Bailey Hartmann & Braun
symphony™

Instruction
Harmony

Cnet-to-Cnet Communication Interface

INIIR01/INIIL02

Preface

The INIIR01 Cnet-to-Cnet Remote Interface and INIIL02 Cnet-to-Cnet Local Interface are Harmony rack communication interfaces. These interfaces provide a communication link between local and remote Control Networks (Cnet) in the Bailey Hartmann & Braun Symphony Enterprise Management and Control System.

This instruction explains Cnet-to-Cnet interface features, specifications, and operation. It includes installation, troubleshooting, maintenance, and replacement procedures for each module.

NOTE: The INIIR01 and INIIL02 interfaces are fully compatible with existing INFI 90® OPEN Strategic Enterprise Management Systems using the INFI-NET® communication system.

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Introduction

Section 1

Overview

The INIIR01 Cnet-to-Cnet Remote Interface and INIIL02 Cnet-to-Cnet Local Interface are Harmony rack communication interfaces. The interfaces provide a communication link between local and remote Control Networks (Cnet) in the Symphony Enterprise Management and Control System. Figure 1-1 shows the remote interface and Figure 1-2 shows the local interface.

NOTE: The INIIR01 and INIIL02 interfaces are fully compatible with existing INFI 90 OPEN Strategic Enterprise Management Systems using the INFI-NET communication system.

Control Network

Cnet is a unidirectional, high speed serial data network that operates at a ten-megabaud communication rate. It supports a central network with up to 250 system node connections. Multiple satellite Cnet networks can link to a central network. Each satellite network supports up to 250 system node connections. Interfacing a maximum number of satellite networks gives a system capacity of 62,500 nodes. Redundant Cnet communication capability is a standard feature.

On the central network, nodes can be satellite networks, Harmony control units (HCU), human system interfaces, and computers each connected through a Cnet communication interface. On a satellite network, nodes can be HCU cabinets, human system interfaces, and computers.

Intended User

Personnel installing, operating, or maintaining a Cnet-to-Cnet interface should read this instruction before performing any installation, operation, or maintenance procedures. Installation requires an engineer or technician with experience handling electronic circuitry and familiar with communication networks.

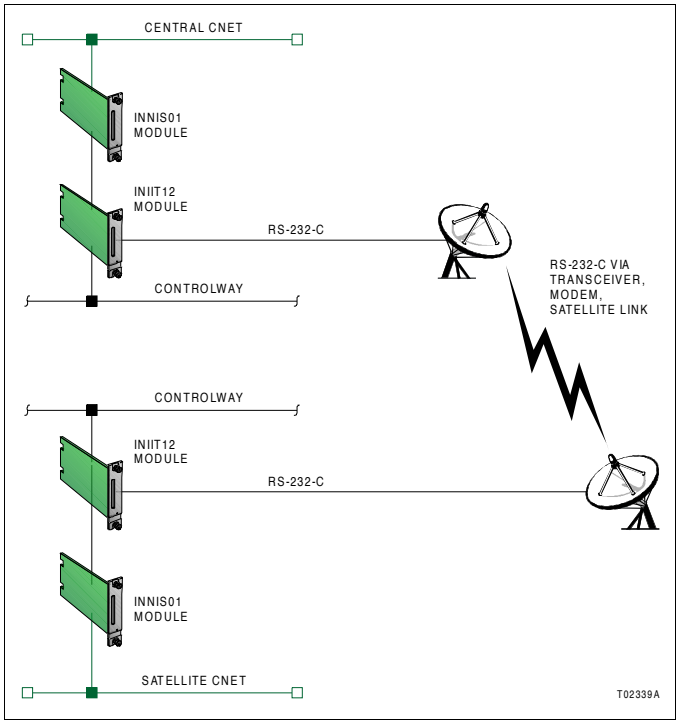

Figure 1-1. Cnet-to-Cnet Remote Interface

Cnet-to-Cnet Remote Interface

The INIIR01 Remote Interface consists of the INNIS01 Network Interface module and the INIIT12 Remote Transfer module (Fig. 1-1). This interface is a node on the central network that can communicate to an interface node on a remote, satellite network. In this arrangement, two interfaces are required: one for the central network and the other for the satellite network. Bidirectional communication from the central network to the remote, satellite network is through standard RS-232-C ports.

The remote interface supports hardware redundancy (Fig. 1-3). Redundancy requires a full set of duplicate modules (two INNIS01 modules and two INIIT12 modules on each network).

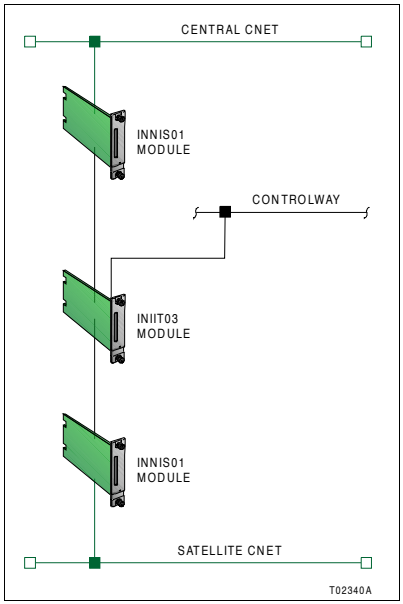

Figure 1-2. Cnet-to-Cnet Local Interface

The backup INIIT12 module continuously monitors the primary over dedicated Controlway. A failover occurs when the backup module detects a primary module failure. When this happens, the backup interface takes over and the primary interface is taken offline. Refer to Appendix C for information on hardware redundancy.

This remote interface transfers system data, control and configuration messages, and exception reports between the central Cnet network and a remote, satellite Cnet network.

Cnet-to-Cnet Local Interface

The INIIL02 Local Interface consists of two INNIS01 Network Interface modules and the INIIT03 Local Transfer module (Fig. 1-2). This interface acts as a bridge between two local Cnet networks. One of the INNIS01 modules operates on the central network side and the other operates on the satellite

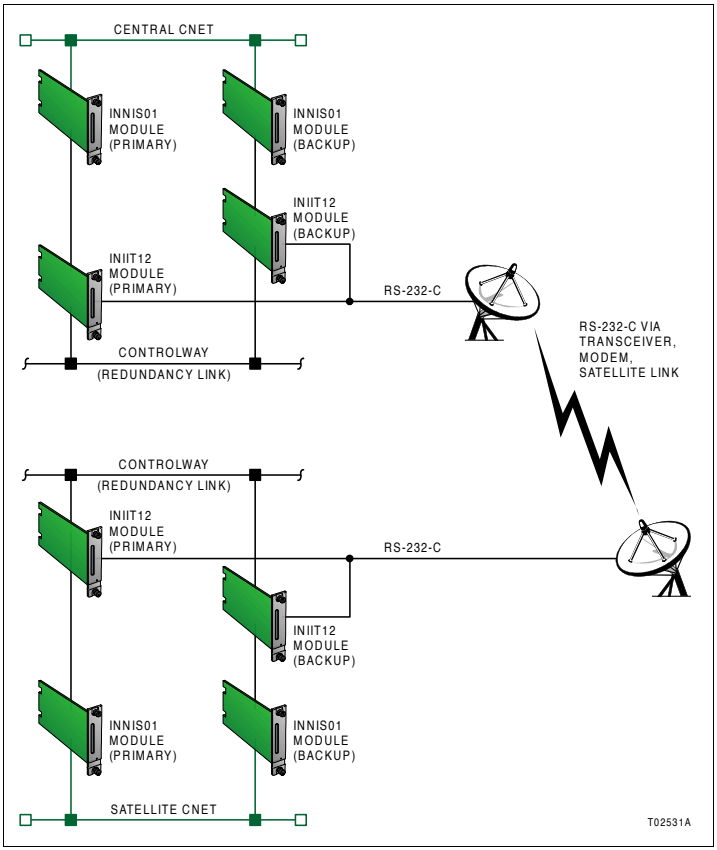

Figure 1-3. Redundant Cnet-to-Cnet Remote Interfaces

network side. Bidirectional communication from the central network to the local, satellite network is through cable connection to the NTCL01 termination unit. The maximum distance between termination units on the two communication networks is 45.8 meters (150 feet).

The local interface supports hardware redundancy (Fig. 1-4). Redundancy requires a full set of duplicate modules (four INNIS01 modules and two INIIT03 modules). The backup

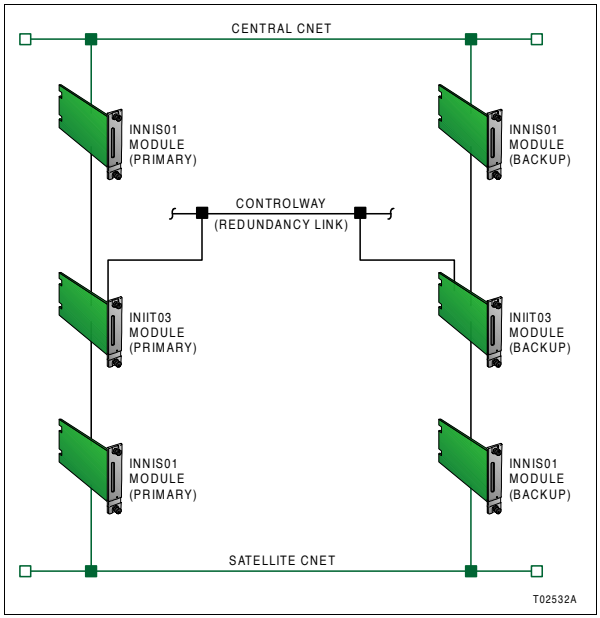

Figure 1-4. Redundant Cnet-to-Cnet Local Interfaces

INIIT03 module continuously monitors the primary over dedicated Controlway. A failover occurs when the backup detects a primary module failure. When this happens, the backup assumes responsibility and the primary is taken offline.

This local interface transfers system data, control and configuration messages, and exception reports between the central Cnet network and a local, satellite Cnet network.

Communication Modules

Table 1-1 lists the Harmony rack communication modules that combine to create the Cnet-to-Cnet interfaces.

INNIS01 Network Interface

The INNIS01 Network Interface module is the front end of every Cnet communication interface. It is the intelligent link between

Table 1-1. Harmony Rack Communication Modules

Module	Description	Cnet-to-Cnet Remote	Cnet-to-Cnet Local
INIIT03	Cnet-to-Cnet Local Transfer		•
INIIT12	Cnet-to-Cnet Remote Transfer	•	
INNIS01	Network Interface	•	•

a node and the Cnet network. In this case, it works in conjunction with the INIIT03 module (local) or INIIT12 module (remote). The INNIS01 module allows any node to communicate with any other node within the Symphony system.

The INNIS01 module is a single printed circuit board that occupies one slot in a module mounting unit (MMU). The circuit board contains microprocessor based communication circuitry that enables it to interface with the transfer modules over dedicated I/O expander bus. The INIIR01 Remote Interface requires one INNIS01 module; the INIIL02 Local Interface requires two INNIS01 modules.

Two latching screws on the faceplate secure the INNIS01 module to the module mounting unit. There are 16 LEDs on the faceplate that display error codes and event/error counts.

The INNIS01 module has three card edge connectors for external signals and power (P1, P2, and P3). Connector P1 connects to common and +5, +15, and -15 VDC power. Connector P2 connects the INNIS01 module to the I/O expander bus to communicate with the INIIT03 module or INIIT12 module.

The INNIS01 module connects to its Cnet communication network through a cable attached between its P3 connector and an NTCL01 termination unit. Communication between nodes is through coaxial or twinaxial cables that connect the termination units of each node.

INIIT12 Remote Transfer

The INIIT12 Remote Transfer module supports bidirectional communication through two RS-232-C ports. Port one passes system data only. Port two passes system data or can be used as a diagnostic port. The central network INIIT12 module can use a variety of means to link to the satellite network INIIT12 module such as modems, microwave, and transceivers. The

INIIT12 module directly communicates with an INNIS01 module over dedicated I/O expander bus.

Many of the operating characteristics of the INIIT12 module are determined by specifications in the INIIT12 executive block (function code 202). These specifications are configurable.

The INIIT12 module is a single printed circuit board that occupies a single slot adjacent to the INNIS01 module in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to serially communicate with another INIIT12 module, to directly communicate with its INNIS01 module, and to interface to Controlway (for redundancy).

Two latching screws on the faceplate secure the INIIT12 module to the module mounting unit. The faceplate contains eight CPU LEDs, a red/green status LED, and a stop/reset pushbutton.

The INIIT12 module has three card edge connectors for external signals and power (P1, P2, and P3). Connector P1 connects to common, +5 VDC power, and Controlway. Connector P2 connects the INIIT12 module to the I/O expander bus to communicate with the INNIS01 module. Connector P3 is used to cable connect the module to an NTMP01 termination unit. Two RS-232-C ports are located on the termination unit.

INIIT03 Local Transfer

The INIIT03 Local Transfer module serves as the bridge between two local Cnet communication networks. It holds the node database and is responsible for transferring all messages between networks. This module directly communicates with the INNIS01 module of the central network and of the satellite network simultaneously.

The INIIT03 module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to directly communicate with its two INNIS01 modules and to interface to Controlway (for redundancy).

Two latching screws on the faceplate secure the INIIT03 module to the module mounting unit. The faceplate contains 16

CPU LEDs, a red/green status LED, and a stop/reset pushbutton.

The INIIT03 module has three card edge connectors for external signals and power (P1, P2, and P3). Connector P1 connects to common, +5 VDC power, and Controlway. Connector P2 connects the INIIT03 module to the I/O expander bus to communicate with the INNIS01 module. Connector P3 is not used.

Features

- Cnet provides a plantwide communication network. Cnet time-synchronizes the control process plantwide.
- Each node can operate independently of other nodes. Cnet communication modules provide localized startup/shutdown on power failure without operator intervention.
- Fast response time. The ten-megabaud communication rate gives timely information exchange.
- Cnet communication modules handle four message types: broadcast, time-synchronization, multicast and NIS poll. All messages contain cyclic redundancy check codes (CRC) and checksums to insure data integrity.

Instruction Content

This instruction provides introductory, installation, operation, troubleshooting, and maintenance information. Read and understand this document before placing the communication system into service.

Introduction — Provides an overview of the interfaces and modules, description of hardware, glossary of unique terms, reference documentation, and physical and electrical specifications.

Description and Operation — Explains how key parts of the system operate.

Installation — Covers handling, inspection, location and safety considerations, and explains how to set up module dipswitches and install the interfaces before placing them into operation.

Operating Procedures — Explains how to start up and use the interfaces and individual controls.

Troubleshooting — Contains error indications, corrective actions, problem determination, and verification information.

Maintenance — Provides guidelines to assist in establishing a preventive maintenance program.

Repair and Replacement — Provides procedures for module repair and replacement.

Replacement and Spare Parts — Provides a list of part numbers and nomenclatures.

Appendices — Contain information on termination unit configuration and how to set up redundant INIIR01 interfaces.

How to Use this Instruction

Read this instruction in sequence. It is important to become familiar with the entire contents of this instruction before using the modules. This instruction is organized to enable quick information retrieval.

1. Perform the steps in the installation section.

2. Read the operating procedures section thoroughly before powering up the system.

3. Refer to the troubleshooting section if a problem occurs.

4. Refer to the maintenance section for scheduled maintenance requirements.

5. Read the repair and replacement section if module replacement is needed.

6. Refer to the replacement and spare parts section for a list of part numbers and nomenclatures.

Glossary of Terms and Abbreviations

Table 1-2 contains those terms and abbreviations that are unique to Elsag Bailey Process Automation or have a definition that is different from standard industry usage.

Table 1-2. Glossary of Terms and Abbreviations

Term	Definition
Cnet	Symphony system advanced data communication highway.
Controlway	High speed, redundant, peer-to-peer communication link. Used to transfer information between intelligent modules within a Harmony control unit.
Exception report	Information update generated when the status or value of a point changes by more than a specified significant amount or after a specified period of time.
Harmony control unit	A node on the plant wide control network (Cnet) containing Harmony controllers and I/O devices.
I/O expander bus	Parallel communication bus between the Harmony rack controllers and rack I/O modules.
INFI-NET	INFI 90 OPEN system advanced data communication highway.
MMU	Module mounting unit. A card cage that provides electrical and communication support for Harmony rack modules.
Termination unit	Provides input/output connection between plant equipment and the Harmony rack modules.

Document Conventions

The ? in a nomenclature or a part number indicates a variable for that position (e.g., IMMFP1?).

Reference Documents

Table 1-3 lists the documents that provide additional information for related hardware and software. Refer to them as needed.

Table 1-3. Reference Documents

Document Number	Title
WBPEEUI210504?0	Function Code Application Manual, Symphony
WBPEEUI240762?0	Digital Slave Output Module (IMDSO14)
WBPEEUI240763?0	Digital Slave Output Module (IMDSO15)
WBPEEUI260039?0	Multifunction Processor Termination Unit (NTMP01)
WBPEEUI260040?0	Communication Termination Unit (NTCL01)
WBPEEUI270002?0	Primary Interface, Composer
WBPEEUI270003?0	Automation Architect, Composer

Related Nomenclatures

Table 1-4 lists nomenclatures related to the Cnet-to-Cnet interfaces.

Table 1-4. Related Nomenclatures

Nomenclature	Description
IEMMU11, EMMU12, IEMMU21, IEMMU22	Module mounting unit
NFTP01	Field termination panel

Specifications

Refer to Table 1-5 for the specifications of the modules that create the Cnet-to-Cnet interfaces.

Table 1-5. Specifications

Property	Characteristic/Value
INIIT03	
Memory	2 Mbytes RAM 512 kbytes ROM
Power requirements	+5 VDC at 2 A; 10 W typical
INIIT12	
Memory	256 kbytes ROM 512 kbytes RAM 256 kbytes NVRAM
Power requirements	+5 VDC at 2 A; 10 W typical
Ports	2 full duplex serial EIA standard RS-232-C
Communication rates	75 to 19,200 baud (user-selectable)
INNIS01	
Memory	208 kbytes RAM 64 kbytes ROM
Power requirements	+5 VDC at 900 mA; 4.5 W typical +15 VDC at 5 mA; 0.08 W typical -15 VDC at 200 mA; 3 W typical
System capability	62,500 nodes in the system; 250 nodes on a loop. Any combination of Cnet-to-Cnet, Cnet-to-HCU, and Cnet-to-computer interfaces.
Communication rates	10 Mbaud or 2 Mbaud

Table 1-5. Specifications *(continued)*

Property	Characteristic/Value
All Cnet Communication Modules	
Mounting	Occupies one slot in standard module mounting unit.
Electromagnetic/radio frequency interference	Values not available at this time. Keep cabinet doors closed. Do not use communication equipment any closer than 2 meters from the cabinet.
Ambient temperature	0° to 70°C (32° to 158°F)
Relative humidity	5% to 90% up to 55°C (131°F) noncondensing 5% to 40% above 55°C (131°F) noncondensing
Atmospheric pressure	Sea level to 3 km (1.86 mi.)
Air quality	Noncorrosive
Certification	
Canadian Standards Association (CSA)	Certified for use as process control equipment in an ordinary (nonhazardous) environment.
Factory Mutual (FM) (pending for INIIT12 and INICT03)	Approved for use in Class I, Division 2, hazardous locations

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Description and Operation

Section 2

Introduction

This section explains the functionality of the Cnet-to-Cnet interfaces: INIIR01 Remote Interface and INIIL02 Local Interface.

Module Integrity

All communication modules have normal Symphony system security functions that insure module integrity. The module hardware checks for illegal addresses and monitors the machine fault timer (MFT) and the I/O expander bus clock. If a module detects an illegal address, it generates a bus error and displays an error code on the faceplate LEDs.

If the microprocessor fails to reset the MFT timer, it expires. When this happens, the communication module stops and the status LED turns red.

Module hardware also monitors the I/O expander bus clock. If there is no clock signal, the module hardware generates an interrupt causing the module to stop.

INNIS01 Network Interface

The INNIS01 module is the communication front end for the Cnet-to-Cnet interfaces. This section provides an overview of its operating theory. The module interfaces both the INIIT12 and INIIT03 modules to a Cnet network. The module operates with each type of transfer module in the same manner.

Messages

The INNIS01 module processes four different message types. They are broadcast, time-synchronization, multicast, and NIS poll.

Broadcast

A node generates a broadcast message when sending information to all system nodes. Typically, these messages announce changes in node status. Broadcast messages include:

- Node online.
- Node offline.
- Node restart
- Node busy.

Time-Synchronization

The time-synchronization message is a high priority broadcast type of message. The INNIS01 module services this message type immediately. Time-synchronization provides a common system time base to be used for sequencing exception reports, accessing trend data, and display on a human system interface such as a workstation running Conductor NT or Conductor VMS software.

Multicast

A message that contains data for multiple destinations is a multicast message. This message can have from one to 64 destinations.

NIS Poll

The NIS poll message is a single destination message. The INNIS01 module uses this message type to request the operational status of another node.

Message Format

Messages exist as frames of information. Each frame consists of a message control field that follows an information field. The information field contains the message data. It can consist of multiple messages and vary in size to a maximum of 1,500 bytes. The control field contains time of origination, source node message sequence number, source node number, size, circulation count, message type, destinations, and checksum.

The INNIS01 module increments the circulation count field of all incoming messages. When a message count field exceeds 255, the message is discarded. This is useful in keeping retry and spurious message traffic to a minimum. The INNIS01

module uses the message type to determine how to process the message. The checksum and cyclic redundancy check code fields verify data integrity.

Message Transmission

Any INNIS01 module can transmit a message at any time regardless of the activities of any other INNIS01 module on the Cnet network. Each INNIS01 module can transmit and receive messages simultaneously. Startup and shutdown is local and requires no interaction with other INNIS01 modules on the network. Each module receives all incoming messages and transmits a new stream of messages in a store and forward fashion to the next node. When there are no messages for the INNIS01 module to transmit, the module transmits flag characters (null packets) as the network synchronizing condition to keep the receivers in lock.

Data Integrity

There are three methods by which the INNIS01 module insures data integrity. They are retry logic, node status table, and polling.

Retry Logic

If, on the first message transmission, the INNIS01 module does not receive positive acknowledge (ACK) or busy negative acknowledge (NAK) from the destination node, it retransmits the message 11 times. If after this series of retries there is still no response, the destination node is marked offline and the INNIS01 module informs its transfer module (INIIT03 or INIIT12) of the negative acknowledge.

Node Status Table

The INNIS01 module maintains an internal table of system-wide node status such as offline and busy nodes. The INNIS01 module relays node status changes to its transfer module. When the INNIS01 module periodically polls nodes, it updates this table accordingly.

Polling

The INNIS01 module uses the information in its status table for polling purposes. As it scans the status table, it picks out

destinations targeted for multicast messages that have been marked offline or busy. After polling the destination, the INNIS01 module updates its table and forwards pertinent information to its transfer module.

INIIT12 Remote Transfer (INIIR01 Interface)

The INIIT12 module passes exception reports, and control and configuration data between the central Cnet network and a remote, satellite Cnet network. Operation of the interface is transparent. The INIIT12 module takes responsibility of retrying failed messages and informing the original source of any failure. Other communication modules interact with the INIIT12 module within the node status protocol rules of Cnet. The interface generates online, offline, and busy status for nodes on other satellite networks, and tracks node status for every node on the local network.

Blown Fuse Detection

The INIIT12 module can detect a blown fuse on the NTCL01 termination unit. If the termination unit blows a fuse, or power is removed from the termination unit, the module status LED turns red and CPU LEDs three through six turn on.

NOTE: Blown fuse detection is only available on INNIS01 modules with firmware revision E.1 and later and INIIT12 modules with firmware revision B.1 and later.

Exception Reporting

The INIIT12 module maintains a database of all points that send or receive exception reports on the Cnet network. The database contains specifications for each point, which the INIIT12 module uses to sort and package requests from other points more efficiently. The module generates a report for all destinations every time it receives an exception report. The module does not monitor the data in the exception report. Each node is responsible for verifying any information it receives in an exception report. The INIIT12 module monitors nodes for their status (offline, online, or busy).

Control and Configuration Messages

Control and configuration messages do not require a database within the INIIT12 module. The interface simply passes these messages through to their destination (unless they are destined for the transfer module). The messages are placed in a circular buffer through which they pass to the remote, satellite network.

Status Reporting

The INIIT12 module will report its own status. Exception reporting for status occurs whenever there is a change in status or every 60 seconds if no change occurs.

Communication Protocol

The INIIT12 module communication protocol consists of two layers:

- Link control layer.
- Application layer.

The link control layer is a sequenced delivery system with positive acknowledgment and automatic repeat request for error recovery. The application layers in both the central and satellite network INIIT12 modules use the link control layer to transport control and configuration information and exception reports.

Framing

The INIIT12 module uses message framing to help it track data bytes that pass through the asynchronous communication link. The receiving INIIT12 module looks for a one-byte synchronization character at the start of every transmission. Once it recognizes the synchronization character, it looks at a byte count field in each message to determine the framing of successive messages.

Sequence Control

All messages have a sequence number. The transmitting and receiving communication modules use the sequence number to keep track of outstanding, lost, and bad messages.

Line Control

Line control limits the transmission time of each INIIT12 module when they are in the half duplex mode. There are two limits: the window of outstanding sequenced messages and the maximum transmission time set by executive block (function code 202) specifications S5 and S6. When the transmitting module reaches one of the limits (or has no more data to send), it flags the last message in the transmission. When the receiving module sees this flag it can then start a transmission sequence of its own. If the transfer modules are in the full duplex mode they do not use line control; they can transmit independently of each other.

When external communication equipment (i.e., transceiver) is used and the INIIT12 module is operating in half duplex mode, the INIIT12 module requires a digital I/O module to provide a switching signal to the communication equipment. A digital I/O module is also required for systems that have redundant external communication equipment (refer to Figure C-1).

Error Detection and Recovery

A 16-bit cyclic redundancy check (CRC) code assures the integrity of each transmission. The transfer module uses an automatic repeat request to recover from errors. The receiving INIIT12 module notifies the sending INIIT12 module of the last sequence number it receives. The sending module then knows which message packets to resend.

Startup Control

If either INIIT12 module is restarted, it sends a message to the other INIIT12 module so that it can take the steps needed to synchronize itself with the restarted transfer module.

Redundancy

Redundancy requires a full set of duplicate modules (two INNIS01 modules and two INIIT12 modules on each network). The backup transfer module continuously monitors the primary. A failover occurs when the backup INIIT12 module detects a primary module failure on Controlway. When this happens, the backup interface takes over and the primary interface is taken offline.

INIIR01 Serial Data Channels Operation

Command and data transfers between INIIR01 interfaces are via asynchronous RS-232-C channels. These channels operate in half or full duplex modes at 75 to 19,200 baud using eight-bit characters and various combinations of parity and stop bits.

Messages passed across the serial data channels are formatted in proprietary message formats optimized for transfer of Symphony data. A sliding window acknowledge protocol is used wherein each end of the INIIR01 interface can have several messages outstanding that are acknowledged in sequential order by the opposite side. Messages are automatically retried until they are received correctly and acknowledged by the opposite end.

INIIT03 Local Transfer (INIIL02 Interface)

The INIIT03 module passes exception reports, and control and configuration data between a central Cnet network and a local, satellite Cnet network that have termination points within 45.8 meters (150 feet) of each other. Operation of the interface is transparent.

Blown Fuse Detection

The INIIT03 module can detect a blown fuse on the NTCL01 termination unit. If the termination unit blows a fuse, or power is removed from the termination unit, the module status LED turns red and CPU LEDs three through six turn on.

> **NOTE:** Blown fuse detection is only available on INNIS01 modules with firmware revision E.1 and later.

Data Flow

When an INNIS01 module receives a message, it determines the destination of the message (in or out of its network). If the message has a destination on the other side of the INIIL02 interface or the interface node itself is a destination, then the INNIS01 module acknowledges the message and notifies the INIIT03 module over the I/O expander bus that there is an incoming message. The INIIT03 module transfers the message

from the INNIS01 module. If the received message contains exception reports, these are stored in its exception report database. The interface packages exceptions to a common destination for transmission to minimize traffic through the interface.

When the interface transmits a message it waits for acknowledgment from the destination node. If it does not receive an acknowledge (ACK) or busy negative acknowledge (NAK), the INNIS01 module initiates retries. Refer to ***INNIS01 Network Interface*** in this section for more information. Some messages, such as control and configuration messages, pass through the INIIT03 module unchanged. The original source of the message is responsible for retrying them.

The local interface notifies the message source node when there is a destination node offline. It is then the responsibility of the message source node to refrain from sending messages to offline nodes.

Redundancy

Redundancy requires a full set of duplicate modules (four INNIS01 modules and two INIIT03 modules). The backup transfer module continuously monitors the primary. A failover occurs when the backup INIIT03 detects a primary module failure on Controlway. When this happens, the backup assumes responsibility and the primary is taken offline. The new primary INIIT03 module brings its INNIS01 modules online.

Installation

Section 3

Introduction

This section explains the steps necessary before placing any Cnet-to-Cnet interface modules into operation. Read, understand, and complete the steps in the order they appear before operating the modules.

Special Handling

Observe these steps when handling electronic circuitry:

NOTE: Always use Elsag Bailey's field static kit (part number 1948385A1 - consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipative work surface) when working with the modules. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

1. ***Use Static Shielding Bag.*** Keep the modules in the static shielding bag until you are ready to install them in the system. Save the bag for future use.

2. ***Ground Bag Before Opening.*** Before opening a bag containing an assembly with semiconductors, touch it to the equipment housing or a ground to equalize charges.

3. ***Avoid Touching Circuitry.*** Handle assemblies by the edges; avoid touching the circuitry.

4. ***Avoid Partial Connection of Semiconductors.*** Verify that all devices connected to the modules are properly grounded before using them.

5. ***Ground Test Equipment***.

6. ***Use an Antistatic Field Service Vacuum.*** Remove dust from the module if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug on the power entry panel. The grounding plug on the power entry panel must be effectively

connected to the earth grounding electrode system through the AC safety ground.

8. ***Do Not Use Lead Pencils To Set Dipswitches.*** To avoid contamination of dipswitch contacts that can result in unnecessary circuit board malfunction, do not use a lead pencil to set a dipswitch.

Unpacking and Inspection

1. Examine the hardware immediately to verify that it has not been damaged in transit.

2. Notify the nearest Elsag Bailey 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.

INIIR01 Remote Interface

Install the modules, termination units, and cables that make up an INIIR01 Remote Interface. Two complete interfaces are required: one for the central network and another for the remote, satellite network. The required hardware includes:

- Two INIIT12 modules, one for each network.
- Two INNIS01 modules, one for each network.
- Two NTCL01 termination units, one for each INNIS01 module.
- One termination unit cable for each NTCL01 termination unit. The termination unit uses NKLS01 or NKLS11 termination cables.
- Two NTMP01 termination units, one for each INIIT12 module.

- One termination unit cable for each NTMP01 termination unit. The termination unit uses NKTU01 or NKTU11 termination cables.
- One external serial communication link is required such as a modem or transceiver.

For redundant INIIR01 interfaces, double the required modules, termination units, cables, and external serial communication link. Refer to Appendix C for more information on how to set up redundant remote interfaces.

To install an INIIR01 interface:

1. Set the jumpers on the NTCL01 and NTMP01 termination units.

2. Install the termination units and their cables.

3. Set the dipswitches and jumpers on the INNIS01 and INIIT12 modules.

4. Prepare the module mounting unit for the interface.

5. Install the INNIS01 and INIIT12 modules.

6. Install and connect the external communication equipment to the NTMP01 termination units.

Termination Unit Installation

Configure and install the required termination units and their cables before installing any of the interface modules.

NTCL01

The INNIS01 module terminates through an NTCL01 termination unit. The unit terminates the Cnet communication network at its twinaxial or coaxial terminals.

Appendix A contains a quick reference of termination unit jumper settings, board layout, and cable connections. Refer to the ***Communication Termination Unit (NTCL01)*** instruction for specific directions on configuring jumpers, mounting, termination cable installation, and twinaxial and coaxial cable lengths.

NTMP01

The INIIT12 module terminates through the NTMP01 termination unit. Jumpers select the RS-232-C signals required for the INIIT12 module to act as data communication equipment (DCE) or data terminal equipment (DTE). The termination unit provides DB-25 connectors to terminate the remote communication device.

Appendix B contains a quick reference of termination unit jumper settings. Appendix C explains several ways to terminate redundant INIIR01 interfaces and provides an example of redundant communication equipment setup. Refer to the ***Multi-Function Processor Termination Unit (NTMP01)*** instruction for specific directions on configuring jumpers, mounting, termination cable installation, and RS-232-C cable lengths.

INNIS01 Network Interface

The INIIR01 interface and INIIL02 interface require an INNIS01 Network Interface module. Both dipswitches and jumpers must be set before putting the module into operation. Figure 3-1 shows the dipswitch and jumper locations on the module.

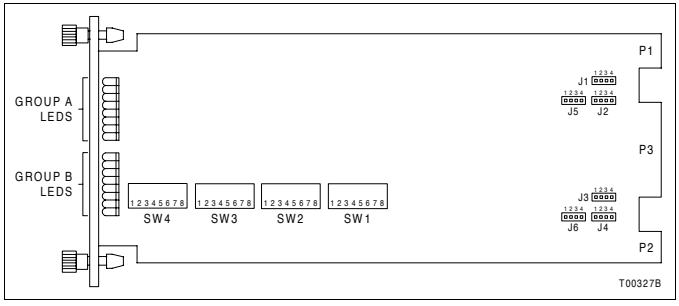

Figure 3-1. INNIS01 Board Layout

Dipswitch Settings

The INNIS01 module has four dipswitches that set the module operating characteristics. The dipswitches set the node address, loop address, loop mode, I/O expander bus address

(i.e., module address), and event and error counter options. Refer to Figure 3-1 for dipswitch locations.

NOTE: Dipswitch positions marked ***not used*** must be set to the indicated position, otherwise the INNIS01 module will not operate properly. Since factory settings may not reflect the default settings, it is imperative to check all dipswitch and jumper settings before putting the module into operation.

Dipswitch SW1 - Node Address. This dipswitch sets the node address. Valid node addresses are one through 250 (refer to Table 3-1). Pole one is the most significant bit with a binary weight of 128. Pole eight is the least significant bit with a binary weight of one. Record the dipswitch SW1 settings in the space provided in Table 3-1.

Table 3-1. Dipswitch SW1/SW2 (INNIS01)

Address Example[1]	Dipswitch Pole (Binary Value)							
	1 (128)	2 (64)	3 (32)	4 (16)	5 (8)	6 (4)	7 (2)	8 (1)
1	0	0	0	0	0	0	0	1
64	0	1	0	0	0	0	0	0
250	1	1	1	1	1	0	1	0
User setting (SW1)								
User setting (SW2)								

NOTE: 0 = closed or on, 1 = open or off.
1. The central network must have a loop address of one. Valid satellite network addresses are two through 250.

Dipswitch SW2 - Loop Address. This dipswitch assigns a loop address to the INNIS01 module in relation to the main Cnet network (refer to Table 3-1). The central network address must be one. Valid remote, satellite loop addresses are two through 250. Record the dipswitch SW2 setting in the space provided in Table 3-1.

INNIS01 Dipswitch SW3 - Loop Mode. Dipswitch SW3 enables or disables ROM checksums, identifies the operating mode as a Cnet-to-Cnet interface, and sets the communication speed to two megabaud or ten megabaud (refer to Table 3-2). Record the dipswitch SW3 settings in the space provided.

Table 3-2. Dipswitch SW3 (INNIS01)

Pole	Setting	Function	User Setting
1	1	Module is part of a Cnet-to-Cnet interface.	1
	0	Module is part of a Cnet-to-HCU interface (or Cnet-to-computer interface).	
2	1	ROM checksumming enabled; normal operating mode.	
	0	ROM checksumming disabled.	
3	1	Test mode: no time-out for handshake failure.	
	0	Normal operating mode.	
4[1]	1	All loop messages return a busy negative acknowledgment.	
	0	Normal operating mode.	
5[1]	1	Group A LEDs will toggle on and off if channel 1 is idle or shorted. Group B LEDs will toggle on and off if channel 2 is idle or shorted. Normal display otherwise.	
	0	LED display as defined by dispwitch SW4.	
6[1]	1	Diagnostic mode.	
	0	Normal operating mode.	
7/8	0/0	10-Mbaud network mode.	
	0/1	2-Mbaud network mode.	
	1/0	Not used.	
	1/1	Not used.	

NOTE: 0 = closed or on, 1 = open or off.
1. Applies to revision B and later ROMs. For revision A ROMs, poles 4 through 6 must be set to 0.

Pole 1 Dipswitch SW3 pole one enables transfer module (INIIT03 or INIIT12) compatibility. Set pole one to open (off) for a Cnet-to-Cnet interface.

Pole 2 Pole two enables or disables ROM checksumming. Elsag Bailey recommends that the INNIS01 module be installed with checksumming enabled to take full advantage of the on-board diagnostics.

Pole 3/4 Pole three enables internal testing which must be disabled for normal operation. Pole four, in conjunction with pole three, makes the node appear to be busy to other nodes. This condition is used by Elsag Bailey personnel only.

Pole 5 Pole five enables the channel idle condition display for the front panel LEDs. If channel one is idle, the group A LEDs will flash

on and off about twice per second. If channel two is idle, the group B LEDs will flash. The channel idle display is intended to serve as a warning that a loop integrity problem exists.

Pole 6 — Pole six enables diagnostic tests that preclude normal INNIS01 module operation.

Pole 7/8 — Poles seven and eight determine loop speed and loop mode.

NOTE: Testing modes involving poles three, four, and six interfere with normal operation.

Dipswitch SW4 - I/O Expander Bus Address and Counters. The INNIS01 module can have an I/O expander bus address from zero to seven. Poles one through three of dipswitch SW4 set the I/O expander bus address of the module. Refer to Table 3-3 for I/O expander bus address settings. Poles four through eight set the address of the on-board event and error counters that the INNIS01 module displays using the group A and B faceplate LEDs. LED B8 is the most significant bit. LED A1 is the least significant bit. Table 3-4 lists the possible event counter addresses. Table 3-5 lists the possible error counter addresses. Record the dipswitch SW4 settings in the space provided.

NOTE: The two INNIS01 modules in an INIIL02 interface must have different I/O expander bus addresses (set by dipswitch SW4, poles one through three).

Example of Counter Usage — A counter setting with the hexadecimal value of 0x09 keeps track of the number of multicast messages received excluding those originated. To display this counter on the front panel LEDs, set dipswitch SW4 as follows: position 4 = closed (off), 5 = open (on), 6 = closed (off), 7 = closed (off), and 8 = open (on).

Table 3-3. I/O Expander Bus Address (INNIS01)

Address Example	Dipswitch Pole (Binary Value)		
	1 (4)	2 (2)	3 (1)
0	0	0	0
3	0	1	1
7	1	1	1

NOTE: 0 = closed or on, 1 = open or off.

Table 3-4. Event Counters (INNIS01)

Dipswitch Pole (Binary Value)					Hex Value	Description
4 (16)	5 (8)	6 (4)	7 (2)	8 (1)		
0	0	0	0	0	00	Number of timer interrupts.
0	1	0	0	1	09	Number of multicast messages received (excluding originated messages).
0	1	0	1	0	0A	Number of multicast destinations received.
0	1	0	1	1	0B	Number of time-sync messages received (excluding originated messages).
0	1	1	0	0	0C	Number of broadcast messages received (excluding originated messages).
0	1	1	0	1	0D	Number of NIS poll messages received (excluding originated messages).
0	1	1	1	0	0E	Number of poll messages acknowledged by this node.
0	1	1	1	1	0F	Number of poll messages busy negative acknowledged by this node.
1	0	0	0	0	10	Number of messages transmitted (total loop traffic); ***normal operation***.
1	0	0	0	1	11	Number of loop messages received and forwarded by this node.
1	0	0	1	0	12	Number of messages originated by this node (including retries).
1	0	0	1	1	13	Number of message retries originated by this node.
1	0	1	0	0	14	Number of transmitted message watchdog expirations.
1	0	1	0	1	15	Number of messages put into the receive buffer and retained.
1	0	1	1	0	16	Number of bytes originated by this node (including retries).
1	0	1	1	1	17	Number of bytes received and forwarded by this node.
1	1	0	0	0	18	Number of I/O expander bus to INNIS01 handshakes.
1	1	0	0	1	19	Number of I/O expander bus to transmit buffer signals.
1	1	0	1	0	1A	Number of I/O expander bus HCU status requests.
1	1	0	1	1	1B	Number of I/O expander bus INNIS01 status requests.
1	1	1	0	0	1C	Number of I/O expander bus interrupts with invalid status.
1	1	1	0	1	1D	Number of transmit buffer realignments due to invalid contents.
1	1	1	1	0	1E	Number of receive buffer realignments.

Table 3-4. Event Counters (INNIS01) *(continued)*

Dipswitch Pole (Binary Value)					Hex Value	Description
4 (16)	5 (8)	6 (4)	7 (2)	8 (1)		
1	1	1	1	1	1F	Number of status buffer realignments.
						User setting

NOTES: 0 = closed or on, 1 = open or off.

Table 3-5. Error Counters (INNIS01)

Dipswitch Pole (Binary Value)					Hex Value	Description
4 (16)	5 (8)	6 (4)	7 (2)	8 (1)		
0	0	0	0	1	01	Number of receive errors on loop 1.
0	0	0	1	0	02	Number of receive errors on loop 2.
0	0	0	1	1	03	Number of transmit errors for this node.
0	0	1	0	0	04	Number of messages lost to receive queue overflow.
0	0	1	0	1	05	Number of messages dumped with circulation count errors.
0	0	1	1	0	06	Number of messages dumped with destination count or message-type errors.
0	0	1	1	1	07	Number of messages dumped with source-state errors.
0	1	0	0	0	08	Number of messages tempted with source-sequence mismatch.
						User setting

NOTE: 0 = closed or on, 1 = open or off.

Jumper Settings

There are six jumpers on the INNIS01 module that set the communication rate of the receiver analog circuit. Refer to Figure 3-1 for jumper locations. All six jumpers (J1 through J6) must be set in the same position. Jumper setting instructions are silk screened on the upper left corner of the INNIS01 circuit board. The jumper setting must match the communication rate set by poles seven and eight of dipswitch SW3. Figure 3-2 shows which pins to jumper for various network modes. This figure shows placement of the pins when looking at the top of the INNIS01 circuit board with the faceplate on the left.

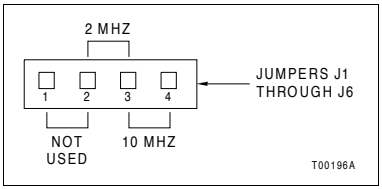

Figure 3-2. INNIS01 Jumpers

Power System Status

The communication system provides a means to monitor the status of the power system of each node. This status information can be displayed on a human system interface. Electronics within the power entry panel monitor the power system status. A single status output is made available to the communication system. To use this feature, wire the status output to the terminal block on the NTCL01 termination unit labeled PSS1 or PSS2. Two sets of terminals are available on the termination unit for interconnecting the power system status output.

This power system status signal is fed through the termination unit cable to the P3 connector on the INNIS01 module. The power system status input is a TTL-compatible signal. A high voltage level (5 VDC) on power system status indicates good status. A low voltage level (0 VDC) indicates bad status. When no connection is made to either of the power system status inputs, a pull-up resistor on the INNIS01 module causes a high level signal on the power system status input, thereby reporting good status.

INIIT12 Remote Transfer

The INIIR01 interface requires an INIIT12 Remote Transfer module. Both dipswitches and jumpers must be set before putting the module into operation. Figure 3-3 shows the dipswitch and jumper locations on the module.

Dipswitch Settings

There are two dipswitches on the INIIT12 module that set the module address and operating characteristics. The dipswitches set the module address, operating mode, and operating and

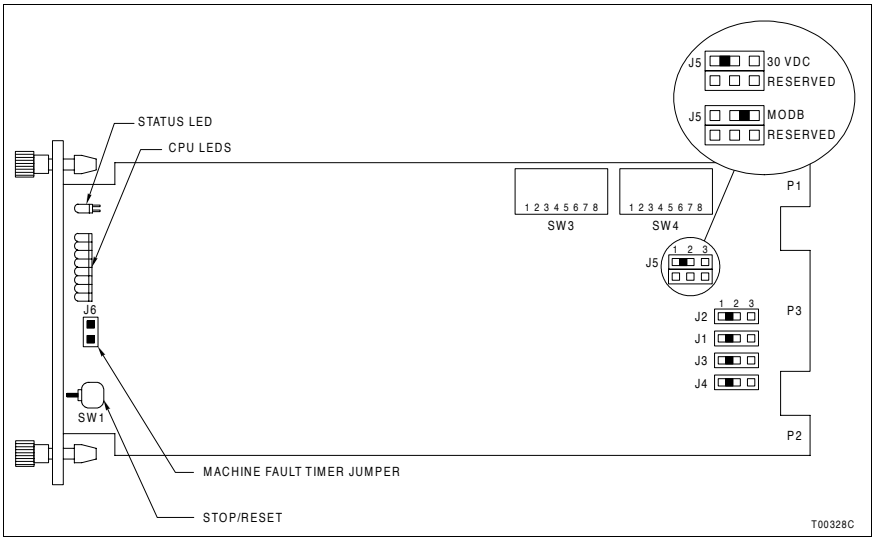

Figure 3-3. INIIT12 Board Layout

communication options. Refer to Figure 3-3 for dipswitch locations.

NOTE: This module uses connections to the MMU backplane that served other functions in earlier Network 90® systems. To avoid potential module damage, evaluate your system for compatibility prior to module installation.

Early Network 90 systems applied -30 VDC to pins three and four of the module connector P1. This voltage is not required for Symphony and INFI 90 OPEN modules. In Symphony and INFI 90 OPEN systems, pin four is used for the Controlway bus.

If your system contains modules that require -30 VDC, set jumper J5 to the 30 VDC position. Doing so allows the installation of the INIIT12 module in a module mounting unit that uses -30 VDC and limits communication to module bus.

Dipswitch SW3 - Module Address and Operating Mode. Dipswitch SW3 is an eight-position dipswitch that sets the module address (i.e.,

Controlway address) and operating mode (refer to Table 3-6). Record the settings in the space provided.

NOTE: Dipswitch positions marked ***not used*** must be set to the indicated position, otherwise the INIIT12 module will not operate properly. Since factory settings may not reflect the default settings, it is imperative to check all dipswitch and jumper settings before putting the module into operation.

Table 3-6. Dipswitch SW3 (INIIT12)

Pole	Setting	Function	User Setting
1	1	Diagnostic mode.	
	0	Diagnostics disabled; normal operation.	
2	0	Not used.	0
3[1]	1	Module bus (83.3 kbaud).	
	0	Controlway (1 Mbaud).	
4	0	Not used.	0
5	1	Dump NVRAM on crash.	
	0	Do not dump NVRAM on crash.	
6	1	Separate time bases on loops.	
	0	Both loops on same time base	
7	1	Redundancy configured.	
	0	No redundancy.	
8	1	Module address 1.	
	0	Module address 0.	

NOTE: 0 = closed or on, 1 = open or off.
1. The module bus setting is for support of existing INFI 90 OPEN and Network 90 systems.

The preferred setting for position three of dipswitch SW3 is Controlway because of its high speed communication and redundancy. In redundant configurations, dipswitch SW3 should be identical on the primary and backup INIIT12 modules, except pole eight.

Dipswitch SW4 - Operating Options. Dipswitch SW4 is an eight-position dipswitch that determines the module operating and communication options (refer to Table 3-7). Record the option settings in the space provided.

Table 3-7. Dipswitch SW4 (INIIT12)

Pole	Setting	Function	User Setting
1	1	ROM checksum disabled.	
	0	ROM checksum enabled; normal operation.	
2	1	RS-232-C DCE mode (modem connections).	
	0	RS-232-C DTE mode (direct connections).	
3	1	Equipment select output initially energized.	
	0	Equipment select output initially de-energized.	
4	1	Enable port 2 as diagnostic channel.[1]	
	0	Enable port 2 as data channel.[2]	
5/6	1/1	19,200 baud rate on diagnostic port.	
	1/0	9,600 baud rate on diagnostic port.	
	0/1	2,400 baud rate on diagnostic port.	
	0/0	1,200 baud rate on diagnostic port.	
7	1	Initialize NVRAM.	
	0	Do not initialize NVRAM.	
8	1	Enable alternate default baud rate.[3]	
	0	Disable alternate default baud rate.	

NOTES: 0 = closed or on, 1 = open or off.
1. If port 2 is connected to a remote INIIT12 port, disconnect it before enabling it as a diagnostic port. Failure of all serial link communication may result if this precaution is not observed. If the diagnostic is enabled, port 2 data characteristics are 8 data bits, 1 stop bit, and no parity. Port 1 baud rate is selected by poles 5 and 6.
2. If the diagnostic port is not enabled, then port 2 data characteristics and baud rate are taken from the configuration of the INIIT12 executive block.
3. If the alternate default baud rate is enabled, and the INIIT12 module NVRAM is initialized (pole 7 open (off)), then specifications S9 and S10 of the INIIT12 executive block are set to the baud rate selected by poles 5 and 6.

Jumper Settings

There are five jumpers on the INIIT12 circuit board. Refer to Figure 3-3 for jumper locations. Jumpers J1 through J4 direct signals to the termination unit. These jumpers are factory set with pin one and pin two connected together. ***Do not change these jumper settings.***

Jumper J5 disconnects -30 VDC, supplied in early Network 90 systems, from the INIIT12 module. This jumper is factory set with pin one and pin two connected. This setting allows the module to function in early Network 90 systems (-30 VDC supplied to modules) or limits communication to the module bus in INFI 90 OPEN systems. Connect pin two and pin three

together to use the module on Controlway (MODB position). Refer to Table 3-8 for more information.

CAUTION	**Always operate the INIIT12 module with the machine fault timer circuit enabled. Unpredictable module outputs may result if the machine fault timer circuit is disabled. These unpredictable module outputs may adversely affect the entire communication system.**

NOTE: Two through-holes labeled J6 are located at the front of the INIIT12 circuit board. These are for Elsag Bailey development personnel only. Connecting header pins and a jumper will disable the machine fault timer circuit. If this function is disabled and a problem develops in the INIIT12 module, the module will not halt which may result in configuration corruption and unpredictable module outputs.

Table 3-8. Jumpers J1 through J5 (INIIT12)

Jumper	Setting	Function	User Setting
J1	1-2	Factory setting. Do ***not*** change this setting.	1-2
J2			
J3			
J4			
J5[1]	1-2	Disconnects Controlway for operation in module mounting units that have -30 VDC (early Network 90).	
	2-3	Allows operation in module mounting units that have Controlway communication. This setting must be used if dip-switch SW3 selects the Controlway.	

NOTES:
1. Refer to ***INIIT12 Installation Options*** for an explanation of the installation options available when installing the module in a system that uses -30 VDC.

Module Mounting Unit Preparation

CAUTION	**To avoid potential module damage, evaluate your system for compatibility prior to module installation. This module uses connections to the module mounting unit backplane that served other functions in early Network 90 systems.**

The INIIR01 interface requires a dedicated module mounting unit. If the module mounting unit is part of an older system, it must be checked for -30 VDC. The next sections explain how to

check the module mounting unit for -30 VDC, INIIT12 module installation options available for systems that use -30 VDC, and how to isolate the MMU card cage for the INIIR01 interface. ***Do not*** attempt to install the INIIR01 interface modules until all the steps in the next sections have been completed.

-30 VDC Pre-Installation Check

To check the module mounting unit for -30 VDC:

1. Face the rear of the cabinet. Locate the -30 VDC faston. It is the second faston from the top on the back of the MMU backplane.

NOTE: If the module mounting unit does not use -30 VDC, the second faston from the top on the back of the MMU backplane supplies 5 VDC.

2. Check for -30 VDC with respect to system common at the -30 VDC faston.

3. If there is -30 VDC present then either set INIIT12 jumper J5 to the 30 V position or disconnect -30 VDC from the module mounting unit (refer to ***INIIT12 Installation Options***). Turn off power to the cabinet. Remove -30 VDC from the module mounting unit by removing the supply wiring from the -30 VDC faston.

4. For additional information and assistance, contact Elsag Bailey technical support.

INIIT12 Installation Options

There are two installation options available. The first option applies to systems that do not have -30 VDC power. The second option is for systems that have -30 VDC power.

1. Set J5 to MODB when installing the INIIT12 module in a module mounting unit that does not have -30 VDC on the module mounting unit. Pole three of dipswitch SW3 is set to closed (on) for Controlway.

or

2. Set J5 to 30 V when installing the INIIT12 module in a module mounting unit that has -30 VDC on the module mounting unit. Pole three of dipswitch SW3 is set to open (on) for module bus.

Isolating Controlway and I/O Expander Bus

The INIIT12 module must have a dedicated Controlway. In redundant applications, both the primary and backup INIIT12 module share this isolated Controlway. Additionally, each INIIT12 module in a redundant interface must have its own, isolated I/O expander bus. The INNIS01 modules communicate to their respective INIIT12 modules through the isolated I/O expander bus. To isolate a module mounting unit:

1. Select the module mounting unit that will be dedicated to the INIIR01 interface.

2. Disconnect the Controlway cable from the module mounting unit to be isolated for the interface. Figure 3-4 shows an example of how the Controlway is disconnected to isolate Controlway on the module mounting unit.

NOTE: The I/O expander bus for each set of one INNIS01 module and one INIIT12 module must be as short as possible. Elsag Bailey recommends that adjacent MMU slots be connected for each set of interface modules. Failure to keep the I/O expander bus short results in unreliable operation.

WARNING	**Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

3. There is no set procedure for isolating the I/O expander bus because system architectures differ so widely from system to system. The example in Figure 3-4 shows one way to isolate the I/O expander bus. Using the methods shown in Figure 3-4 (i.e., by removing a dipshunt or a ribbon cable), isolate an I/O expander bus for each interface.

Module Installation

The INIIR01 interface modules are ready to install if:

- Both INIIT12 modules have their dipswitches and jumpers set (four INIIT12 modules for redundant interfaces).
- Both INNIS01 modules have their dipswitches and jumpers set (four INNIS01 modules for redundant interfaces).
- Required number of NTCL01 termination units and cables are installed.

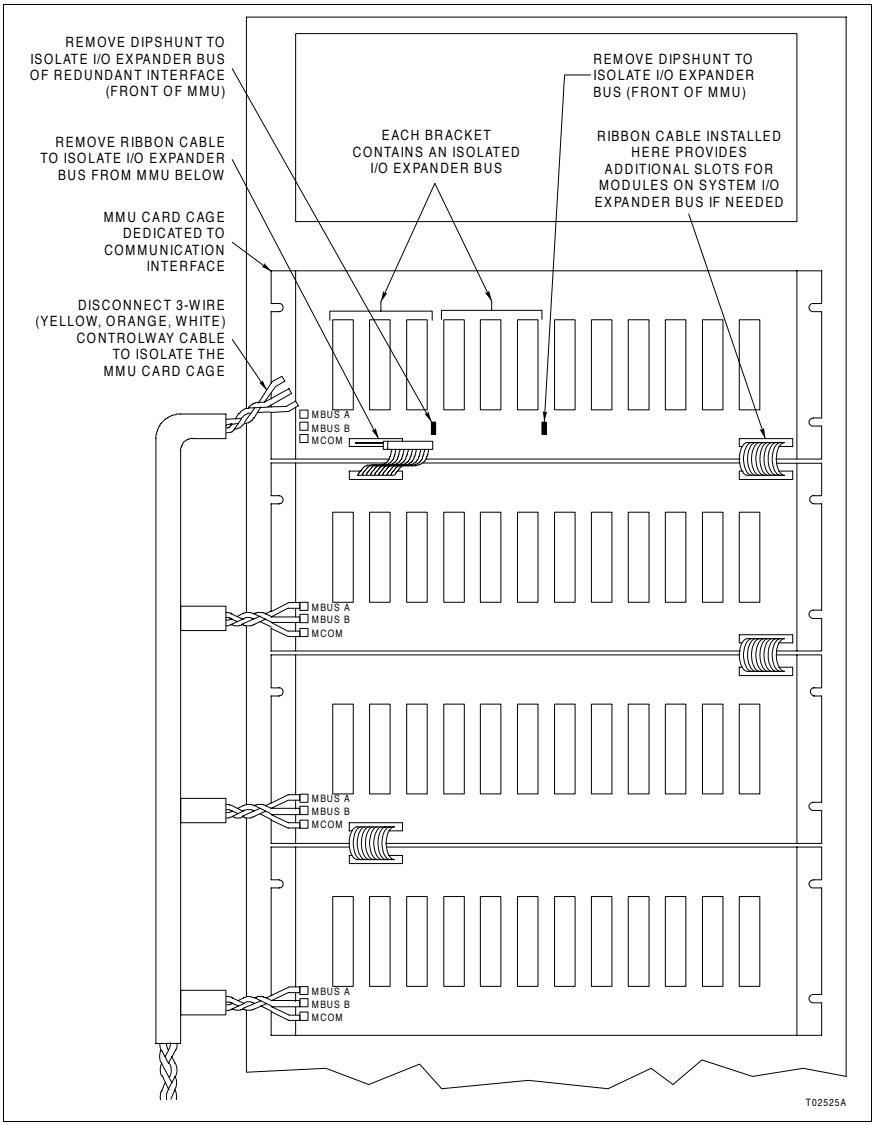

Figure 3-4. Isolated Module Mounting Unit Example

- Required number of NTMP01 termination units and cables are installed.
- Module mounting unit has been checked for -30 VDC and modified if necessary.
- Isolated module mounting unit has been prepared for the INIIR01 interface.

To install the INIIT12 and INNIS01 modules:

1. There must be two empty slots (side by side) available in one module mounting unit (on each network) to install one interface. Redundant interfaces require four slots or more depending on the application (refer to Figure 3-5). Additional slots will be needed if using redundant digital I/O modules to enable a transceiver. Prepare the module mounting units in which to mount the interface so that the required slots are available.

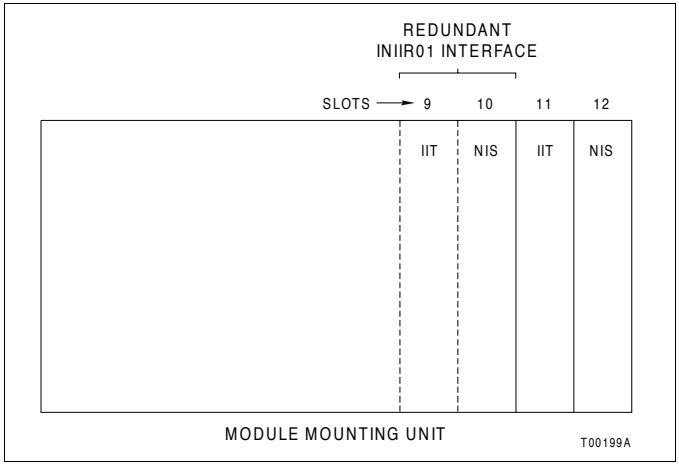

Figure 3-5. Typical INIIR01 Module Slot Assignment

2. Verify that there are 24-pin dipshunts installed in the I/O expander bus socket between the MMU slots to be used by the INNIS01 module and the MMU slot to be used by the INIIT12 module in each module mounting unit. If installing redundant interfaces, the modules that make up the primary INIIR01

interface must be on a separate I/O expander bus from the modules that make up the backup INIIR01 interface.

3. Verify that there are no other modules on the same I/O expander bus as the INIIR01 interface modules.

4. Mount each module in its assigned MMU slot one at a time.

5. Guide the top and bottom edges of each circuit card along the top and bottom rails of its MMU slot.

6. Slide the module into the slot; push the module until the front panel is flush with the top and bottom of the MMU frame and seated within the cable connector at the rear of the MMU card cage.

7. Turn the two captive latches ½-turn to lock the module in place.

INIIT12 Executive Block Initialization

To initialize the INIIT12 module executive block specifications to their default values:

1. Set dipswitch SW4 position seven to open (off).

2. Install the INIIT12 module in its MMU slot and wait for it to initialize. The module halts and CPU LEDs one, two, and four are on when the module is initialized.

3. Remove the module from the module mounting unit and set dipswitch SW4 position seven to closed (on).

4. Insert the module into its MMU slot.

5. The INIIT12 module will enter the configure mode with executive block specifications at their default values.

Optional Digital I/O Module

Install the optional digital I/O module when the interface is set up to run in half duplex mode or requires enable/disable signals for redundant external communication equipment. Redundant applications require two digital I/O modules.

Select one of the digital I/O modules whose output specifications match those of the communication equipment being used. Refer to the product instruction for that I/O module for

directions on installing the module. The available I/O modules and their output specifications are listed in Table 3-9. Refer to Appendix C for more information on redundant hardware configuration.

Table 3-9. Optional Digital I/O Modules

Nomenclature	Output
IMDSO14	24/48 VDC solid state relay
IMDSO15	Onboard electromechanical relay

INIIL02 Local Interface

Install the modules, termination units, and cables that make up an INIIL02 Local Interface. The required hardware includes:

- One INIIT03 module.
- Two INNIS01 modules, one for each network.
- Two NTCL01 termination units, one for each INNIS01 module.
- One termination unit cable for each NTCL01 termination unit. The termination unit uses NKLS01 or NKLS11 termination cables.

For redundant INIIL02 interfaces, double the required modules, and termination units, and cables.

To install an INIIL02 interface:

1. Set the jumpers on all termination units.
2. Install all the termination units and their cables.
3. Set the dipswitches and jumpers on the INNIS01 modules and INIIT03 module.
4. Prepare the module mounting unit for the interface.
5. Install the INNIS01 modules and INIIT03 module.

Termination Unit Installation

Configure and install the required NTCL01 termination units and their cables before installing any of the interface modules.

The INNIS01 module terminates through an NTCL01 termination unit. The unit terminates the Cnet communication network at its twinaxial or coaxial terminals.

Appendix A contains a quick reference of termination unit jumper settings, board layout, and cable connections. Refer to the ***Communication Termination Unit (NTCL01)*** instruction for specific directions on configuring jumpers, mounting, termination cable installation, and twinaxial and coaxial cable lengths.

INNIS01 Dipswitch and Jumper Settings

Configure the dipswitches and jumpers on the INNIS01 module before putting the module into operation. Refer to ***INNIS01 Network Interface*** in this section for information on the dipswitches and jumpers.

> **NOTE:** The INIIL02 interface uses two INNIS01 modules. The two INNIS01 modules must have different I/O expander bus addresses (set by dipswitch SW4 on the INNIS01 module).

INIIT03 Local Transfer

The INIIL02 interface requires an INIIT03 Local Transfer module. Dipswitches, jumpers, and a dispshunt must be set before putting the module into operation. Figure 3-6 shows the dipswitch, jumper, and dipshunt locations on the module.

> **NOTE:** Dipswitch positions marked ***not used*** must be set to the indicated position, otherwise the INIIT03 module will not operate properly. Since factory settings may not reflect the default settings, it is imperative to check all dipswitch and jumper settings before putting the module into operation.

Dipswitch Settings

The INIIT03 module has four dipswitches that set the module operating characteristics. The dipswitches set the module address and operating mode. Refer to Figure 3-6 for dipswitch locations.

Dipswitch SW4 UUB0 - Module Address and Operating Mode. Dipswitch SW4 UUBO sets the INIIT03 module address (i.e., Controlway address) and operating mode (refer to Table 3-10). Record the settings in the space provided.

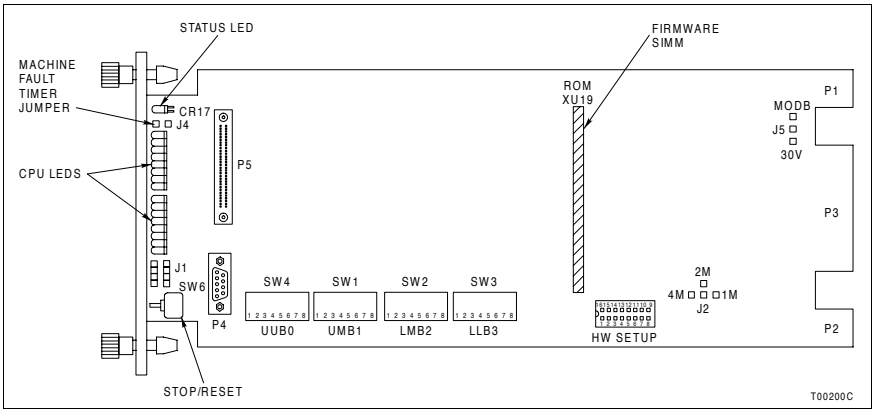

Figure 3-6. INIIT03 Board Layout

Table 3-10. Dipswitch SW4 UUB0 (INIIT03)

Pole	Setting	Function	User Setting
1	0	Not used.	0
2	0	Not used.	0
3[1]	1	Module bus (83.3 kbaud).	
	0	Controlway (1 Mbaud).	
4-8	00001	Module address 1.	
	00000	Module address 0.	

NOTE: 0 = closed or on, 1 = open or off.
1. The module bus setting is for support of existing INFI 90 OPEN and Network 90 systems.

Dipswitch poles one through three set normal operation and communication speed. Poles four through eight set the INIIT03 module address. The INIIT03 module must have an address of either zero or one.

The preferred setting for position three of dipswitch SW4 UUB0 is Controlway because of its high speed communication and redundancy. In redundant configurations, dipswitch SW4 UUB0 should be identical on the primary and backup INIIT03 modules, except pole eight.

Dipswitch SW1 UMB1 - Not Used. Dipswitch SW1 UMB1 is not used by the INIIT03 module and is reserved for future use. All poles of dipswitch SW1 UMB1 must be set to closed (on).

Dipswitch SW2 LMB2 - Operating Options. Dipswitch SW2 LMB2 is an eight-position dipswitch that determines additional operating options of the module (refer to Table 3-11). Record the settings in the space provided.

Table 3-11. Dipswitch SW2 LMB2 (INIIT03)

Pole	Setting	Function	User Setting
1	1	ROM checksum disabled.	
	0	ROM checksum enabled; normal operation.	
2/3	11	8 data bits, 2 stop bits, no parity on diagnostic port (P4).	
	10	8 data bits, 1 stop bit, odd parity on diagnostic port (P4).	
	01	8 data bits, 1 stop bit, even parity on diagnostic port (P4).	
	00	8 data bits, 1 stop bit, no parity on diagnostic port (P4).	
4/5	11	0.25 seconds exception reporting rate (time between scans).	
	10	0.50 seconds exception reporting rate.	
	01	1.00 second exception reporting rate.	
	00	2.00 seconds exception reporting rate.	
6	1	Failover to backup module on power system status alarm.	
	0	No failover to backup module on power system status alarm.	
7	0	Not used.	0
8	1	Redundancy configured.	
	0	No redundancy.	

NOTE: 0 = closed or on, 1 = open or off.

Dipswitch SW3 LLB3 - Diagnostics. Dipswitch SW3 LLB3 selects certain operating options and enables diagnostics that are meaningful to qualified Elsag Bailey service personnel (refer to Table 3-12). Record the settings in the space provided.

Table 3-12. Dipswitch SW3 LLB3 (INIIT03)

Pole	Setting	Function	User Setting
1	1	INNIS01 handshake time-out disabled.	
	0	INNIS01 handshake time-out enabled.	
2	0	Not used.	0

Table 3-12. Dipswitch SW3 LLB3 (INIIT03) *(continued)*

Pole	Setting	Function	User Setting
3	1	Cnet/INFI-NET diagnostics enabled.	
	0	Cnet/INFI-NET diagnostics disabled; normal operation.	
4	1	Time-synchronization isolation.	
	0	Common time-synchronization between networks.	
5	0	Not used.	0
6	1	Cache burst fill enabled.	
	0	Cache burst fill disabled; normal operation.	
7	1	Data cache enabled.	
	0	Data cache disabled.	
8	1	Instruction cache enabled.	
	0	Instruction cache disabled.	

NOTE: 0 = closed or on, 1 = open or off.

Jumper Settings

CAUTION

Always operate the INIIT03 module with the machine fault timer circuit enabled. Unpredictable module outputs may result if the machine fault timer circuit is disabled. These unpredictable module outputs may adversely affect the entire communication system.

Jumpers J1, J4, and J5 define module functions and operation. Jumper J1 determines if the RS-232-C diagnostic port (P4) operates as data communication equipment (DCE) or data terminal equipment (DTE). Jumper J4 enables the machine fault timer (MFT). Jumper J5 disengages -30 VDC from the module when installing it in an MMU card cage that uses -30 VDC. Jumper J5 disconnects -30 VDC, supplied in early Network 90 systems, from the INIIT03 module. Jumper J2 is set at the factory and should not be changed. Refer to Table 3-13 for those jumpers that have default settings.

Dipshunt

The HW SETUP dipshunt is factory installed. There should be a jumper installed in the second dipshunt position (i.e., pin two is shorted to pin 15). Verify that the jumper is installed in the correct position. The INIIT03 module will not operate properly

Table 3-13. Jumpers for J1, J2, J4, and J5 (INIIT03)

Jumper	Setting	Function	User Setting
J1[1]	Vertical	Sets the RS-232-C diagnostic port (P4) to operate as DCE.	
	Horizontal	Sets the RS-232-C diagnostic port (P4) to operate as DTE.	
J2	4-3	Factory setting. Do ***not*** change this setting.	4-3
J4	Open	MFT disable jumper. This jumper must remain open for normal operation.	Open
J5[2]	30 V	Disconnects Controlway for operation in module mounting units that have -30 VDC (early Network 90).	
	MODB	Allows operation in module mounting units that have Controlway communication. This setting must be used if dipswitch SW4 UUB0 selects the Controlway.	

NOTES:
1. This feature is used by Elsag Bailey service personnel. The J1 setting does not affect the module during normal operation.
2. Refer to ***INIIT03 Installation Options*** for an explanation of the installation options available when installing the module in a system that uses -30 VDC.

if this dipshunt position is open. All other dipshunt positions should be open.

Module Mounting Unit Preparation

CAUTION	**To avoid potential module damage, evaluate your system for compatibility prior to module installation. This module uses connections to the module mounting unit backplane that served other functions in early Network 90 systems.**

The INIIL02 interface requires a dedicated module mounting unit. If the module mounting unit is part of an older system, it must be checked for -30 VDC. The next sections explain how to check the module mounting unit for -30 VDC, INIIT03 module installation options available for systems that use -30 VDC, and how to isolate the MMU card cage for the INIIL02 interface. ***Do not*** attempt to install the INIIL02 interface modules until all the steps in the next sections have been completed.

-30 VDC Pre-Installation Check

1. Face the rear of the cabinet. Locate the -30 VDC faston. It is the second faston from the top on the back of the MMU backplane.

2. Check for -30 VDC with respect to system common at the -30 VDC faston.

NOTE: If the module mounting unit does not use -30 VDC, the second faston from the top on the back of the MMU backplane supplies 5 VDC.

3. If there is -30 VDC present then either set INIIT03 jumper J5 to the 30 V position or disconnect -30 VDC from the module mounting unit (refer to ***INIIT03 Installation Options***). Remove -30 VDC from the module mounting unit by removing the supply wiring from the -30 VDC faston.

4. For additional information and assistance, contact Elsag Bailey technical support.

INIIT03 Installation Options

There are two installation options available. The first option applies to systems that do not have -30 VDC power. The second option is for systems that have -30 VDC power.

1. Set J5 to MODB when installing the INIIT03 module in a module mounting unit that does not have -30 VDC on the module mounting unit. Position three of dipswitch SW4 UUB0 is set to closed (on) for Controlway.

or

2. Set J5 to 30 V when installing the INIIT03 module in a module mounting unit that has -30 VDC on the module mounting unit. Pole three of dipswitch SW4 UUB0 is set to open (off) for module bus.

Isolating Controlway and I/O Expander Bus

The INIIT03 module must have a dedicated Controlway. In redundant applications, both the primary and backup INIIT03 modules share this isolated Controlway. Additionally, each INIIT03 module in a redundant interface must have its own, isolated I/O expander bus. The INNIS01 modules communicate to their respective INIIT03 modules through the isolated I/O expander buses. To isolate a module mounting unit:

1. Select the module mounting unit that will be dedicated to the INIIL02 interface.

2. Disconnect the Controlway cable from the module mounting unit to be isolated for the interface. Figure 3-4 shows an

example of how the Controlway is disconnected to isolate Controlway on that module mounting unit.

NOTE: The I/O expander bus for each set of two INNIS01 modules and one INIIT03 module must be as short as possible. Elsag Bailey recommends that three adjacent MMU slots be connected for each set of interface modules. Failure to keep the I/O expander bus short results in unreliable operation.

WARNING	**Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

3. There is no set procedure for isolating the I/O expander bus because system architectures differ so widely from system to system. The example in Figure 3-4 shows one way to isolate the I/O expander bus. Using the methods shown in Figure 3-4 (i.e., by removing a dipshunt or a ribbon cable), isolate an I/O expander bus for each interface.

Module Installation

The INIIL02 interface modules are ready to install if:

- INIIT03 module has its dipswitches and jumpers set (two INIIT03 modules for redundant interfaces).
- Both INNIS01 modules have their dipswitches and jumpers set (four INNIS01 modules for redundant interfaces).
- Required number of NTCL01 termination units and their cables are installed.
- Module mounting unit has been checked for -30 VDC and modified if necessary.
- Isolated module mounting unit has been prepared for the INIIL02 interface.

To install the INIIT03 and INNIS01 modules:

1. There must be three empty slots (side by side) available in one module mounting unit to install one interface. Redundant interfaces require six slots (refer to Figure 3-7).

2. Verify that there are 24-pin dipshunts installed in the I/O expander bus sockets between the MMU slots to be used by

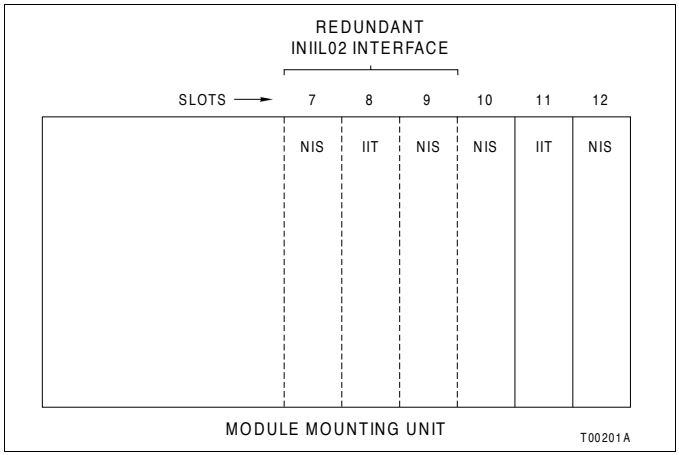

Figure 3-7. Typical INIIL02 Module Slot Assignment

both INNIS01 modules and the MMU slot to be used by the INIIT03 module. If installing redundant interfaces, the modules that make up the primary INIIL02 interface must be on a separate I/O expander bus from the modules that make up the backup INIIL02 interface.

3. Verify that there are no other modules on the same I/O expander bus as the INIIL02 interface modules.

4. Mount each module in its assigned MMU slot one at a time.

5. Guide the top and bottom edges of the circuit card along the top and bottom rails of its assigned MMU card cage slot.

6. Slide the module into the slot; push the module until the front panel is flush with the MMU frame and seated within the cable connector at the rear of the MMU card cage.

7. Turn the two captive latches ½-turn to lock the module in place.

The modules can be installed under power. Install the INIIT03 module last, otherwise the status LED turns red. When installing a module under power, the status LED will turn red momentarily and then turn green. If it does not, refer to Section 5.

Operating Procedures

Section 4

Introduction

After completing the steps detailed in the installation section, the Cnet-to-Cnet interface modules are ready to be put into operation. This section explains information for daily operation of these interfaces.

INNIS01 Network Interface

Figure 4-1 shows the INNIS01 module faceplate.

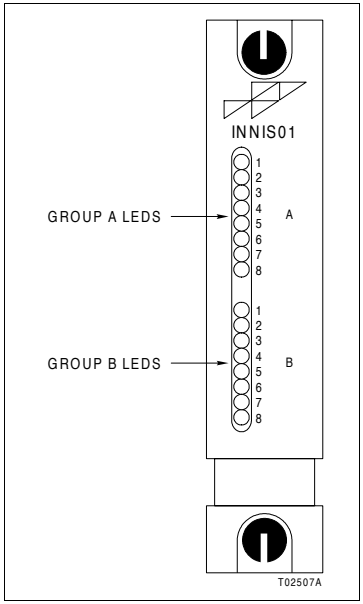

Figure 4-1. INNIS01 Faceplate

On power up, the INNIS01 module microprocessor stays in reset until its associated transfer module (INIIT03 or INIIT12)

removes the reset and allows the firmware to execute self-diagnostic routines. The transfer module determines when the INNIS01 module will go online. The INNIS01 module comes online in the network mode set by poles seven and eight of dipswitch SW3, with the type of counter display set by poles four through eight of dipswitch SW4.

Use the counter display (faceplate LEDs) to check the INNIS01 module operation. If communication errors occur, the host module sets the INNIS01 module communication status bits in the module status report. View the module status by using a human system interface (HSI).

Event Counters

Internal counters maintain a count of events such as the number of messages transmitted, retries, and number of messages lost. Table 3-4 has a complete list of event counters. The group A and B LEDs on the module faceplate display a binary value of the event counters (LED B8 is the most significant bit, LED A1 is the least significant bit). Figure 4-1 shows the location of the group A and group B LEDs.

Error Counters

Errors such as receive errors, messages with circulation count errors, etc., are maintained in internal counters just like the event counters. Refer to Table 3-5 for a listing of error counter address settings. Table 5-1 lists the error codes that appear on the INNIS01 module faceplate LEDs.

INIIT12 Remote Transfer

The faceplate of the INIIT12 module has the following features (Fig. 4-2):

- Status LED.
- Eight CPU LEDs.
- Stop/reset pushbutton.

Status LED

The red/green status LED displays the operating status of the INIIT12 module. It has four possible states. Table 4-1 lists the

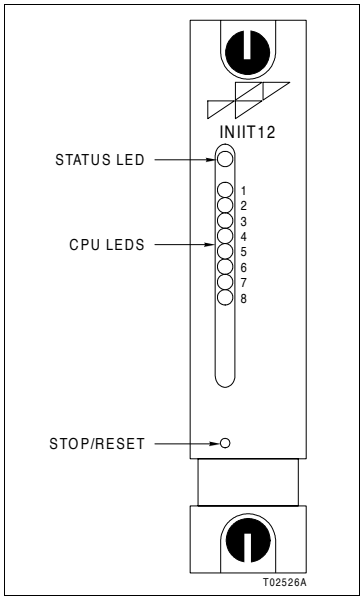

Figure 4-2. INIIT12 Faceplate

Table 4-1. Status LED States (INIIT12)

LED State	Meaning
Off	No power to the module or the machine fault timer is disabled (jumper installed) and the module is running.
Solid green	Module is in execute mode.
Flashing green	Module is in configure mode.
Solid red	Module diagnostics detect a hardware failure or configuration problem. CPU LEDs display an error code when the status LED is red.

meaning of the status LED states. Refer to Section 5 for corrective actions if the status LED indicates that an operating error exists.

CPU LEDs

If a communication or module error occurs, the CPU LEDs display an error code and the red/green status LED turns red. Refer to Table 5-2 for a list of LED error codes and corrective actions. Table 4-2 shows the CPU LED states during normal operation.

Table 4-2. CPU LED States (INIIT12)

LED State	Meaning
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 1 (flashing)	Module is online (no serial communication).
1 1 0 0 0 0 0 0	Primary transfer module; normal operation.
1 0 0 0 0 0 0 0	Backup transfer module; normal operation.

Stop/Reset

Push the stop pushbutton once and wait for the red/green status LED to turn red before removing the INIIT12 module from the module mounting unit. Using the stop pushbutton allows any NVRAM write in progress to complete before the module halts operation.

After module operation stops, pushing the stop/reset switch once more resets the INIIT12 module. This action:

1. Resets the module to power up values after a stop.

2. Recovers from an operator-initiated stop or module time-out.

NOTE: Pressing and holding the switch will not stop and reset the module. It will only stop the module. Release then press again to reset. If the module halts due to an error and the status LED is red, a single push resets the module.

Operating Modes

The INIIT12 module has two modes of operation: execute and configure.

Execute

This is the normal mode of operation for the INIIT12 module. In the execute mode, the module on the central Cnet network communicates with the INIIT12 module on the remote, satellite Cnet network. They process exception reports, and control and configuration messages.

Configure

The configure mode allows the executive block configuration to be modified. While in the configure mode, all INIIT12 module functions continue to operate normally. Any changes made to the INIIT12 executive block (function code 202) have no effect until the module returns to the execute mode. A human system interface running Conductor NT or Conductor VMS software or a computer running Composer software is required to perform configuration tasks. Refer to the instruction for the HSI interface being used or to the Composer instructions for details.

Point Count

It is important when using the INIIT12 module to be aware of the data point limitations of the device. The absolute restrictions imposed by the design of the INIIR01 interface are:

- Index table size of the INIIT12 module limits the device to exception reports from 8,000 distinct (unique) points.
- Total RAM available for the database is approximately 550 kilobytes.

Table 4-3 lists the INIIT12 database record sizes. The figures in the tables apply to both the central network and the remote, satellite network databases. Table 4-4 lists memory bytes required for block records.

INIIT03 Transfer

The faceplate of the INIIT03 module has the following features (Fig. 4-3):

- Status LED.
- 16 CPU LEDs divided into two banks.
- Stop/reset pushbutton.

Table 4-3. Database Memory Usage (INIIT12)

Record Type	Bytes Required[1]	Comments
Bridge	14	A bridge is any local or remote Cnet-to-Cnet communication interface. One bridge record is created for each bridge other than the one under consideration.
Node	50	The INIIR01 interface allocates a node record for each node on the central network and each node on the remote, satellite network.
Module	14	One module record is allocated for each remote module from which the INIIR01 interface imports or exports exception reports.
Block	42+ (refer to Table 4-4)	One block record is required for each exception report being imported.
Route	10	A remote route record is required for each destination of an exception report. The maximum number of destinations can be approximated by summing the number of HSI interfaces and bridges on each communication network connected to the INIIR01 interface.

NOTE:
1.The INIIT12 module has 550 kilobytes of RAM available for use.

Table 4-4. Block Record Memory Bytes (INIIT12)

Block Type	Bytes				
	Block	Status	Value	Specs	Total[1]
Digital	42	1	—	1	44
RCM	42	2	—	1	46
Module status	42	5	—	—	48
Extended module status	42	16	—	—	58
Analog real-3	42	1	3	13	60
RMSC real-3	42	1	3	13	60
Analog real-4	42	1	4	17	64
RMSC real-4	42	1	4	17	64
Station real-3	42	2	12	20	76
DAANG real-3	42	2	12	20	76
Station real-4	42	2	16	26	86
DAANG real-4	42	2	16	26	86

NOTE:
1.Total bytes must be an even number, therefore all odd totals are increased by one.

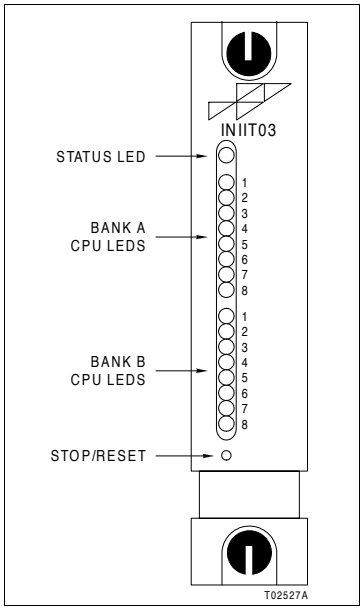

Figure 4-3. INIIT03 Faceplate

Status LED

The status LED is a red/green LED that displays the operating status of the INIIT03 module. It has three possible states. Table 4-5 lists the meaning of the status LED states. Refer to Section 5 for corrective actions if the status LED indicates that an operating error exists.

Table 4-5. Status LED States (INIIT03)

LED State	Meaning
Off	No power to the module or the machine fault timer is disabled (jumper installed) and the module is running.
Solid green	Module is in the execute mode.
Solid red	Hardware failure or configuration error, check bank B CPU LEDs for an error code.

Bank A CPU LEDs

These LEDs display the status of the module while it is in normal operation. Table 4-6 shows the bank A CPU LED states during normal operation. Refer to Table 5-3 for a list of LED error codes and corrective actions.

Table 4-6. Bank A CPU LED States (INIIT03)

LED State	Meaning
8 7 6 5 4 3 2 1	
x x x x x x x x	Module startup, LEDs one through eight sequence irregularly.
1 1 0 0 0 0 0 0	Primary transfer module; normal operation.
1 0 0 0 0 0 0 0	Backup transfer module; normal operation.

Stop/Reset

Push the stop/reset pushbutton once and wait for the status LED to turn red before removing the INIIT03 module from the module mounting unit.

After the module is stopped, pushing the stop/reset pushbutton resets the INIIT03 module. This action:

1. Resets the module to power up values after a stop.

2. Recovers from an operator-initiated stop or module time-out.

NOTE: Pressing and holding the switch will not stop and reset the module. It will only stop the module. Release then press again to reset. If the module halts due to an error and the status LED is red, a single push resets the module.

Operating Modes

The INIIT03 module has one mode of operation. The module should be in execute mode. If not, it has failed or there is some other problem with the module. In execute mode, the INIIT03 module transfers data and status information from the central Cnet network to the local, satellite Cnet network.

Point Count

There are three factors that determine the maximum number of points in an INIIL02 interface configuration: Point type (exception report data type), the number of devices that receive each distinct (unique) exception report and the total memory available (1.66 megabytes). Table 4-7 lists the INIIT03 database record sizes. Table 4-8 lists the memory bytes required for block records.

Table 4-7. Database Memory Usage (INIIT03)

Record Type	Bytes Required[1]	Comments
Bridge	18	A bridge is any local or remote Cnet-to-Cnet communication interface. One bridge record is created for each bridge other than the one under consideration.
Node	50	The INIIL02 interface allocates a node record for each node on the central network and each node on the local, satellite network.
Module	14	One module record is allocated for each remote module from which the INIIL02 interface imports or exports exception reports.
Block	Refer to Table 4-8	One block record is required for each exception report being imported.
Route	12	A remote route record is required for each destination of an exception report. The maximum number of destinations can be approximated by summing the number of HSI interfaces and bridges on each communication network connected to the INIIL02 interface.

NOTE:
1.The INIIT03 module has 1.66 megabytes of RAM available for use.

Table 4-8. Block Record Memory Bytes (INIIT03)

Tag Type (Acronym)	Point Type	Record Type	Memory Bytes Required
Digital (DIGITAL)	7	Digital	42
Plant loop analog (ANALOG)	5	Analog real 3	56
Cnet/INFI-NET analog (ANALOG)	21	Analog real 4	62
Multi-state device driver (MSDD)	15	Remote switch	42
Device driver (DD)	15	Remote switch	42
Remote control memory (RCM)	15	Remote switch	42
Remote motor control block (RMCB)	15	Remote switch	42
Remote manual set constant (RMSC)	19	Analog real 4	62

Table 4-8. Block Record Memory Bytes (INIIT03) *(continued)*

Tag Type (Acronym)	Point Type	Record Type	Memory Bytes Required
Text select (TEXT)	5	Analog real 3	56
ASCII text string (TEXTSTR)	30	UDXR	48 to 552[1]
Control station (STATION)	17	Station real 4	84
Data acquisition digital (DADIG)	15	Remote switch	42
Data acquisition digital macro (DADIGTL)	15	Remote switch	42
Data acquisition analog (DAANG)	29	Station real 4	84
Data acquisition analog macro (DAANLG)	17	Station real 4	84
Plant loop module status (N90STA)	14	Module status	56
Cnet/INFI-NET module status (N90STA)	23	Module status	56

NOTE:
1.The UDXR record size depends on the number of data bytes, the number of status bytes, and the number of specification bytes. ASCII text string as it is currently implemented allows 1 to 81 data bytes, 4 status bytes (fixed), and 16 specification bytes (fixed) for a range of 60 to 140 bytes.

Troubleshooting

Section 5

Introduction

Troubleshooting the Cnet-to-Cnet interface is limited to viewing the contents of the error counters and the module status report from any human system interface (HSI). Refer to the instruction for your specific HSI interface for information on module status reports.

Error Counters

All Cnet communication modules have faceplate LEDs that serve as error code displays. The INNIS01 module has event and error counters that are selectable (refer to Tables 3-4 and 3-5).

INNIS01 Error Codes

The INNIS01 module error counters total errors in the same manner as the event counters total events. Table 3-5 lists the types of error counters. The module halts operation if a fatal error condition occurs. Group A LEDs display error codes. Group B LEDs are off when group A LEDs are displaying error codes. Refer to Table 5-1 for a list of error codes and associated corrective actions.

Table 5-1. INNIS01 Error Codes

Code	LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
13	0 0 0 1 0 0 1 1	ROM checksum error	Replace INNIS01 module.
16	0 0 0 1 0 1 1 0	Loopback test failure	1. Check cabling and termination unit. 2. Replace INNIS01 module.
31	0 0 1 1 0 0 0 1	Memory or CPU fault	Replace INNIS01 module.

Table 5-1. INNIS01 Error Codes *(continued)*

Code	LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
32	0 0 1 1 0 0 1 0	Address or bus error	1. Reset INIIT12/INIIT03 module. 2. Replace INNIS01 module if error recurs.
33	0 0 1 1 0 0 1 1	Illegal instruction	
34	0 0 1 1 0 1 0 0	Trace/privilege violation	
35	0 0 1 1 0 1 0 1	Spurious/unassigned exception	
36	0 0 1 1 0 1 1 0	Divide by 0/checksum/format error	
37	0 0 1 1 0 1 1 1	Trap instruction	
38	0 0 1 1 1 0 0 0	Invalid dipswitch setting on INNIS01 module	Check dipswitches SW1 through SW4.
3E	0 0 1 1 1 1 1 0	INNIS01/device handshake failure	1. Verify that dipshunt exists between INNIS01 and INIIT12/INIIT03 modules. 2. If dipshunt exists, replace INNIS01 or INIIT12/INIIT03 module.

NOTE: 0 = LED off, 1 = LED on

INIIT12 Error Codes

If module errors occur while the INIIT12 module is operating, the module halts, the status LED turns red, and the eight CPU LEDs display an error code. Table 5-2 lists the INIIT12 error codes, their meanings, and corrective actions. Nonfatal module errors appear in the module status report that can be seen on a human system interface.

Table 5-2. INIIT12 Error Codes

Code	LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
01	0 0 0 0 0 0 0 1	NVRAM error. NVRAM not initialized or bad checksum.	Initialize NVRAM.
0B	0 0 0 0 1 0 1 1	NVRAM initialized.	Set dipswitch SW4 pole 7 to closed (on) on INIIT12 module and reset.
0D	0 0 0 0 1 1 0 1	Redundancy failure.	1. Check I/O expander bus. 2. Check dipswitch SW3 pole 7 on INIIT12 module.

Table 5-2. INIIT12 Error Codes *(continued)*

Code	LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
12	0 0 0 1 0 0 1 0	INNIS01 handshake failure.	1. Check INIIT12 and INNIS01 modules seating and cable connection. 2. Replace INIIT12 or INNIS01 module.
13	0 0 0 1 0 0 1 1	ROM checksum error.	1. Reset INIIT12 module. 2. Replace INIIT12 module if error continues.
14	0 0 0 1 0 1 0 0	I/O expander bus message failure.	
15	0 0 0 1 0 1 0 1	Loopback test failure.	1. Check cabling and termination unit. 2. Replace INNIS01 module if error continues.
31	0 0 1 1 0 0 0 1	Memory or CPU fault.	Replace INIIT12 module.
32	0 0 1 1 0 0 1 0	Address or bus error.	1. Reset INIIT12 module. 2. Replace INIIT12 module if error continues.
33	0 0 1 1 0 0 1 1	Illegal instruction.	
34	0 0 1 1 0 1 0 0	Trace/privilege violation.	
35	0 0 1 1 0 1 0 1	Spurious/unassigned exception.	
36	0 0 1 1 0 1 1 0	Divide by 0/checksum/ format error.	1. Reset INIIT12 module. 2. Repeat INIIT12 module initialization. 3. Replace INIIT12 module if error continues.
38	0 0 1 1 1 0 0 0	Dipswitch mismatch between primary and backup INIIT12/ INNIS01 modules.	Check primary and backup INIIT12 and INNIS01 modules dipswitch settings.
39	0 0 1 1 1 0 0 1	Duplicate node address on loop.	Select another node address on INNIS01 dipswitch SW1.
3C	0 0 1 1 1 1 0 0	Relay or fuse failure on termination unit or power supply failure.	1. Check relay or fuse. 2. Check power supply. 3. Replace termination unit if error continues.
3F	0 0 1 1 1 1 1 1	INIIT12 module was stopped with the stop/reset pushbutton.	Reset INIIT12 module.

INIIT12 Status Summary

The INIIT12 module has a 16-byte module status record that provides summary flags for error conditions, module type, and firmware revision level. Refer to the ***Function Code Application Manual*** for a listing of the fields that make up the INIIT12 module status report and the definition of each field within the module status report. Refer to the applicable human system interface instruction for an explanation of how to access the module status report.

INIIT03 Error Codes

If module errors occur while the INIIT03 module is operating, the module halts, the status LED turns red, and the bank B CPU LEDs display an error code. If a redundant module is installed, it takes over operation. Table 5-3 lists the INIIT03 error codes, their meanings, and corrective actions. Nonfatal module errors appear in the module status report that can be seen on a human system interface.

Table 5-3. INIIT03 Error Codes

Code	B CPU LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
0D	0 0 0 0 1 1 0 1	Intermodule link error.	1. Check for I/O expander bus connection between primary and backup INNIS01 modules. 2. Check cable to termination unit.
0E	0 0 0 0 1 1 1 0	Module addresses are the same on primary and redundant INIIT03 modules.	Change dipswitch SW4 UUB0 pole 8 on one of the INIIT03 modules.
11[1]	x 0 0 1 0 0 0 1	INNIS01 module handshake failure.	Replace INIIT03 or INNIS01 module.
12[1]	x 0 0 1 0 0 1 0	INNIS01 module not responding.	Check I/O expander bus address and INNIS01 module seating.
13	0 0 0 1 0 0 1 1	ROM checksum error.	1. Reset INIIT03 module. 2. Replace INIIT03 module if error continues.
14	0 0 0 1 0 1 0 0	I/O expander bus message failure.	
15[1]	x 0 0 1 0 1 0 1	Loop failure.	1. Replace INNIS01 module. 2. Check cabling and termination unit.
16[1]	x 0 0 1 0 1 1 0	Loopback test failure.	

Table 5-3. INIIT03 Error Codes *(continued)*

Code	B CPU LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
2B[1]	x 0 1 0 1 0 1 1	Attempt to de-allocate block not allocated.	1. Reset INIIT03 module. 2. Review system configuration, particularly ASCII tags, incomplete console databases, or missing exception report source nodes. 3. If error continues contact Elsag Bailey technical support.
31	0 0 1 1 0 0 0 1	Memory or CPU fault.	Replace INIIT03 module.
32	0 0 1 1 0 0 1 0	Address or bus error.	1. Reset INIIT03 module. 2. Replace INIIT03 module if error continues.
33	0 0 1 1 0 0 1 1	Illegal instruction.	1. Reset INIIT03 module. 2. Replace INIIT03 module if error continues.
34	0 0 1 1 0 1 0 0	Trace/privilege violation.	
35	0 0 1 1 0 1 0 1	Spurious/unassigned exception.	
36	0 0 1 1 0 1 1 0	Divide by 0/checksum/ format error.	
38[1]	x 0 1 1 1 0 0 0	Option dipswitches do not match between primary and backup modules.	Check for compatible dipswitch settings on INNIS01/INIIT03 module pairs.
39[1]	x 0 1 1 1 0 0 1	Duplicate node number.	Select another node address on network (dipswitch SW1 on INNIS01 module).
3C[1]	x 0 1 1 1 1 0 0	Relay or fuse failure on termination unit or power supply failure.	1. Check relay or fuse. 2. Check power supply. 3. Replace termination unit if error continues.
3F	0 0 1 1 1 1 1 1	INIIT03 module was stopped with the stop/reset pushbutton.	Reset INIIT03 module.

Table 5-3. INIIT03 Error Codes *(continued)*

Code	B CPU LEDs	Condition	Corrective Action
	8 7 6 5 4 3 2 1		
FF	1 1 1 1 1 1 1 1	Power fail interrupt or I/O expander bus clock failure.	1. Check +5 VDC and ±15 VDC power. 2. Check I/O expander bus dipshunts and MMU backplane. 3. Replace INIIT03 module if error continues.

NOTE:
1. Bit eight indicates which communication network is in error. If bit 8 = 0, the error code applies to the central network. If bit 8 = 1, the error code applies to the local, satellite network.

INIIT03 Status Summary

The INIIT03 module has a 16-byte module status record that provides summary flags for error conditions, module type, and firmware revision level. Refer to the ***Function Code Application Manual*** for a listing of the fields that make up the INIIT03 module status report and the definition of each field within the module status report. Refer to the applicable human system interface instruction for an explanation of how to access the module status report.

INNIS01 Edge Connectors

Tables 5-4, 5-5, and 5-6 list INNIS01 module edge connector pin assignments.

Table 5-4. P1 Pin Assignments (INNIS01)

Pin	Signal	Pin	Signal
1	+5 VDC	2	+5 VDC
3	Unused	4	Unused
5	Common	6	Common
7	+15 VDC	8	-15 VDC
9	Power fail interrupt[1]	10	Power fail interrupt[1]
11	Unused	12	Unused

NOTE:
1. Active low.

Table 5-5. P2 Pin Assignments (INNIS01)

Pin	Signal	Pin	Signal
1	Addr. 1, data bit 1	2	Addr. 0, data bit 0
3	Addr. 3, data bit 3	4	Addr. 2, data bit 2
5	Addr. 5, data bit 5	6	Addr. 4, data bit 4
7	Data bit 7	8	Data bit 6
9	Clock[1]	10	Sync[1]
11	Unused	12	Unused

NOTE:
1. Active low.

Table 5-6. P3 Pin Assignments (INNIS01)

Pin	Signal	Pin	Signal
A	Receive 1 +	1	Receive 1 –
B	Ground	2	Ground
C	Ground	3	Ground
D	Bypass control +	4	Bypass control –
E	Ground	5	Ground
F	Transmit 1 + (phase 2)	6	Transmit 1 – (phase 2)
H	Transmit 1 – (phase 1)	7	Transmit 1 + (phase 1)
J	Ground	8	Ground
K	Transmit 2 + (phase 1)	9	Transmit 2 – (phase 1)
L	Transmit 2 – (phase 2)	10	Transmit 2 + (phase 2)
M	Ground	11	Ground
N	Power system status 1	12	Power system status 2
P	Ground	13	Ground
R	Ground	14	Ground
S	Receive 2 –	15	Receive 2 +

INIIT12 Edge Connectors

Tables 5-7, 5-8, and 5-9 list INIIT12 module edge connector pin assignments.

Table 5-7. P1 Pin Assignments (INIIT12)

Pin	Signal	Pin	Signal
1	+5 VDC	2	+5 VDC
3	No connection	4	Controlway
5	Common	6	Common
7	Not used	8	Not used
9	Power fail interrupt[1]	10	Power fail interrupt[1]
11	Controlway 1	12	No connection

NOTE:
1. Active low.

Table 5-8. P2 Pin Assignments (INIIT12)

Pin	Signal[1]	Pin	Signal[1]
1	Data bit D1	2	Data bit D0
3	Data bit D3	4	Data bit D2
5	Data bit D5	6	Data bit D4
7	Data bit D7	8	Data bit D6
9	Clock	10	Sync
11	No connection	12	No connection

NOTE:
1. All data bits are active low.

Table 5-9. P3 Pin Assignments (INIIT12)

Pin	Signal	Pin	Signal
1	SAC/DCS link A (–)	16	SAC/DCS link A (+)
2	SAC/DCS link B (–)	17	SAC/DCS link B (+)
3	Redundancy transmit (–)	18	Redundancy transmit (+)
4	Redundancy transmit clock (–)	19	Redundancy transmit clock (+)
5	Redundancy receive (–)	20	Redundancy receive (+)
6	Redundancy receive clock (–)	21	Redundancy receive clock (+)
7	Receive A (–)	22	Receive A (+)
8	Receive B (–)	23	Receive B (+)
9	Clear to send A (–)	24	Clear to send A (+)
10	Clear to send B (–)	25	Clear to send B (+)
11	Transmit A (–)	26	Transmit A (+)
12	Transmit B (–)	27	Transmit B (+)
13	Request to send A (–)	28	Request to send A (+)
14	Request to send B (–)	29	Request to send B (+)
15	Digital output (+)	30	Digital output (–)

INIIT03 Edge Connectors

Tables 5-10, 5-11, and 5-12 list INIIT03 module edge connector pin assignments.

Table 5-10. P1 Pin Assignments (INIIT03)

Pin	Signal	Pin	Signal
1	+5 VDC	2	+5 VDC
3	No connection	4	Controlway B
5	Common	6	Common
7	No connection	8	Not used
9	Power fail interrupt[1]	10	No connection
11	Controlway A	12	No connection

NOTE:
1. Active low.

Table 5-11. P2 Pin Assignments (INIIT03)

Pin	Signal[1]	Pin	Signal[1]
1	Data bit D1	2	Data bit D0
3	Data bit D3	4	Data bit D2
5	Data bit D5	6	Data bit D4
7	Data bit D7	8	Data bit D6
9	Clock	10	Sync
11	Parity	12	Error

NOTE:
1. All data bits are active low.

Table 5-12. P3 Pin Assignments (INIIT03)

Pin	Signal	Pin	Signal
1	Red1 parity	16	GND
2	Red1 data 7	17	Red1 data 6
3	Red1 data 5	18	Red1 data 4
4	Red1 data 3	19	Red1 data 2
5	Red1 data 1	20	Red1 data 0
6	GND	21	GND
7	Red1 BLCK	22	Red2 BLCK
8	GND	23	GND
9	Red1 busy	24	Red2 busy
10	GND	25	GND
11	Red2 data 7	26	Red2 data 6
12	Red2 data 5	27	Red2 data 4
13	Red2 data 3	28	Red2 data 2
14	Red2 data 1	29	Red2 data 0
15	GND	30	Red2 parity

INIIT03 Diagnostic Port

Table 5-13 lists INIIT03 diagnostic port connector pin assignments.

Table 5-13. P4 RS-232-C Diagnostic Port Pin Assignment (INIIT03)

Pin[1]	Signal	
	Configured as DCE	Configured as DTE
2	RXD	TXD
3	TXD	RXD
5	GND	GND
7	RTS	CTS
8	CTS	RTS

NOTE:
1. This port is useful only to qualified Elsag Bailey personnel.

Maintenance

Section 6

Introduction

WARNING	**Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard.**
	Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board.

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. Elsag Bailey recommends that all equipment users practice a preventive maintenance program that will keep the equipment operating at an optimum level.

This section presents procedures that can be performed on-site. These preventive maintenance procedures should be used as guidelines to assist you in establishing good preventive maintenance practices. Select the minimum steps required to meet the cleaning needs of your system.

- Maintenance personnel should be qualified electrical technicians or engineers that know the proper use of test equipment and how to handle electronic circuitry.
- Maintenance personnel should be familiar with the Cnet network (or INFI-NET system), have experience working with process control systems, and know what precautions to take when working around live electrical systems.

Preventive Maintenance Schedule

Table 6-1 is the preventive maintenance schedule for the Cnet-to-Cnet interface modules. The table lists the preventive maintenance tasks in groups according to their specified

maintenance interval. Some tasks in Table 6-1 are self explanatory. Instruction for tasks that require further explanation are covered under ***Preventive Maintenance Procedures***.

NOTE: The preventive maintenance schedule list is for general purposes only. Your application may require special attention.

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check the Cnet-to-Cnet interface modules and module mounting unit for dust. Clean as necessary using an antistatic vacuum.	3 months
Check all signal, power and ground connections associated with the interface modules and the associated termination units or modules. Refer to procedure.	
Inspect the interface modules and associated termination units or modules, giving particular attention to power supply contacts and edge connectors. Clean as necessary. Refer to procedure.	12 months
Complete all tasks in this table.	Shutdown

Equipment Required

This is a list of tools and equipment required for the maintenance procedures.

- Antistatic vacuum.
- Compressed air.
- Flat-blade screwdriver suitable for termination unit terminals.
- Isopropyl alcohol (99.5 percent electronic grade).
- Eberhard Faber (400A) pink pearl eraser.
- Foam-tipped swab.
- Fiberglass burnishing brush.
- Lint-free cloths.
- Small needlenose pliers.

Preventive Maintenance Procedures

This section covers tasks from Table 6-1 that require specific instructions or further explanation:

- Checking signal, power and ground connections.
- Cleaning printed circuit boards and edge connectors.

Checking Connections

Check all signal wiring, power and ground connections to the interface modules and their associated termination unit or module. When checking connections, always turn a screw, nut or other fastening device in the direction to tighten only. If the connection is loose, it will be tightened. If the connection is tight, the tightening action will verify that it is secure. There must not be any motion done to loosen the connection.

NOTE: Power to the cabinet should be off while performing this preventive maintenance task.

1. Verify module cable connections.

2. Verify that all power and field wiring connections to the interface termination units or termination modules are secure.

Printed Circuit Board Cleaning

There are several circuit board cleaning procedures in this section. These procedures cover circuit board cleaning and washing, and cleaning edge connectors. Use the procedures that meet the needs of each circuit board. Remove all dust, dirt, oil, corrosion or any other contaminant from the circuit board.

Do all cleaning and handling of the printed circuit boards at static safe work stations. Always observe the steps under ***Special Handling*** in Section 3 when handling printed circuit boards.

General Cleaning and Washing

If the printed circuit board needs minor cleaning, remove dust and residue from the printed circuit board surface using clean, dry, filtered compressed air or an antistatic field service vacuum cleaner.

Another method of washing the printed circuit board is:

1. Clean the printed circuit board by spraying or wiping the board with isopropyl alcohol (99.5% electronic grade). Use a foam-tipped swab to wipe the circuit board.

2. When the circuit board is clean, remove excess solvent by using compressed air to blow it free of the circuit board.

Edge Connector Cleaning

To clean edge connector contacts:

1. Use a solvent mixture of 80% isopropyl alcohol (99.5% electronic grade) and 20% distilled water.

2. Soak a lint-free cloth with the solvent mixture.

3. Work the cloth back and forth parallel to the edge connector contacts.

4. Repeat with a clean cloth that is soaked with the solvent mixture.

5. Dry the edge connector contact area by wiping with a clean lint-free cloth.

To clean tarnished or deeply stained edge connector contacts:

1. Use an Eberhard Faber (400A) pink pearl eraser or equivalent to remove tarnish or stains. Fiberglass or nylon burnishing brushes may also be used.

2. Minimize electrostatic discharge by using the 80/20 isopropyl alcohol/water solution during burnishing.

3. Do not use excessive force while burnishing. Use only enough force to shine the contact surface. Inspect the edge connector after cleaning to assure no loss of contact surface.

4. Wipe clean with a lint-free cloth.

Cleaning Female Edge Connectors

To clean the contacts on a female edge connector:

1. Use a foam-tipped swab or a lint-free cloth wrapped over a piece of scrap circuit board. Soak the swab or cloth in electronic grade isopropyl alcohol.

2. Insert the swab or cloth covered circuit board into edge connector and work it back and forth to clean the contacts.

3. Rinse the edge connector contacts by spraying with isopropyl alcohol.

4. Remove excess alcohol and dry using compressed air.

Repair and Replacement

Section 7

Introduction

This section explains repair and replacement procedures for Cnet-to-Cnet interface modules. There are no special tools required to replace any of the modules.

NOTE: Always use the Elsag Bailey field static kit (part number 1948385A1) when working with any Cnet interface module. This kit connects the static dissipative work surface and technician to the same ground point.

Repair

Repair procedures are limited to module replacement. If a module fails, remove and replace it with another. Verify that the replacement module dipswitch and jumper settings are the same as those of the failed module.

NOTE: Do not remove interface modules under power unless module operation has been halted.

Module Replacement

The following steps describe module replacement. The module can be removed while system power is supplied. To replace a module:

1. Press the stop/reset pushbutton if the module is not already halted.

2. Push and turn the two front panel captive retaining latches ½-turn to unlatch the module. It is unlatched when the slots on the latches are vertical and the open end of the slots face away from the module.

3. Slide the module out of the module mounting unit (MMU).

4. Configure the replacement module dipswitch and jumper settings to match the original module.

5. In the same slot assignment as the original module, align the replacement module with the plastic guide rails of the

MMU card cage slot. Slide it in until the front panel is flush with the top and bottom of the MMU frame.

6. Push and turn the two captive retaining latches on the module faceplate ½-turn to the latched position. It is latched when the slots on the latches are vertical and the open ends face the center of the module.

7. Return to normal operation.

Termination Unit Replacement

Refer to the ***Communication Termination Unit (NTCL01)*** and ***Multifunction Processor Termination Unit (NTMP01)*** instruction for termination unit step-by-step replacement procedures and spare parts information.

Replacement and Spare Parts

Section 8

Parts

Order parts without commercial descriptions from the nearest Elsag Bailey sales office. Contact Elsag Bailey for help determining the quantity of spare parts to keep on hand for your particular system. Tables 8-1 through 8-3 list Cnet-to-Cnet interface related parts.

Table 8-1. Miscellaneous Nomenclatures

1	2	3	4	5	6	7	
I	N	I	I	L	0	2	Cnet-to-Cnet local interface: INIIT03 and INNIS01
I	N	I	I	R	0	1	Cnet-to-Cnet remote interface: INIIT12 and INNIS01
I	N	I	I	T	0	3	Local transfer module
I	N	I	I	T	1	2	Remote transfer module
I	N	N	I	S	0	1	Network interface module
N	T	C	L	0	1	_	Communication termination unit
N	T	M	P	0	1	_	Multifunction processor termination unit

Table 8-2. Cable Nomenclatures

1	2	3	4	5	6	
N	K	L	S	0	1	INNIS01-to-NTCL01 termination unit cable (PVC)
N	K	L	S	1	1	INNIS01-to-NTCL01 termination unit cable (non-PVC)
N	K	M	P	0	1	INIIT12-to-NTMP01 termination unit cable (PVC)
N	K	M	P	1	1	INIIT12-to-NTMP01 termination unit cable (non-PVC)

Table 8-3. Miscellaneous Parts

Description	Part Number
Dipshunt (8-position, 16-pin)	1946715A8
Jumper	1946984A1

NTCL01 Termination Unit

Appendix A

Description

The INNIS01 Network Interface module uses an NTCL01 termination unit. Jumpers on the NTCL01 unit select the type of cable used to connect the INNIS01 module to Cnet (or INFI-NET). Refer to the ***Communication Termination Unit (NTCL01)*** instruction for complete information.

Figure A-1 shows the location of jumpers and connectors. Table A-1 lists the jumper settings used on NTCL01 unit circuit board revision levels D and E. Table A-2 lists the jumper settings used on NTCL01 unit circuit board revision levels F and later.

Figures A-2 and A-3 show the termination unit, and coaxial and twinaxial cable connections.

Table A-1. Revisions D and E Jumpers (NTCL01)

Jumper	Settings	
	Twinaxial Cable	Coaxial Cable
J5 - J12	2-3	2-3
J13 - J18	1-2	2-3

Table A-2. Revisions F and Later Jumpers (NTCL01)

Jumper	Settings	
	Twinaxial Cable	Coaxial Cable
J5 - J10	1-2	2-3

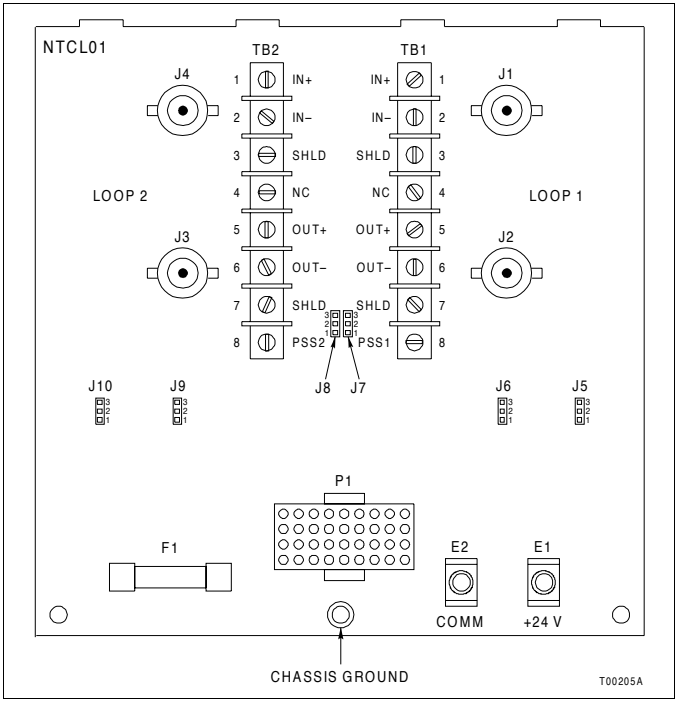

Figure A-1. NTCL01 Board Layout (Revision F and Later)

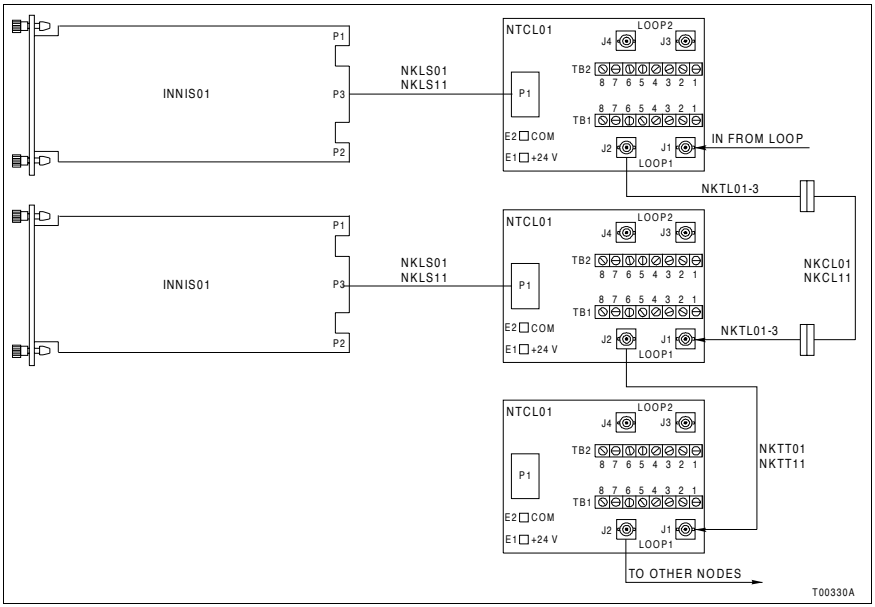

Figure A-2. Coaxial Cable Connections (NTCL01)

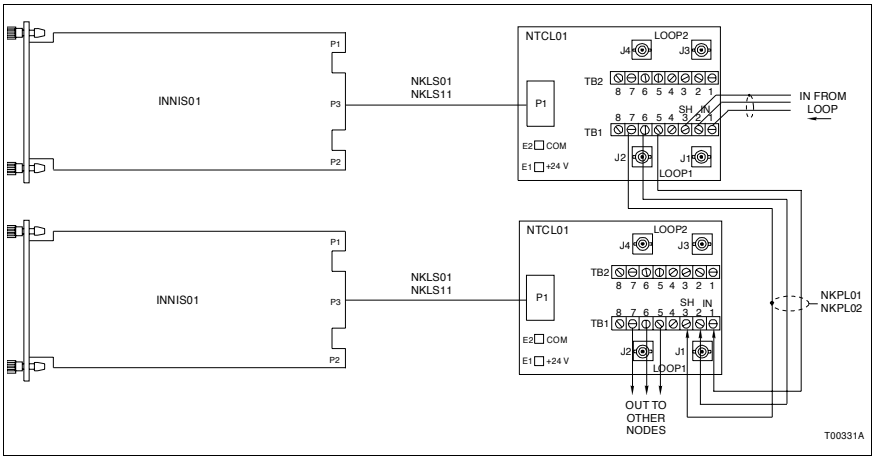

Figure A-3. Twinaxial Cable Connections (NTCL01)

NTMP01 Termination Unit

Appendix B

Description

The INIIT12 Remote Transfer module uses the NTMP01 termination unit. Jumpers on the NTMP01 unit setup the communication ports. Refer to the ***Multifunction Processor Termination Unit (NTMP01)*** instruction for complete information.

Figure B-1 shows the NTMP01 connector assignments and jumper locations.

Figure B-2 shows the dipshunt configuration required for ports one or two to operate as a data port. Figure B-3 shows the dipshunt configuration required for port two to drive a diagnostic terminal. Figure B-4 shows the jumper assignments for handshake signals. These jumpers are normally installed.
Figure B-5 shows the required jumper settings for J14 through J17. Figure B-6 shows the required jumper setting for J18.

Figure B-7 shows NTMP01 termination unit cable connections.

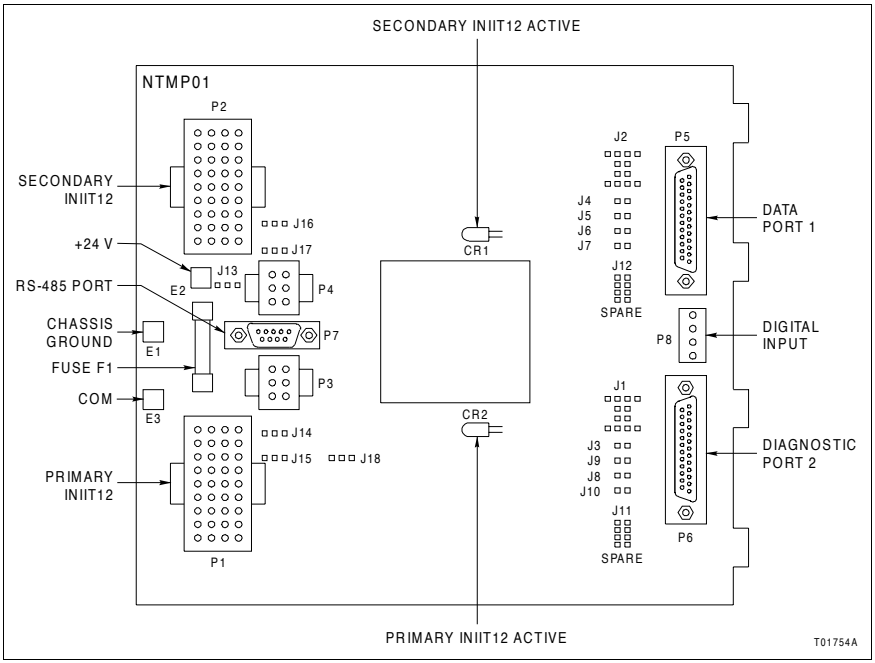

Figure B-1. NTMP01 Board Layout

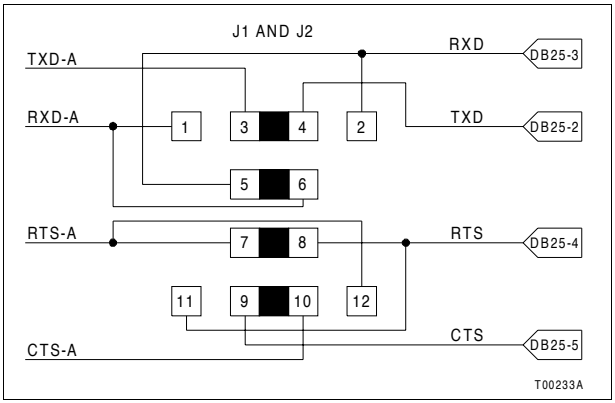

Figure B-2. Data Port (Port 1 or 2) Jumper Configuration (NTMP01)

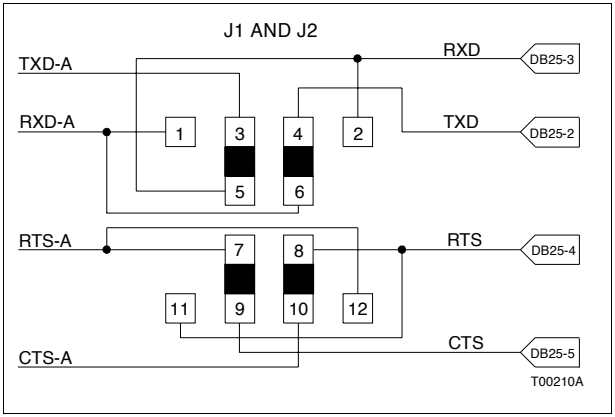

Figure B-3. Diagnostic Port (Port 2 Only) Jumper Configuration (NTMP01)

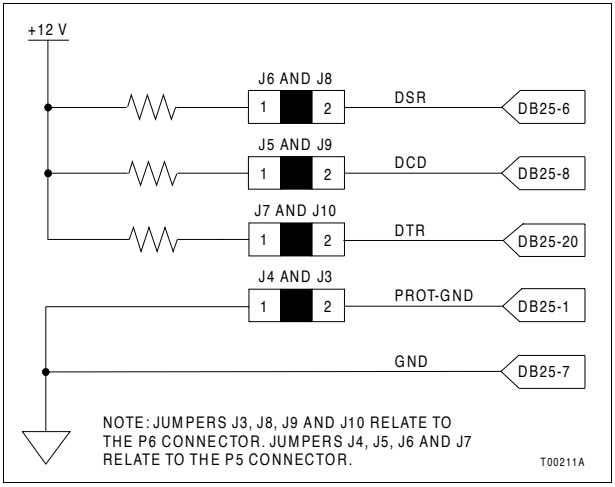

Figure B-4. Handshake Signal Jumpers (NTMP01)

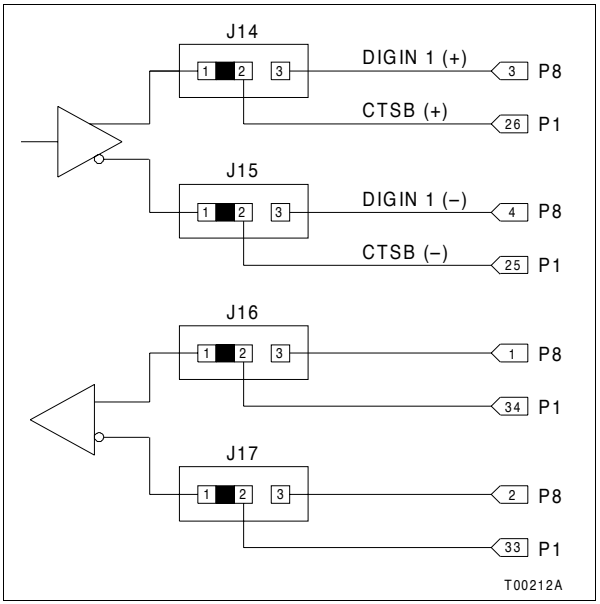

Figure B-5. J14 through J17 Jumper Settings (NTMP01)

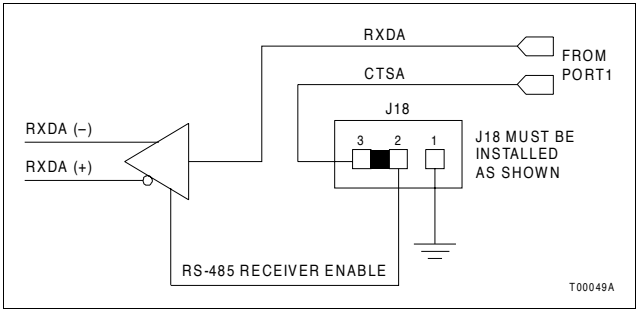

Figure B-6. J18 Jumper Setting NTMP01)

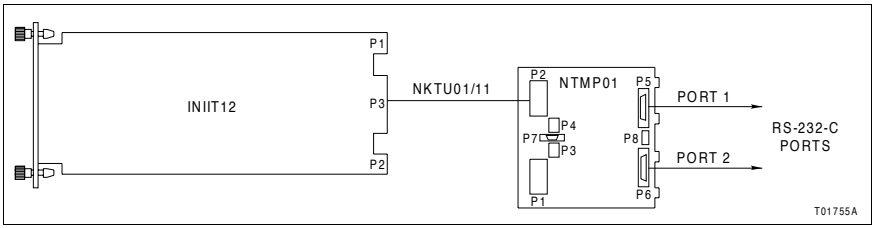

Figure B-7. Cable Connections (NTMP01)

Redundant INIIR01 Remote Interfaces

Appendix C

Introduction

This appendix provides information on various ways to terminate a redundant INIIR01 Remote Interface. Redundant interfaces provide an additional level of operational security against module or communication system component failure.

Redundant Configurations

Redundant INIIT12 Remote Transfer modules must share a common Controlway. The transfer modules use Controlway for redundancy communication and for transfer of the executive block (function code 202) configuration between the primary and backup INIIT12 module.

An I/O expander bus connection must exist between each INIIT12 module and its associated INNIS01 module. Do not connect the I/O expander bus between the primary and backup INIIT12 module. Keep each I/O expander bus as short as possible.

Switch Settings

To enable redundancy, dipswitch SW3 pole seven must be set to one on both INIIT12 modules. Executive block specification S17 and the serial port configuration determine what conditions will lead to a failover from primary to backup INIIT12 module. If the primary module stops executing for any reason, the backup INIIT12 module will attempt to come online.

The INIIT12 module supports external equipment switching on failover. This feature requires redundant digital I/O modules and associated termination units. The setting of dipswitch SW4 pole three on the INIIT12 module (and specification S17 of function code 202) determines the initial or final state of digital I/O module output number three. In redundant applications, dipswitch SW4 pole three on the primary INIIT12 module enables the primary transceiver while the primary INIIT12 module is online. Setting the same switch to the opposite

position on the backup INIIT12 module enables the backup transceiver if a failover occurs.

Hardware Configuration Example

Figure C-1 shows a diagram of a configuration using redundant transceivers. The connections shown allow the primary INIIT12 module to connect the antenna to the primary transceiver. If failover occurs, the backup INIIT12 module connects the antenna to the redundant transceiver. Refer to the information about Function Code 202 - Remote Transfer Module Executive Block (INIIT12) in the ***Function Code Application Manual*** for an explanation of how to configure the executive block when using redundant transceivers.

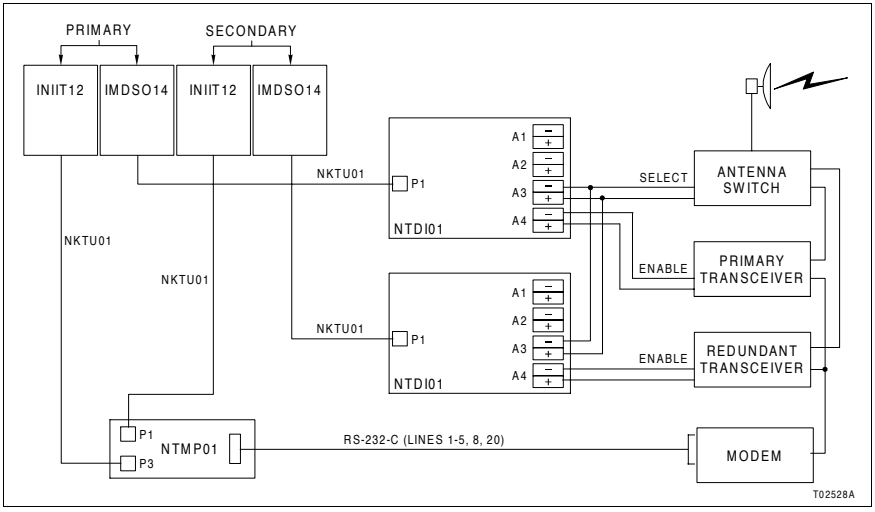

Figure C-1. Redundant Communication Equipment

Voltage levels and polarities of enable signals to transceivers and other communications equipment vary. Refer to the applicable user manuals for the operating specifications of transceivers or other communication equipment before making any connections to the IMDSO14 or IMDSO15 Digital Output modules.

Termination Units

Redundant configurations can be with or without redundant termination units. In both cases, one or both serial ports can be used for data transfer depending on the needs of the application.

Figure C-2 illustrates redundant INIIT12 modules using a single NTMP01 termination unit. In this configuration, the INIIT12 modules share a single termination unit and communicate through one or two serial channels. The primary INIIT12 module controls the termination unit.

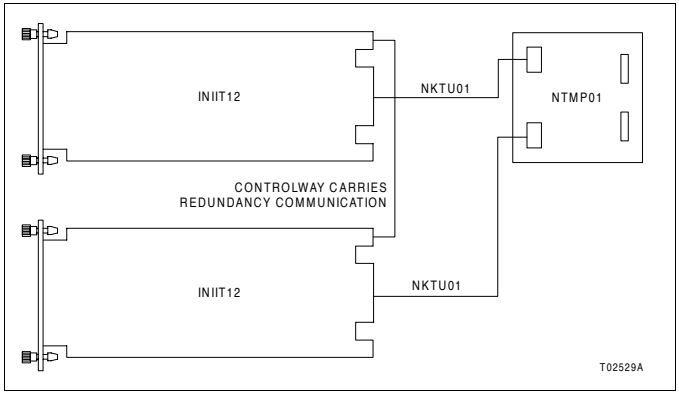

Figure C-2. Redundant INIIT12 Modules Using One Termination Unit

Figure C-3 illustrates how redundant INIIT12 modules use two NTMP01 termination units. This configuration gives each INIIT12 module control of a termination unit with two RS-232-C serial channels. Only the primary INIIT12 module will enable its termination unit. The backup INIIT12 module will not attempt to enable its termination unit unless it becomes the primary transfer module.

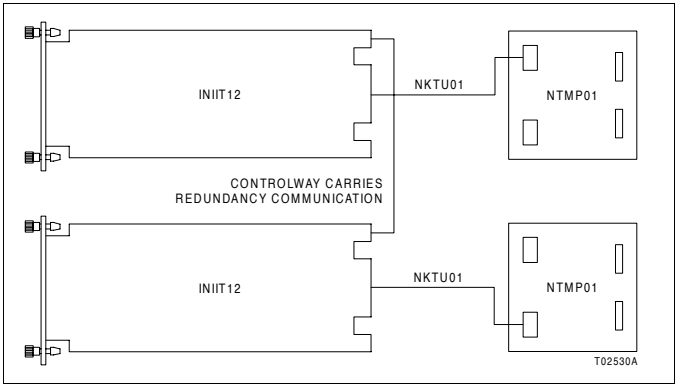

Figure C-3. Redundant INIIT12 Modules Using Redundant Termination Units

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