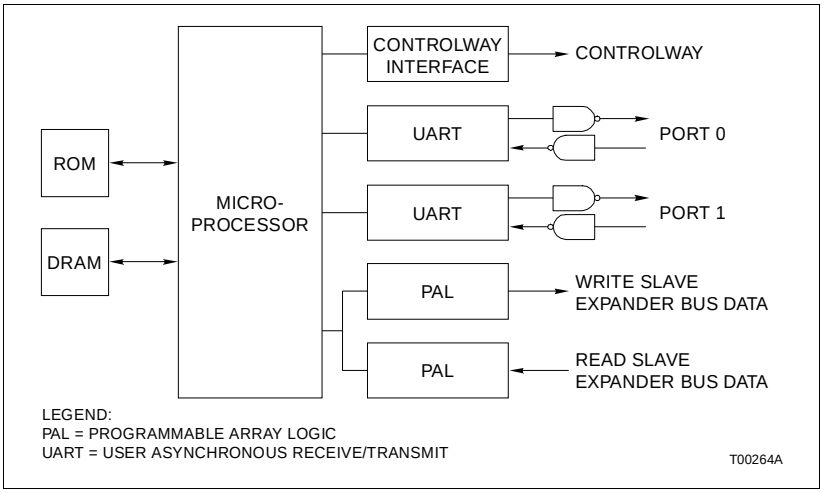

Figure 2-3. Infi-Net to Plant Loop Transfer Module Circuit Block Diagram

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains what must be done before you put the Gateway into operation. Do not proceed with operation until you read, understand and complete the steps in the order in which they appear.

NOTE: Refer to Product Instruction I-E93-911 for termination wiring information.

UNPACKING AND INSPECTION

Each Gateway module comes in a separate package. Handle the modules per the steps in ***HANDLING***.

HANDLING

NOTE: Always use Bailey's Field Static Kit (wrist strap, ground cord assembly, alligator clip - P/N 1948385A2) 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.

Special Handling

The Gateway modules use electrostatic sensitive devices. Follow Steps 1 through 4 when handling:

1. Keep the modules in their special anti-static bag until you are ready to install them 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.

General Handling

1. Examine the hardware immediately to verify that 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.

SWITCH SETTINGS - INFI-NET TO PLANT LOOP TRANSFER MODULE

The user-configurable switches on each Gateway module are very important. Each switch setting determines an operating characteristic or default. Without these settings, the Gateway would not function.

NOTE: Each IPT module comes with a fixed module address of 2. This address is not user-configurable.

See Figure 3-1 for switch locations.

NOTES:
1. All switches - DOWN, OPEN or OFF = Logic 1; UP, CLOSED or ON = Logic 0.

2. Switches marked Not Used must be kept in the 0 position. The IPT may not operate properly if these switches are set to the 1 position.

3. Since factory settings do not reflect default settings, it is imperative that you check all switch settings before putting the modules into operation.

For quick reference, record your settings in the User Setting column.

Switch U72 - Options

Switch U72 is an 8-pole dipswitch. Pole 1 is the most significant bit (MSB); pole 8 is the least significant bit (LSB). This switch determines Gateway operating characteristics and module functions. Refer to Table 3-1 for settings.

Switch U73 - Baud Rate Select

Switch U75 is an 8-pole dipswitch. It sets the baud rate for Serial Port 1. Refer to Table 3-2 for settings.

Switch U75 - Test

Switch U75 is a 5-pole dipswitch. This switch sets test modes and primary or secondary status. Refer to Table 3-3 for settings.

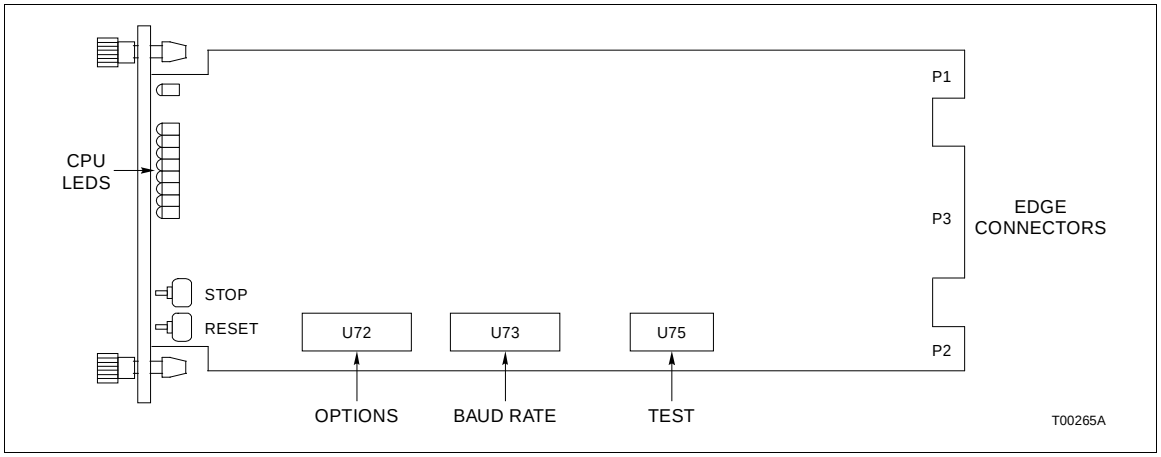

Figure 3-1. Switch Locations - Infi-Net to Plant Loop Transfer Module

Table 3-1. Option Switch U72

Pole	Function	Setting	User Setting
1	ROM Checksumming On	0[1]	
	ROM Checksumming Off	1	
2/3	Port 0/1 data characteristics		
	8 data bits, 1 stop bit, no parity	0/0	
	8 data bits, 1 stop bit, even parity	0/1	
	8 data bits, 1 stop bit, odd parity	1/0	
	8 data bits, 2 stop bit, no parity	1/1	
4/5	Not Used	0/0	
6	Power System Status Failure Disabled	0	
	Power System Status Failure Disabled	1	
7	NVM Initialize No	0	
	NVM Initialize Yes	1	
8	Redundancy Configured No	0	
	Redundancy Configured Yes	1	

[1] Normal setup

Table 3-2. Serial Port 1 Baud Rate Select Switch U73

Baud Rate	Pole 5 6 7 8	Baud Rate	Pole 5 6 7 8	User Setting
50	0 0 0 0	1800	0 0 0 1	
75	1 0 0 0	2000	1 0 0 1	
110	0 1 0 0	2400	0 1 0 1	
134.5	1 1 0 0	3600	1 1 0 1	
150	0 0 1 0	4800	0 0 1 1	
300	1 0 1 0	7200	1 0 1 1	
600	0 1 1 0	9600	0 1 1 1	
1200	1 1 1 0	19200	1 1 1 1	

NOTE: U73, poles 1 through 4 are unused; their settings do not matter.

Table 3-3. Test/Module Address Switch U75

Pole	Function	Setting	User Setting
1	Test Mode Enable		
	Normal IPT Operating Mode	0[1]	
	Test Mode Enabled	1	
	(NIS handshake timeouts ignored)		
2	Not Used	0	
3	Infi-Net Diagnostics Enable		
	Normal IPT Operating Mode	0	
	Diagnostics Port Enabled	1	
4	Cross-Loop Time Sync Enabled	0	
	Time Sync Isolated	1	
5	Primary IPT	0	
	Secondary IPT	1	

[1] Normal setup

SWITCH SETTINGS - NETWORK INTERFACE SLAVE

Switch SW1 - Node Address

Switch SW1 is an 8-pole dipswitch that sets the node address. Pole 1 is the most significant bit (MSB) with a binary weight of 128; pole 8 is the least significant bit (LSB) with a binary weight of 1. Valid node addresses are:

1-250 for Infi-Net side of Gateway
1-63 for Plant Loop side of Gateway

Switch SW2 - Ring Address

Switch SW2 sets the ring address. The NIS module on the Infi-Net side of the Gateway must be set as follows:

pole	1	2	3	4	5	6	7	8
	0	0	0	0	0	0	0	1

The NIS module on the Plant Loop side can have a ring address from 2 to 250.

See Figure 3-2 for switch locations; refer to Table 3-4 for address setting examples for switches SW1 and SW2.

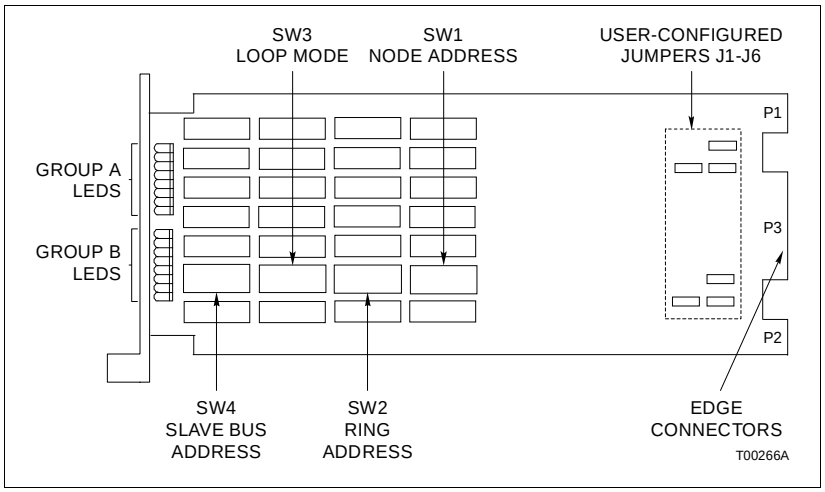

Figure 3-2. Switch Locations - Network Interface Slave Module

Table 3-4. Address Examples

Address	Switch Location	1	2	3	4	5	6	7	8	User Setting
	Switch Value	128	64	32	16	8	4	2	1	
63		0	0	1	1	1	1	1	1	
250		1	1	1	1	1	0	1	0	

Switch SW3 - Mode

Switch SW3 sets the NIS operating mode defaults. Refer to Table 3-5 for settings.

Switch SW4 - Slave Bus Address/Counter Address

Switch SW4 is dual purpose. Poles 1 through 3 set the NIS Slave Bus Address (0 through 7); poles 4 through 8 set the Event and Error Counter addresses. Refer to Table 3-6 for settings.

NOTE: The Central Ring NIS Slave Expander Bus address must be set to 0, satellite ring to 1.

Table 3-5. Loop Mode Switch SW3 Settings

Pole	Function	Setting	User Setting
1	Gateway Mode	1	
2	ROM Checksum Enabled	1	
	ROM Checksum Disabled	0	
3/4	Not Used	0	
5	LEDs do not flash on loop failure	0	
	LEDs flash on loop failure	1	
6	Not Used	0	
7/8	10 MHz Infi-Net	0/0	
7/8	2 MHz Infi-Net	0/1	
7/8	Plant Loop Side only	1/1	
7/8	Illegal - **Do Not Use**	1/0	

NOTE: Switches that are Not Used must be kept in the 0 position. The NIS may not operate properly if these switches are set to the 1 position.

Table 3-6. Address/Counter Switch SW4 Settings

Address	Counter	Poles 1 2 3 4 5 6 7 8	User Setting
0	00	0 0 0 0 0 0 0 0	
1	01	0 0 1 0 0 0 0 1	
	02	X X X 0 0 0 1 0	
	03	X X X 0 0 0 1 1	
	04	X X X 0 0 1 0 0	
	05	X X X 0 0 1 0 1	
	06	X X X 0 0 1 1 0	
	07	X X X 0 0 1 1 1	
	08	X X X 0 1 0 0 0	
	09	X X X 0 1 0 0 1	
	0A[1]	X X X 0 1 0 1 0	
	0B	X X X 0 1 0 1 1	
	0C	X X X 0 1 1 0 0	
	0D	X X X 0 1 1 0 1	
	0E	X X X 0 1 1 1 0	
	0F	X X X 0 1 1 1 1	
	10	X X X 1 0 0 0 0	
	11	X X X 1 0 0 0 1	
	12	X X X 1 0 0 1 0	
	13	X X X 1 0 0 1 1	
	14	X X X 1 0 1 0 0	
	15	X X X 1 0 1 0 1	
	16	X X X 1 0 1 1 0	
	17	X X X 1 0 1 1 1	
	18	X X X 1 1 0 0 0	
	19	X X X 1 1 0 0 1	
	1A	X X X 1 1 0 1 0	
	1B	X X X 1 1 0 1 1	
	1C	X X X 1 1 1 0 0	
	1D	X X X 1 1 1 0 1	
	1E	X X X 1 1 1 1 0	

NOTES:

1. Example: Counter 0A keeps track of the number of multicast messages received. To display this counter's contents on the front panel LEDs, set switch SW4 as follows: pole 4 = 0, 5 = 1, 6 = 0, 7 = 1 and 8 = 0. Refer to Table 4-1 for a complete listing of the counters.
2. X = address setting.

PREPARING THE MODULE MOUNTING UNIT

Dipshunts

Install an intact dipshunt (supplied with the MMU) in the MMU Slave Expander Bus. One dipshunt goes between each module slot to maintain Slave Expander Bus continuity as follows:

Option 1 Slots 9, 10, 11 and 12 for non-redundant configurations.

Option 2 Slots 1, 2, 3 and 4 (secondary) and 9, 10, 11 and 12 (primary) for redundant configurations.

Option 3 Slots 1, 2, 3 and 4 (primary) in Module Mounting Unit 1 and Slots 1, 2, 3 and 4 (secondary) in Module Mounting Unit 2.

Module Bus Cable

NOTE: For options 1 and 2, the Module Bus is automatically connected. For option 3, do Steps 1 and 2.

1. Attach one end of the Module Bus Cable (two-wire, twisted pair) to the second column of two tabs on the lower left of the MMU backplane (facing from behind). See Figure 3-3.

2. Attach the other end of the cable to the first column of two tabs on the lower left of the next MMU backplane.

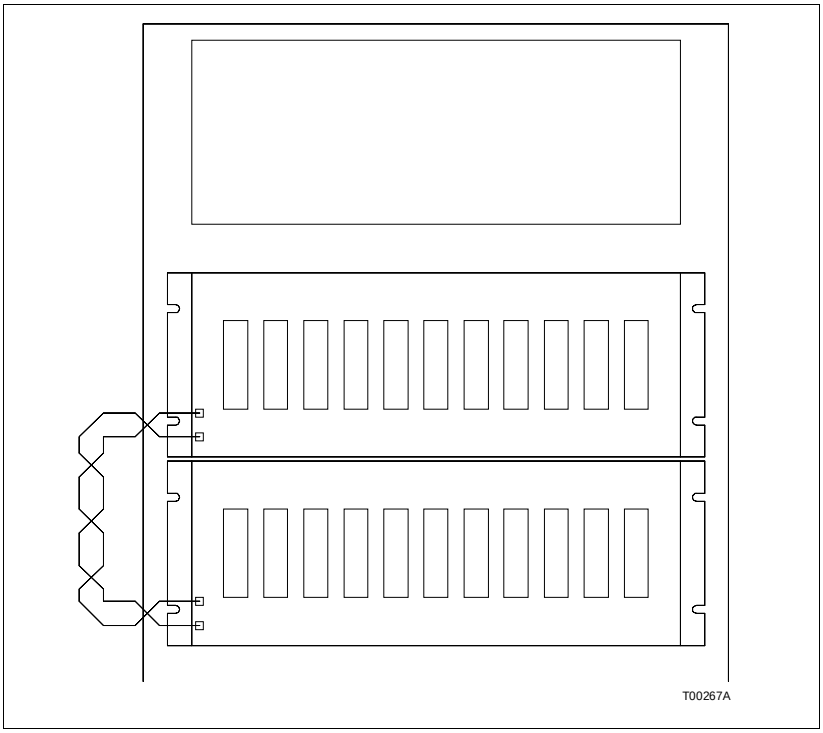

Figure 3-3. Module Bus Cable Installation

INSTALLING THE MODULES

NOTE: To install modules, guide their top and bottom edges along the top and bottom rails of the MMU. Slide the module into the slot. Push it until the rear edge is firmly seated in the backplane connectors. Then, turn the two concentric screws one-half turn clockwise to lock the modules in place.

Steps 1 through 4 refer to non-redundant configurations; 5 through 7 to redundant configurations. Before you install the modules, check all switch settings, and ensure that respective module cables are attached to the MMU backplane (refer to I-E93-911 for further details).

Modules can be installed and removed under power.

1. Insert the Infi-Net Network Interface Slave in slot 9.

2. Insert the Infi-Net to Plant Loop Transfer Module in slots 10 and 11.

3. Insert the Plant Loop Network Interface Slave in slot 12.

4. For redundant configurations, follows Steps 1 through 4 for the primary set. See Figure 3-4.

5. Insert the redundant Network Interface Slave in slot 1.

6. Insert the redundant Infi-Net to Plant Loop Transfer Module in slots 2 and 3.

7. Insert the other Network Interface Slave in slot 4.

When power is applied, the IPT Status LED should turn green and its CPU Status LEDs red. The NIS Group A and B LEDs should illuminate in about 18 seconds. If LEDs do not illuminate, refer to Section 5 for corrective action.

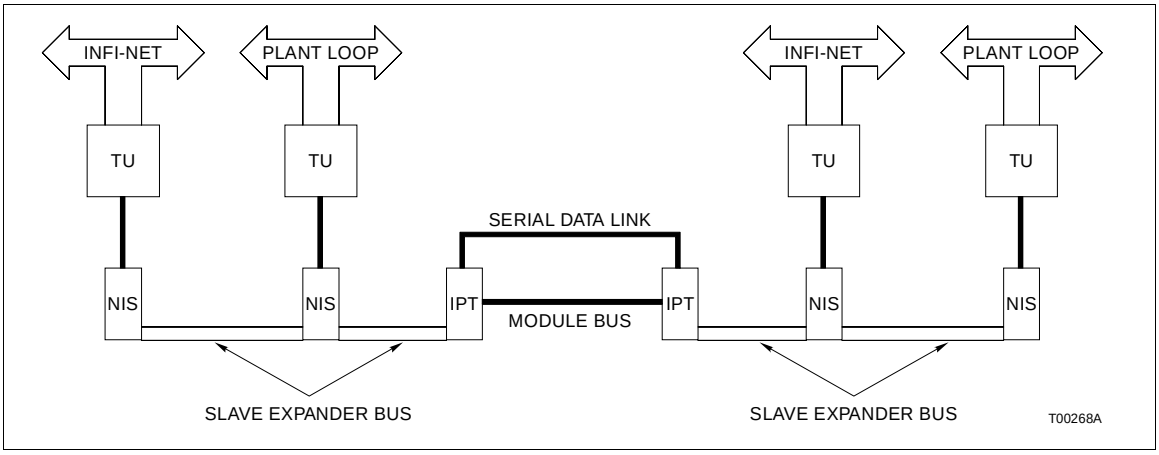

Figure 3-4. Redundant Configuration

SECTION 4 - OPERATION

INTRODUCTION

This section discusses the start-up, indicators and controls, and operating modes for the Gateway Modules. The operator needs to closely observe these indicators as they provide a quick look at module status.

START-UP

When power is applied, the IPT module:

- Checks its hardware
- Checks its configuration and builds databases
- Brings the NIS modules on-line

If LEDs 7 and 8 are not lit, refer to Section 5 for corrective action.

The NIS module performs its self-diagnostic routines immediately after IPT initialization. Group A and B LEDs activate after about 18 seconds. If they do not, refer to Section 5.

OPERATOR/INTERFACE CONTROLS

Infi-Net to Plant Loop Transfer Module

The Infi-Net to Plant Loop Transfer (IPT) Module has these indicators and controls on its faceplate:

Status LED
8 CPU LEDs
2 Memory Status LEDs
Stop Pushbutton
Reset Pushbutton

STATUS LED

The Status LED is a red/green LED. It indicates IPT operating condition. There are five possible states:

Off — No power.

Solid Green — The IPT is in Execute mode.

Flashing Green Slow — (once/second) - the IPT is in Execute mode, however, there is an NVM checksum error.

Flashing Green Fast — (4 times/second) - The IPT is in Configure or Error mode.

Solid Red The IPT diagnostics have detected a hardware failure, configuration problem, etc. and halted the module. Additionally, the eight CPU LEDs illuminate to display the error code (refer to Section 5 for further details).

CPU LEDS

These LEDs indicate primary and secondary IPT modules and error codes. LEDs 7 and 8 illuminate on the primary, 8 on the secondary. If an error occurs, the IPT ***red lights*** and the LEDs illuminate to display the error code (refer to Section 5). Note that LEDs 1 and 2 flash when the system is first coming up. This indicates the module is not yet on-line.

MEMORY LEDS

There are two Memory LEDs. MEM LED 2 illuminates only when a single bit error is being corrected. Both LEDs illuminate when 2-bit errors or complete memory failure occurs.

STOP PUSHBUTTON

The Stop Pushbutton does three functions:

- Completes any NVM write in progress.
- Forces control from primary to secondary IPT in redundant configurations.
- Stops the module in an orderly fashion.

  NOTE: Push this button before removing or resetting the IPT module.

RESET PUSHBUTTON

The Reset pushbutton does two functions:

- Resets the IPT to power-up values after a halt.
- Recovers from an operator-initiated stop or module timeout.

See Figure 4-1 for indicator and pushbutton location.

Network Interface Slave

On the Network Interface Slave (NIS) front panel, there are two groups of eight LEDs (LED A1= LSB, LED B8 = MSB). These LEDs display the contents of event and error counters as set in Section 3 (Table 3-5). They also display pass/fail information when on-board diagnostics are run. Refer to Table 4-1. See Figure 4-2.

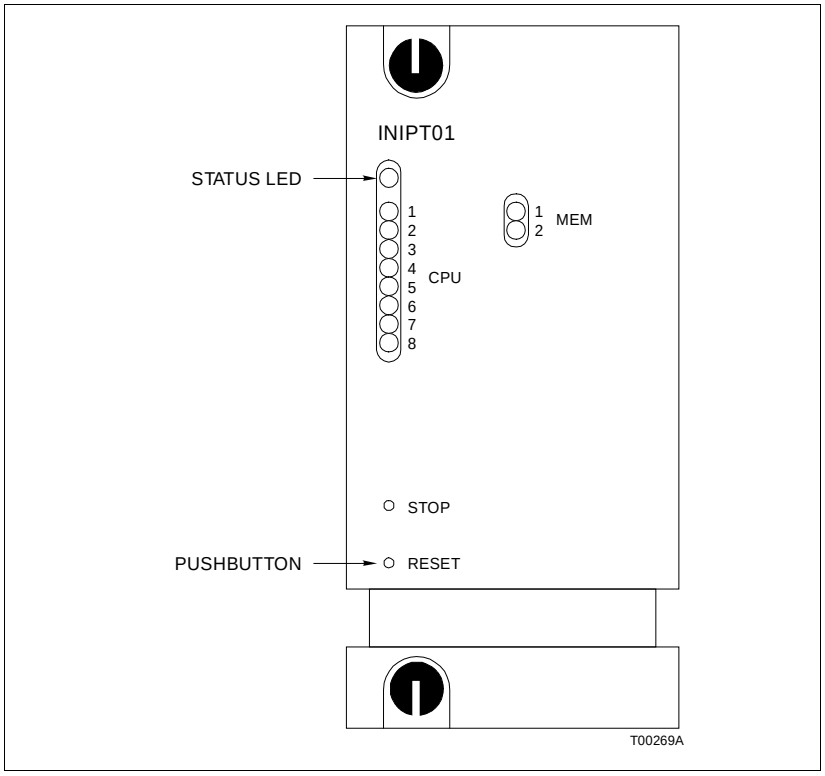

Figure 4-1. IPT Module Faceplate

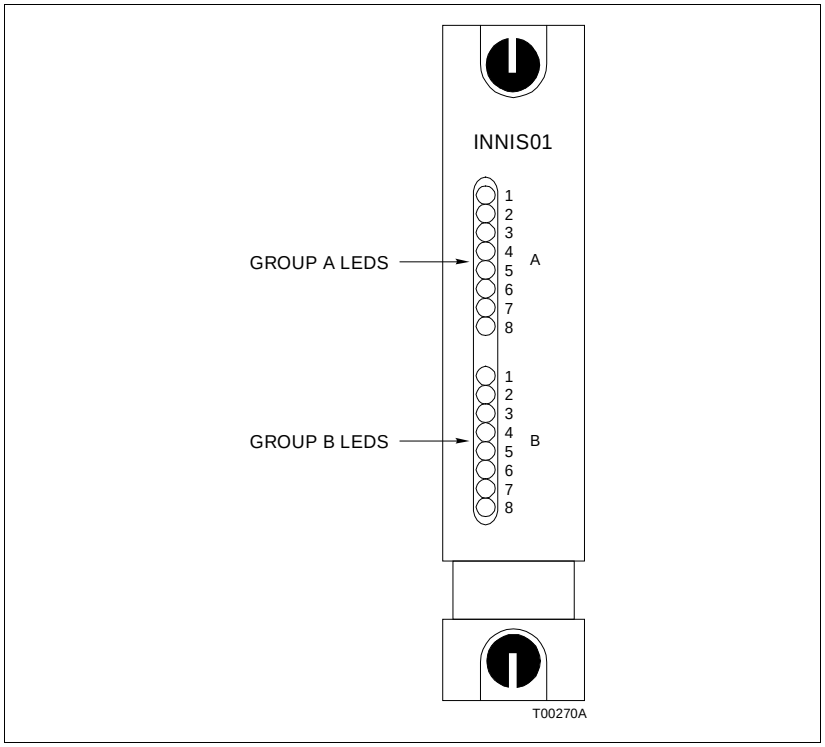

Figure 4-2. NIS Module Faceplate

Table 4-1. Event Counter Display

Counter	Description
00	Number of timer interrupts
04	Number of messages lost to receive queue overflow
09	Number of multicast messages received, excluding original
0A	Number of multicast destinations received
0B	Number of time-sync messages received, excluding original
0C	Number of broadcast messages received, excluding original
0D	Number of NIS poll messages received, excluding original
0E	Number of NIS poll messages acknowledged (ACK) by this node
0F	Number of NIS poll messages busy-not acknowledged (BSY-NAK) by this node
10	Number of messages transmitted, total loop traffic
11	Number of messages received and forwarded by this node
12	Number of messages originated by this node, including retries
13	Number of message retires originated by this node
14	Number of transmitted message watchdog expirations
15	Number of messages put into receive buffer and retained
16	Number of bytes originated by this node, including retries
17	Number of bytes received and forwarded by this node
18	Number of Slave Expander Bus to NIS handshakes
19	Number of Slave Expander Bus “Message to Transmit Buffer” signals
1A	Number of Slave Expander Bus PCU-status requests
1B	Number of Slave Expander Bus NIS-status requests
1C	Number of Slave Expander Bus interrupts with invalid status
1D	Number of transmit buffer realignments due to invalid contents
1E	Number of receive buffer realignments

MODES OF OPERATION

Infi-Net to Plant Loop Transfer Module

The Infi-Net to Plant Loop Gateway module has three modes of operation: Configure, Execute and Error. The Network Interface Slave always operates in the Execute mode.

CONFIGURE MODE

Use the Configure Mode to assign values to the Executive (function code 200) and Data Point Definition (function code 201) function blocks (refer to I-E93-900-20 Function Code Application Manual). You must have an Infi 90 operator

interface device to perform configuration tasks. Refer to the product instruction for your particular device for details.

NOTES:
1. The IPT continues to report data values and respond to control commands while in Configure Mode.

2. When configuring the module from the loop (via a Computer Interface Unit (CIU)), the Gateway responds at module address 2. Whereas, when configuring from the Module Bus (via a Serial Port Module (SPM)), the Gateway responds at module address 0 or 1 depending on how Switch U75 pole 5 is set.

EXECUTE MODE

The Execute Mode is the normal mode of operation. In this mode, the IPT communicates with the NIS modules and processes Exception Reports and Configuration and Control messages.

ERROR MODE

If the built-in system diagnostics detect a hardware or configuration error, the IPT goes into the Error Mode. If a hardware error is detected, the module halts and displays the error code on the front panel (refer to Section 5 for details). If a configuration error is detected, the Status LED flashes, but the module continues to operate.

Network Interface Slave - Execute Mode

This is the normal mode of operation for the Network Interface Slave. In this mode, it receives messages from Infi-Net and Plant Loop and communicates with the IPT module. If the built-in system diagnostics detect an error, the NIS halts and the front panel LEDs illuminate to display the appropriate error code. Refer to Section 5 for details.

REDUNDANT OPERATION

Redundant switchover is automatic. In redundant configurations, the primary IPT transfers a copy of its data base to the redundant (backup) IPT. The redundant IPT accepts the copy and continuously monitors the primary. The backup IPT stays in ***cold standby*** mode. Communications between primary and redundant IPTs is over a serial link; handshaking occurs over the Module Bus. The primary IPT is identified by LEDs 7 and 8; the backup by LED 8.

A ***cold*** failover occurs when the secondary IPT assumes control. This type of failover causes temporary disruption of data flow and is seen by all nodes as a node restart by the node

which has failed over. In this failover condition, all points are automatically re-established.

NOTE: Redundancy requires four Network Interface Slave Modules.

POINT COUNT, THROUGHPUT AND CONFIGURATION

Gateway data throughput is dependent upon these factors:

- The number of data points that can be processed
- The rate at which the data can be transferred between rings
- The effect on messages passed through the device
- The maximum number of blocks available for configuration is 5,000
- There is 80 kbytes of Battery Backed RAM available to hold the configuration
- Total RAM for Infi-Net and Plant Loop data base is approximately 415 kbytes

Use the following figures to estimate if a given configuration will fit in the IPT module's memory.

1. Battery Backed RAM usage:

   Function Code 200 (SPG Executive) 16 bytes
   Function Code 201 (Import Remote Data) 8 bytes

   NOTE: Refer to Function Code Application Manual for more information.

2. Database Record Sizes

Use these figures for both Central and Satellite Rings.

Exception Report Blocks

Digital	38 bytes	RCM	40 bytes
Analog	58 bytes	Status	56 bytes
Station	80 bytes	Trend points from Infi-Net (38 bytes each)	

Miscellaneous

Each unique ring	18 bytes
Each unique node	58 bytes
Each unique module	14 bytes

Routing Records

Each route established	14 bytes

TRENDING

The Infi-Net side of the Gateway trends automatically. The Plant Loop side trending process is semi-automatic. It requires that you identify a trend block with the Infi-Net Data Point Definition function code 201. Follows Steps 1 through 8 to enter function code 201 into the IPT module.

> **NOTE:** Refer to the product instruction for your particular configuration device for details on how to enter function code configuration information. Refer to I-E93-900-20 Function Code Application Manual for specifics about function codes.

1. Use your configuration device (e.g., CTM, MCS, etc.) to change the IPT operating mode to Configure.

2. Use your configuration device to configure Function Code 201 in the IPT Module in as many blocks as you desire.

3. Set Specification S1 to 6 (Trend Point).

4. Set Specification S2 to the source ring address.

5. Set Specification S3 to the source node address.

6. Set Specification S4 to the source module address.

7. Set Specification S5 to the block where the trend point is located.

8. Put the IPT back into Execute Mode.

Use your Plant Loop console (e.g., MCS) to request trend data from each Data Point Definition block configured as a trend point (Step 3, S1=6) in the IPT. When the Gateway receives a trend request, it automatically reroutes the request to the actual trend block location specified in Steps 4 through 7. The output of the trend type block indicates whether or not a request for trend data has been received and the data was actually acquired.

SECTION 6 - MAINTENANCE

INTRODUCTION

The Gateway modules require minimal maintenance. If you do the tasks in Table 6-1, the Gateway modules will provide long, trouble free service. Please note that only qualified personnel should perform maintenance.

MAINTENANCE SCHEDULE

Table 6-1 is the maintenance schedule. These tasks are to be performed 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 shutdown, 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 shutdown, whichever occurs first.

SECTION 7 - REPAIR/REPLACEMENT

INTRODUCTION

Gateway repair procedures are limited to module replacement. If a Gateway module fails, remove and replace with another. Verify that firmware revision levels match and that replacement switch settings are the same as the failed module. Refer to Table 7-1 for a list of recommended spare parts.

Table 7-1. Recommended Spare Parts List

Description	Part Number	Quantity
Cable, NIS to NICL01	NKLS02	1
Cable, NIS to NTCL01	NKLS01	1
Cable, IPT to NIMF01	NKTM01	1
Cable, IPT to NTMF01	NKTU01	1
Module, Infi-Net to Plant Loop Transfer	INIPT01	1[1]
Module, Network Interface Slave	INNIS01	1[1]
Termination Module	NICL01	1
Termination Module	NIMF01	1[2]
Termination Unit	NTCL01	1
Termination Unit	NTMF01	1[2]

[1]Requires 2 if redundancy is used.
[2]Required only if using engineering diagnostics.

MODULE REPLACEMENT

NOTE: You can remove Gateway modules under power.

Infi-Net to Plant Loop Transfer Module

Follow Steps 1 through 3 to replace the IPT Module:

1. Grasp the lower faceplate, push the latch up and slide the module out.

2. Set switches U72, U73 and U75 on the replacement to match the settings of the IPT you have just removed.

3. Hold the module by the faceplate and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

Network Interface Slave

Follow Steps 1 through 3 to replace the NIS module:

1. Grasp the lower faceplate, push the latch up and slide the module out.

2. Set switches SW1 and SW2 on the replacement to match the settings of the NIS you have just removed.

3. Hold the module by the faceplate and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls is ready to assist in the use and repair of its products. Requests for sales and applications services along with installation, repair, overhaul and maintenance contract services should be made to the nearest sales office.

REPLACEMENT PARTS AND ORDERING INFORMATION

If you are making repairs at your own facility, replacement parts should be ordered through a Bailey sales office. Provide the following information to expedite the handling of parts orders:

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable) of the assembly for which the part has been ordered.

3. Bailey publication number, page number and reference figure used in identifying the part.

When ordering standard parts from Bailey Controls, use part numbers and descriptions from respective Renewal Parts sections of applicable equipment manuals. Parts which do not have a commercial description provided in the description column of the Renewal Parts sections must be ordered from the nearest Bailey Controls sales office.

TRAINING

Bailey Controls has a modern training facility equipped to provide service and repair instruction. This facility is available for in-plant training of your personnel. Contact a Bailey Controls sales office for specific information pertaining to covered assemblies and available scheduling.

TECHNICAL DOCUMENTATION

You can obtain additional copies of this manual through the nearest Bailey sales office. Extra copies are available at a reasonable charge.

APPENDIX A - QUICK REFERENCE

INTRODUCTION

This appendix provides several tables for quick reference. Table A-1 shows default settings for the Gateway modules. Use the User Setting column to record your specific settings. Tables A-2 and A-3 are abbreviated error code listings.

Table A-1. Switch Setting Reference

Module	Switch	Default Setting 1 2 3 4 5 6 7 8	User Setting
Infi-Net to Plant Loop Transfer	U72 U75	0 0 0 0 0 0 0 0 0 0 0 0 0 - - - -	
Network Interface Slave	SW3	1 1 0 0 0 0 0 0 (Infi-Net side) 1 1 0 0 0 0 1 1 (Plant Loop side)	
	SW4	0 0 0 1 0 0 0 0 (Infi-Net side) 0 0 1 1 0 0 0 0 (Plant Loop side)	

Table A-2. IPT Codes

NOTE: Refer to Table 5-1 in Section 5 for corrective action for these errors.

Code	LEDs 8 7 6 5 4 3 2 1	Condition
01	0 0 0 0 0 0 0 1	NVM checksum error
02	0 0 0 0 0 0 1 0	NVM write error
0B	0 0 0 0 1 0 1 1	NVM initialized
0D	0 0 0 0 1 1 0 1	Intermodule link error
0E	0 0 0 0 1 1 1 0	Redundancy switches set the same
11	0 0 0 1 0 0 0 1	Infi-Net NIS handshaking failure
12	0 0 0 1 0 0 1 0	Infi-Net NIS not responding
13	0 0 0 1 0 0 1 1	ROM checksum error
14	0 0 0 1 0 1 0 0	Slave Expander Bus message failure Infi-Net side
15	0 0 0 1 0 1 0 1	Infi-Net failure
16	0 0 0 1 0 1 1 0	Infi-Net NIS loopback test failure
17	0 0 0 1 0 1 1 1	Power system status failure

Table A-2. IPT Codes (continued)

NOTE: Refer to Table 5-1 in Section 5 for corrective action for these errors.

Code	LEDs 8 7 6 5 4 3 2 1	Condition
21	0 0 1 0 0 0 0 1	Software error
22	0 0 1 0 0 0 1 0	Software error
23	0 0 1 0 0 0 1 1	Software error
24	0 0 1 0 0 1 0 0	Software error
25	0 0 1 0 0 1 1 1	Software error
26	0 0 1 0 0 1 1 0	Software error
27	0 0 1 0 0 1 1 1	Software error
28	0 0 1 0 1 0 0 0	Software error
29	0 0 1 0 1 0 0 1	Software error
2A	0 0 1 0 1 0 1 0	Software error
2B	0 0 1 0 1 0 1 1	Software error
2C	0 0 1 0 1 1 0 0	Software error
2D	0 0 1 0 1 1 0 1	Software error
2E	0 0 1 0 1 1 1 0	Software error
2F	0 0 1 0 1 1 1 1	Software error
31	0 0 1 1 0 0 0 1	Memory or CPU fault
32	0 0 1 1 0 0 1 0	Address or bus error
33	0 0 1 1 0 0 1 1	Illegal instruction
34	0 0 1 1 0 1 0 0	Internal error
35	0 0 1 1 0 1 0 1	Internal error
36	0 0 1 1 0 1 1 0	Internal error
37	0 0 1 1 0 1 1 1	Any trap instruction
38	0 0 1 1 1 0 0 0	Infi-Net switch setting invalid
39	0 0 1 1 1 0 0 1	Duplicate node number on ring
3E	0 0 1 1 1 1 1 0	NIS/Device handshake failure
3F	0 0 1 1 1 1 1 1	Normal Stop
40	0 1 0 0 0 0 0 0	Backup - cold takeover ready
80	1 0 0 0 0 0 0 0	Backup - hot takeover ready
91	1 0 0 1 0 0 0 1	Plant Loop NIS handshake failure
92	1 0 0 1 0 0 1 0	Plant Loop NIS not responding
94	1 0 0 1 0 1 0 0	Slave Expander Bus message failure Plant Loop side
95	1 0 0 1 0 1 0 1	Plant Loop failure
96	1 0 0 1 0 1 1 0	PLant Loop NIS loopback test failure
98	1 0 0 1 1 0 0 0	Plant Loop NIS switch settings invalid
99	1 0 0 1 1 0 0 1	Plant Loop duplicate node number

Table A-3. NIS Error Codes

NOTE: Refer to Table 5-3 in Section 5 for corrective action for these errors.

Code	LEDs 8 7 6 5 4 3 2 1	Condition
13	0 0 0 1 0 0 1 1	ROM checksum error
16	0 0 0 1 0 1 1 0	Loopback test failure
31	0 0 1 1 0 0 0 1	Memory or CPU fault
32	0 0 1 1 0 0 1 0	Address or bus error
33	0 0 1 1 0 0 1 1	Illegal instruction
34	0 0 1 1 0 1 0 0	Internal error
35	0 0 1 1 0 1 0 1	Internal error
36	0 0 1 1 0 1 1 0	Internal error
37	0 0 1 1 0 1 1 1	Internal error
38	0 0 1 1 1 0 0 0	Invalid switch setting
3E	0 0 1 1 1 1 1 0	Handshake failure

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