symphony™

Instruction
Harmony

Harmony Area Controller

Preface

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Introduction

Section 1

Purpose

The Harmony area controller (HAC) is an area management and control node for the Symphony Enterprise Management and Control System. The controller communicates with other system nodes over Control network (Cnet). It collects process I/O, performs control algorithms, and outputs control signals to process level devices. The controller also imports and exports process data from and to other system nodes. It accepts control commands from operators through computers connected to the network.

> **NOTE:** The Harmony area controller is compatible with the INFI 90 OPEN Strategic Enterprise Management System and the INFI-NET communication network.

The Harmony area controller is comprised of a P-HC-DOC docking station, P-HC-PLT controller module, and S-HB-ACT software. These individual components combine to create the Harmony area controller. Refer to Section 9 for complete nomenclature.

Each controller can handle thousands of analog and digital I/O points with functions such as multiloop, analog, sequential, batch, and advanced controls. It has advanced data acquisition features: trending, variable alarming, alarm inhibiting, and sequence of events. The controller communicates with both Harmony I/O blocks and Harmony rack I/O modules to meet the input and output requirements of virtually any process.

On-board, user-addressable control algorithms called function codes enhance processing power. Multiple programming and control languages are supported including C, Batch 90™, and UDF (user-defined function). A standard library of function codes ranges from simple AND and NOT logic functions to complex Smith Predictor and Linear Regression functions, with no advanced programming knowledge required to apply these powerful capabilities. A greatly expanded capacity of user-configurable function blocks supports even the most complex process management and control strategies.

System Overview

Figure 1-1 is a hierarchical view of the Symphony communications architecture: Onet (Operations network), Cnet, Hnet (Harmony network), and I/O expander bus. It shows the position of the Harmony area controller within the architecture.

Control Network

The Harmony area controller is a node on the Cnet. Cnet is a unidirectional, high speed serial data network that operates at a 10-megahertz communication rate. It supports a central network with up to 250 system node connections. Multiple satellite Cnets can link to the 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. A node can be a satellite network, a Harmony control unit consisting of a Harmony area controller with its I/O devices, or a Harmony network communications coupler connecting human system interfaces and computers operating on the Onet.

The Harmony area controller uses Cnet to:

- Communicate field input values and states for process monitoring and control.
- Communicate configuration parameters that determine the operation of functions such as alarming, trending, and logging on a human system interface.
- Acquire process field inputs.
- Receive control instructions from a human system interface to adjust process field outputs.
- Provide feedback to plant personnel of actual output changes.
- Download firmware.

Data is transferred in messages that contain system data, control, and configuration information and also in exception reports. Exception reported data appears as dynamic values, alarms, and state changes on displays and in reports generated by human system interfaces and other system nodes.

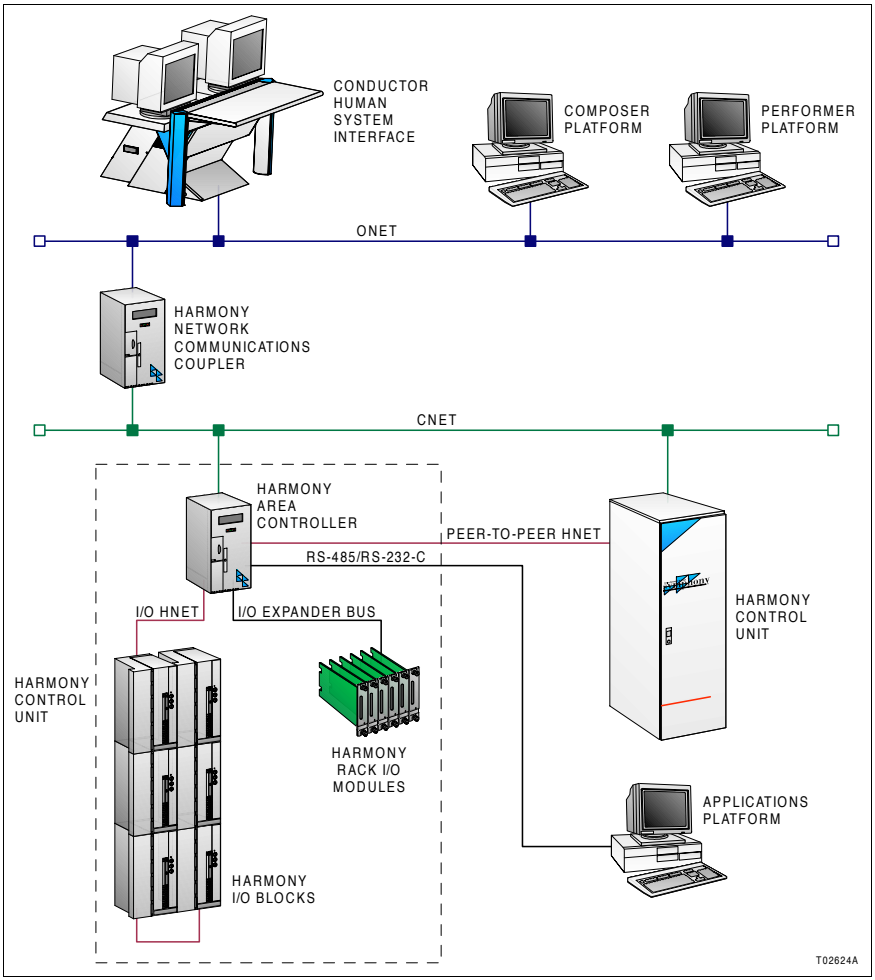

Figure 1-1. Symphony Communications Architecture

Exception reporting for the controller is automatic. The controller generates an exception report periodically to update data, after a process point reaches a defined alarm limit or changes state, or after a significant change in value occurs.

I/O Interface

Figures 1-2 and 1-3 show the Harmony area controller interfacing to Harmony I/O blocks and Harmony rack I/O modules respectively. I/O blocks and rack I/O modules can operate in parallel with a single controller (Fig. 1-1).

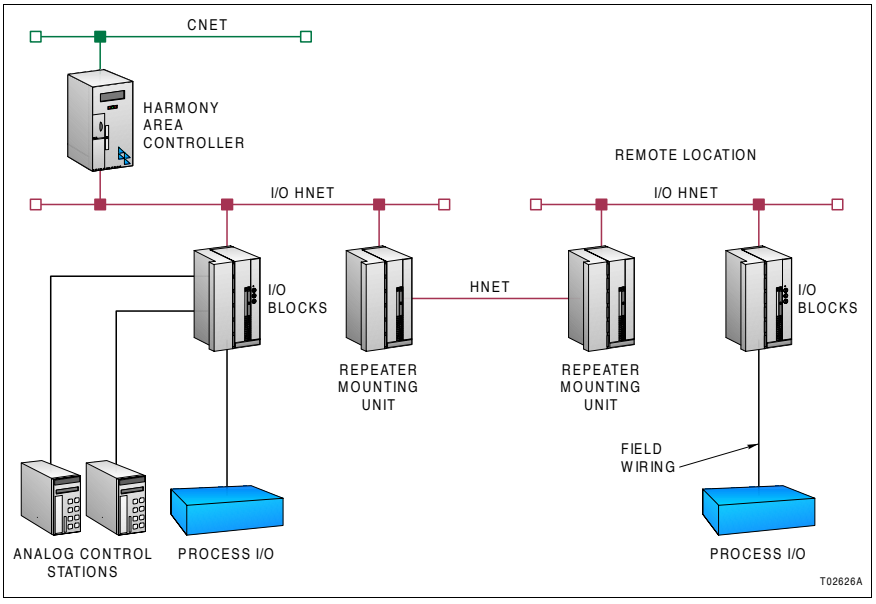

Figure 1-2. Harmony I/O Block Interface

The Harmony I/O system incorporates a variety of input and output devices (i.e., blocks) to interface process signals to the Harmony area controller. The controller communicates with I/O blocks over Hnet. Block types include analog, digital, and control I/O. Additionally, the Harmony I/O system supports remote I/O communication through Hnet repeaters mounted in repeater mounting units.

The Harmony rack I/O system utilizes a wide variety of input, output, and signal conditioning modules to interface process signals to the Harmony area controller. The controller communicates with rack I/O modules over I/O expander bus. Rack

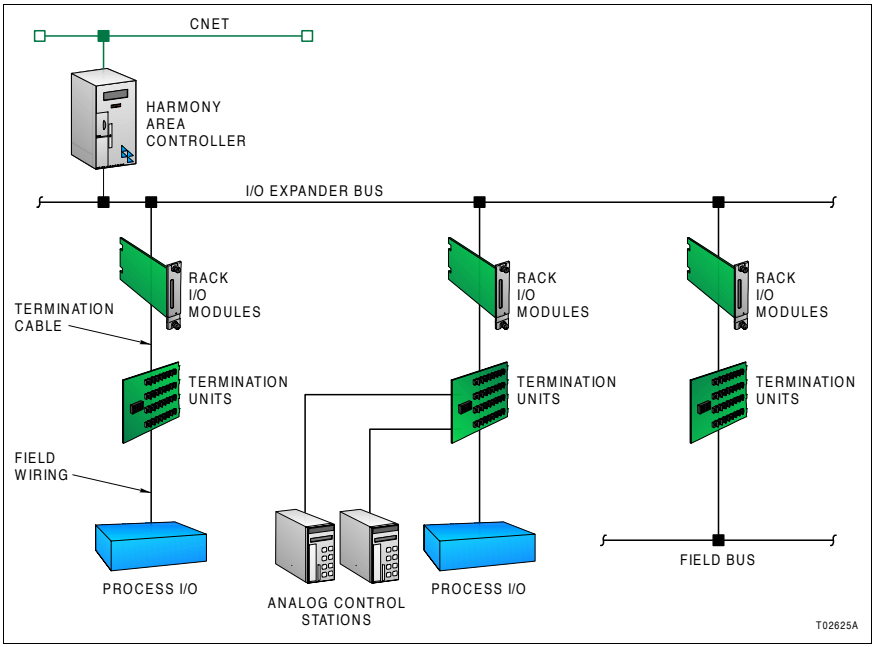

Figure 1-3. Harmony Rack I/O Interface

I/O module types range from standard analog and digital I/O to specialty I/O such as turbine control, field bus, and sequence of events.

Peer-to-Peer Communication

Figure 1-4 shows peer-to-peer Harmony area controller communication. This type of communication requires an Hnet segment that is completely separate from the Hnet segment used by I/O blocks.

Peer-to-peer communication is intended as an alternate means for transferring point data between controllers instead of transferring the data over Cnet. It is only intended for transferring a small number of points (50) at a fast rate of approximately 500 points per second. All controllers that communicate over the peer-to-peer Hnet must reside on the same local Cnet.

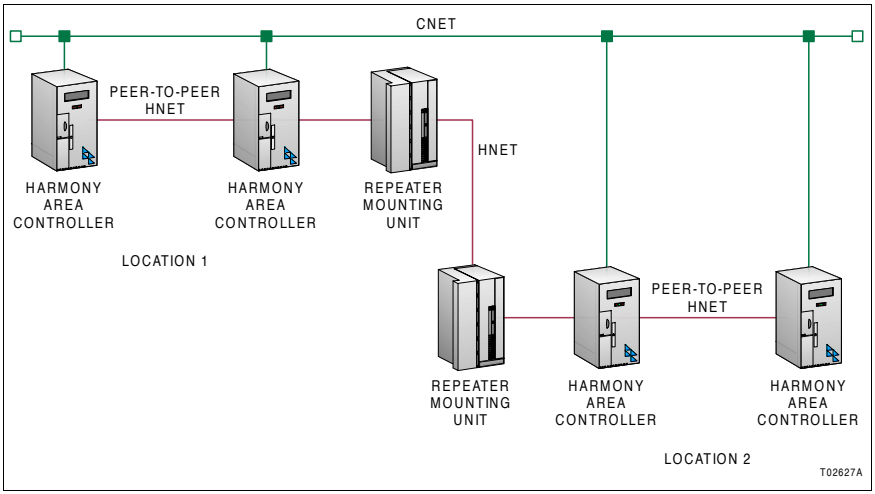

Figure 1-4. Peer-to-Peer Communication

Additionally, redundant controllers communicate over the peer-to-peer Hnet.

Compatibility

The Harmony area controller is compatible with existing INFI 90 OPEN systems. The controller can easily be integrated into established installations that currently use INFI-NET communication networks. Communication with INFI 90 OPEN I/O modules is over I/O expander bus (Fig. 1-3).

Function block configurations in existing INFI 90 OPEN control modules can be downloaded to the Harmony area controller with only minor modifications. Refer to the Symphony ***Function Code Application Manual*** for a complete list of supported function codes.

C programs will need to be relinked using the C utility program version that supports the Harmony area controller. Batch 90 and UDF programs will also need to be compiled using the batch data manager version that supports the Harmony area controller.

Features

Integrated controller. Consolidates area management and control and network communications into one user-replaceable unit, reducing implementation costs.

Downloadable firmware. Downloaded over the Cnet to take advantage of future system enhancements, thereby reducing life cycle costs.

Multiple I/O systems support. Supports both Harmony I/O blocks as well as Harmony rack I/O modules.

Compatible with existing configurations. Execution environment is compatible with existing INFI 90 OPEN function codes and language configurations.

Improved online configuration. New strategy allows function blocks to be added or deleted anywhere within a control segment without interrupting the process.

Redundancy. Provides exceptionally high availability and fault tolerance when configured as a redundant controller.

Local interface. LCD display indicates module type, displays menus, and provides operational feedback.

Serial communications channels. Two independent general purpose serial channels are available to interface third-party devices.

Flexible configuration. The controller is scalable for a variety of applications from complex control strategies to data acquisition to advanced information processing. It supports multiple programming and control languages including C, Batch 90, and UDF.

Enhanced communications. State-of-the-art hardware and new internal architecture increases process data import and export rates.

Modular packaging. One user-replaceable unit reduces installation costs. Block packaging combines an enclosure mounting panel, a docking station for module interconnection, controller assemblies, and termination assembly.

Improved operator interface. A front panel keypad in conjunction with the LCD screen assist in selecting mode changes and setup options.

Intended User

This instruction is intended for technical personnel responsible for installation, operation, maintenance, and replacement of the Harmony area controller. System engineers and technicians with a background in process control systems should read this instruction thoroughly before installing and using the system. Formal training in Symphony system setup and configuration, especially function codes, is helpful when configuring the controller.

Instruction Content

Introduction	Contains an overview of the Harmony area controller and describes the content and intended user of this instruction. It also highlights features, lists reference documents, and contains system specification information.
Description and Operation	Provides a general description of the controller and its capabilities, and details functional operation.
Installation	Describes controller installation and connection.
Configuration	Describes controller function block configuration and operation.
Operating Procedures	Details controller front panel items, modes of operation, LCD menus, startup, stop/reset, and initialization procedures.
Troubleshooting	Provides troubleshooting information including status messages, status reports, and problem reports.
Maintenance	Includes a preventive maintenance schedule and lists the related procedures.
Repair and Replacement	Describes repair and replacement procedures for controller components.
Replacement and Spare Parts	Provides a list of part nomenclature and part numbers.

Procedures

Individual procedure sections (e.g., PR1, PR6, PR13, etc.) detail installation and replacement actions. A procedure section typically gives the steps for a single task. Installation flowcharts and replacement flowcharts indicate the order in which these procedures are to be performed.

How to Use This Instruction

To use the instruction:

1. Read the ***Introduction*** section for an overview of the Harmony area controller and a description of the instruction content.

2. Read the ***Description and Operation*** section to become familiar with the controller capabilities.

3. Read the ***Installation*** section to install the controller. The section contains a flowchart that points to the various procedures that must be performed to complete installation and connection.

4. Read the ***Configuration*** section for controller and function code configuration information.

5. Read the ***Operating Procedures*** section for controller operating details.

6. Refer to Sections 6, 7, and 8 for troubleshooting, maintenance, and replacement information respectively.

7. Refer to the ***Replacement and Spare Parts*** section for installation, replacement, and spare part nomenclatures and part numbers.

Document Conventions

The ? in a nomenclature or part number indicates a variable for that position (e.g., 1949480?1). In a part number and document number, the ? is a place holder for the revision letter.

Glossary of Terms and Abbreviations

Table 1-1 is a glossary of terms and abbreviations used in the instruction. It contains those terms and abbreviations that are

unique to Bailey or have a definition that is different from standard industry usage.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
Cnet	Control network.
Control network	Symphony system advanced data communication highway.
Exception report	Information update generated when the status or value of a point changes by more than a specified significant amount.
FC	Function code.
Function block	The occurrence of a function code at a block address in controller memory.
Function code	An algorithm that manipulates specific functions. These functions are linked together to form the control strategy.
Harmony network	Redundant communications system that allows data to be transmitted between Harmony devices.
Hnet	Harmony network.
I/O expander bus	Parallel communication bus between the Harmony controller and rack I/O modules.
I/O Hnet	Hnet communication path between the Harmony controller and I/O blocks.
MFT	Machine fault timer. Reset by the processor during normal operation. If not reset regularly, the MFT times out and the device stops.
MMU	Module mounting unit.
Module mounting unit	A card cage that provides electrical and communication support for Harmony rack modules.
Onet	Operations network.
Operations network	IEEE 803.2 Ethernet compliant network that supports TCP/IP communication protocol and operates at a 10-Mbps rate.
Peer-to-peer Hnet	Hnet communication path between Harmony area controllers in a peer-to-peer network architecture.
Repeater mounting unit	Generic name for a block that contains Hnet repeaters.
RMU	Repeater mounting unit.
UDF	User-defined function.

Reference Documents

Table 1-2 lists additional documents that relate to the Harmony area controller and are referenced in this instruction.

Table 1-2. Reference Documents

Number	Title
I-E96-631	Distributed Sequence of Events
WBPEEUI200502?0	Module Mounting Unit (IEMMU11, IEMMU12, IEMMU21, IEMMU22)
WBPEEUI210502?0	Modular Power System II
WBPEEUI210504?0	Function Code Application Manual
WBPEEUI230022A0	IISAC01 Analog Control Station
WBPEEUI240751?0	Harmony I/O System, I/O and Auxiliary Blocks
WBPEEUI240760?0	Harmony I/O System, Block Power and Mounting Hardware
WBPEEUI240761?0	Harmony Communications Network (Hnet)
WBPEEUI260037A0	NTCS04 Station Termination Unit
WBPEEUI270003?0	Composer, Automation Architect

Abbreviated Harmony Nomenclature

Table 1-3 lists the abbreviated nomenclature used throughout the instruction to identify various Harmony devices and system related hardware. Refer to Section 9 for complete Harmony area controller nomenclature.

Table 1-3. Abbreviated Harmony Nomenclature

Nomenclature	Description
CAB-01, CAB-04, CAB-12	Symphony enclosure
MSC-TER	Hnet terminator
HRM-HAC1, HRM-PTP1, HRM-PTP1T, HRM-PTP2, HRM-PTP3, HRM-PWR1	Cable

Related Nomenclature

Table 1-4 provides a listing of Harmony area controller related nomenclatures.

Table 1-4. Related Nomenclature

Nomenclature	Description
IEMMU11, IEMMU12, IEMMU21, IEMMU22	Module mounting unit
IISAC01	Analog control station
IPCHS02	Power module chassis

Table 1-4. Related Nomenclature *(continued)*

Nomenclature	Description
NTCS04	Station termination unit
NTST01	Time-sync termination unit
P-ME-CAB-01, P-ME-CAB-04, P-ME-CAB-12	Symphony enclosure

Design Standards and Certifications

Table 1-5 lists the Harmony area controller design standards and certifications.

Table 1-5. Design Standards and Certifications

Category	Standard	Description
Safety	CSA C22.2 No. 142	Safety standards for process control equipment
	ANSI/ISA S82.01-1994	
	IEC 61010-1	
	CSA C22.2 No. 1010.1	
Environmental	IEC 60068-2-1,2,14	Operating temperature
	IEC 60068-2-4,30	Operating relative humidity
	MIL-STD-810E 502.3 & 501.3	Storage/transportation temperature
	ISA S71.04 (level 1 liquids, solids, gases)	Air quality
	IEC 60068-2-6	Operating vibration (sinusoidal)
Vibration	MIL-STD-810E 514.4	Transportation
	IEC 60068-2-27	Shock
	IEC 61298-3	Endurance
EMI, RFI, and electrical surge	IEC 61000-4-2 (level 3)	ESD (6 kV contact discharge, 8 kV air discharge)
	IEC 61000-4-3 (level 3)	EMI susceptibility (test field strength = 10 V/m)
	IEC 61000-4-4 (level 3)	Electrical fast transient (P/S test = 2 kV, I/O = 1 kV)
	IEC 61000-4-5 (level 3)	Electrical surges
Flammable atmospheres	CSA C22.2 No. 213	Nonincendive equipment
	ISA S12.12	Nonincendive equipment
	FM Class 3611	Division 2 equipment

Table 1-5. Design Standards and Certifications *(continued)*

Category	Standard	Description
Flammability of product components	UL 94 V-0, V-1, V-2, 5V	Flammability of plastic materials
CE mark directives	73/23/EEC	Low voltage directive
	89/336/EEC	EMC directive
	92/31/EEC	
	90/683/EEC	CE marking directives
	93/68/EEC	
	93/465/EEC	
Certifications	Canadian Standards Association (CSA) (pending)	Certified for use as process control equipment in an ordinary (nonhazardous) location
	Factory Mutual (FM) (pending)	Approved for use in Class I; Division 2; Groups A, B, C, D; hazardous locations.

Specifications

Tables 1-6 and 1-7 list the Harmony area controller specifications.

Table 1-6. Specifications

Property	Characteristic/Value
Microprocessor	32-bit processor running at 50 MHz
Memory	DRAM: 16 Mb; NVRAM: 2 Mb; Flash-ROM: 2 Mb
Overvoltage category	I per IEC 61010-1
Voltage requirements	21.6 VDC minimum, 24.0 VDC nominal, 28.0 VDC maximum
Current requirements Controller module Network TU Communications TU	 5.1 A 0.5 A at +12 VDC, 0.5 A at –12 VDC (supplied by controller module) 0.5 A at +12 VDC (supplied by controller module)
Heat dissipation	50 W typical, 120 W maximum

Table 1-6. Specifications *(continued)*

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Communication channels
Cnet
I/O expander bus
I/O Hnet
Peer-to-peer Hnet
Redundancy link
Serial port
Station link
Time-sync link</td><td>
1 redundant Cnet (loop 1 and loop 2)
1
1 redundant
1 redundant
1 redundant
2 RS-485, or 2 RS-232-C, or 1 RS-485 and 1 RS-232-C
2 RS-485
1</td></tr>
<tr><td>Communication rate
Cnet
Hnet
Redundancy link
Serial port
Station link
Time-sync link</td><td>
10 MHz or 2 MHz
4 Mbaud
8 Mbaud
Up to 19.2 kbaud
40 kbaud
62.5 kbaud</td></tr>
<tr><td>I/O
Blocks
Rack modules</td><td>
64 maximum (I/O Hnet)
64 maximum (I/O expander bus)</td></tr>
<tr><td>Stations (IISAC01)</td><td>128 maximum</td></tr>
<tr><td>Application programming</td><td>Function codes, C, Batch 90, UDF (user-defined function)</td></tr>
<tr><td>Dimensions
Controller module

Docking station</td><td>
<table><tr><th colspan="2">Height</th><th colspan="2">Width</th><th colspan="2">Depth[1]</th></tr><tr><th>mm</th><th>in.</th><th>mm</th><th>in.</th><th>mm</th><th>in.</th></tr><tr><td>266</td><td>10.5</td><td>133</td><td>5.2</td><td>303</td><td>11.9</td></tr></table>
<table><tr><th colspan="2">Height</th><th colspan="2">Width</th><th colspan="2">Depth[1]</th></tr><tr><th>mm</th><th>in.</th><th>mm</th><th>in.</th><th>mm</th><th>in.</th></tr><tr><td>266</td><td>10.5</td><td>483</td><td>19.0</td><td>279</td><td>11.0</td></tr></table></td></tr>
<tr><td>Weight
Controller module
Docking station</td><td>
4.1 kg (9 lb., 2 oz.)
4.9 kg (10 lb., 14 oz.)</td></tr>
</table>

NOTE:
1. Includes heat sink.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-7. Environmental Specifications

Environment	Operating	Storage and Transportation
Air Quality	Noncorrosive (level 1)	Noncorrosive (level 1)
Altitude	Sea level to 3,048 m (10,000 ft)	Sea level to 12,000 m (40,000 ft)
Relative humidity (noncondensing)	20% to 95% up to 55°C (131°F) 20% to 45% at 55° to 70°C (131° to 158°F)	20% to 95% up to 55°C (131°F) 20% to 45% at 55° to 70°C (131° to 158°F)
Temperature (internal enclosure)	0° to 70°C (32° to 158°F)	-40° to +85°C (-40° to 185°F)
Vibration	10 to 60 Hz, 1.37 mm (0.054 in.) pp 60 to 150 Hz, 1.0 G sine	0.74 G_{RMS} longitudinal 0.20 G_{RMS} transverse 1.04 G_{RMS} vertical 10 to 500 Hz random
Shock	—	15 G, 11 msec

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Installation

Section 3

Introduction

This section describes Harmony area controller (HAC) installation and connection. It assumes a new installation. There are no jumpers or switches to set for the controller module. Any controller setup requirements are performed through the front panel LCD menu options. Jumpers on the communication termination unit configure the serial ports.

Special Handling

Observe these steps when handling electronic circuitry:

1. ***Use Static Shielding Bag.*** Keep an assembly in its static shielding bag until ready to install it in the system. Save the bag for future use.

2. ***Ground Bags before Opening.*** Before opening a bag containing an assembly with static sensitive devices, touch it to the equipment housing or ground to equalize charges.

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

4. ***Ground Test Equipment***.

5. ***Use an Antistatic Field Service Vacuum***. Remove dust from assemblies if necessary.

6. ***Use a Grounded Wrist Strap***. Use 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 termination units and any device with the access cover removed. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the circuitry by electrostatic discharge. Connect the wrist strap to the appropriate grounding plug on the power entry panel. The grounding plug must be effectively connected to the earth grounding electrode system through the AC safety ground.

Unpacking and Inspection

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

2. Notify the nearest Bailey sales office of any damage.

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

4. Use the original packing material and container to store the hardware.

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

Installation and Connection Sequence

Figure 3-1 is the Harmony area controller installation and connection flowchart. Begin at start and complete each flowchart block until done.

In the flowchart, each flowchart block represents a single task. The PR code in the flowchart block identifies the procedure section that describes the steps to complete. For example, turn to section PR3 to read about controller module installation. Some steps are self-explanatory and have no related procedure section. Complete all steps given in a procedure section before continuing to the next flowchart block. The procedure sections are located towards the back of the instruction.

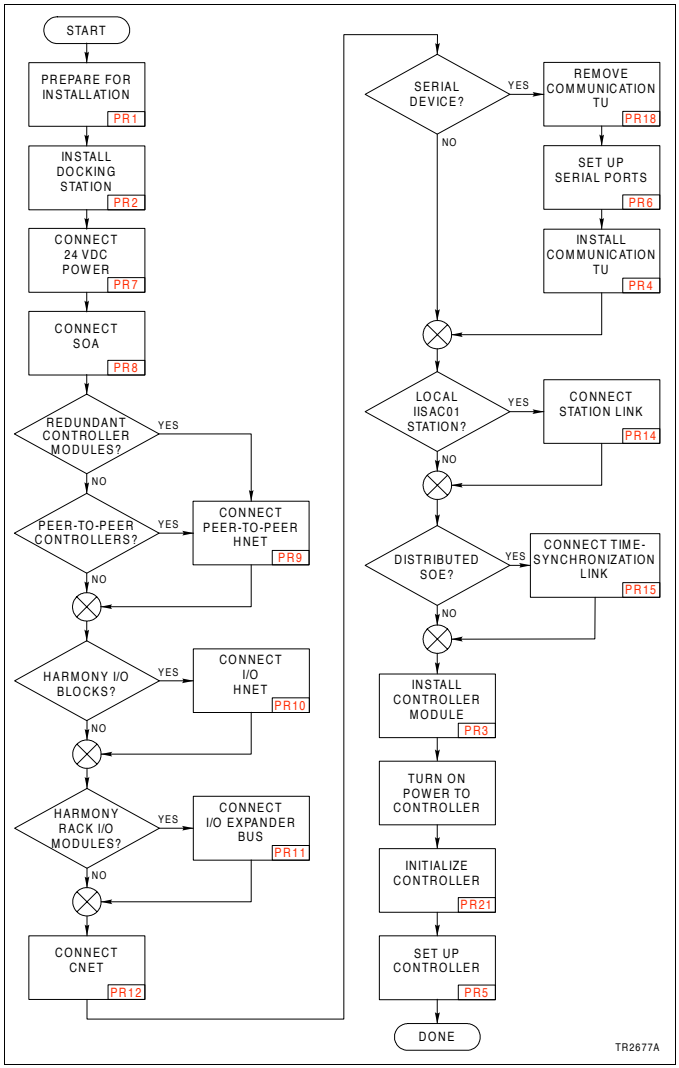

Figure 3-1. Installation and Connection Flowchart

Configuration

Section 4

Introduction

This section details Harmony area controller (HAC) configuration. An extensive library of function codes and C, Batch 90, and UDF (user-defined function) language support allows the design of complex control strategies to fit any control application.

This section identifies and highlights only certain function codes that determine controller operation and are required for specific functions such as external device interface and programming and control language support. Refer to the ***Function Code Application Manual*** for extensive information about Harmony area controller function codes and capabilities:

- Types supported.
- Descriptions, outputs, and specifications.
- Memory utilization.
- Execution times.
- Listing by functional category.

Configuration Tools

The controller can be configured and tuned using any Symphony configuration tools that support editing function block configurations and modifying function code specifications. This includes, for example:

- Composer (2.0 and later).
- Conductor NT (2.3 and later).
- Conductor VMS (2.0 and later).

Using the Composer tools is the recommended method for creating and managing controller configurations. Refer to the Composer tools instructions for further explanation and specifics.

The ***Function Code Application Manual*** contains all of the information needed to design a control strategy and is required when using any configuration tool.

Software Licenses

The controller utilizes licensed software. A software key is necessary for proper operation of specific functions, with a specified licensed quantity. Refer to Appendix B for a description of the license entry program used to download software keys. The following functions are under license management control:

- Number of function blocks (4,000, 10,000, or 20,000).
- C language support.
- Batch 90 and UDF language support.

If the maximum number of licensed function blocks is exceeded during an add block operation, the controller will enter error mode. Additionally, if the maximum number of licensed function blocks is exceeded, upon transition to execute the controller will go into error mode. When the controller goes to error mode because of a function block license error the LCD message *Number of Licensed FBs exceeded* will appear.

Function Code 143 (Invoke C), Function Code 148 (Batch Sequence), and Function Code 190 (User Defined Function Declaration) are under software license control. If one of these function codes is added and the corresponding license is not present, the controller will go into error mode. Additionally, if any of these function codes exist in the function block configuration and the controller is placed into execute without the corresponding license present, the controller will go into error mode. When the controller goes into error mode because of a C license error the LCD message *C license not available* will appear. When the controller goes into error mode because of a Batch 90 or UDF license error the LCD message *Batch 90/UDF license not available* will appear.

Addressing

The Harmony area controller responds to a system address consisting of a loop number, node number, and module address. A nonredundant controller has two module addresses and a redundant controller has four module addresses:

Loop number	1 to 250
Node number	1 to 250

Module address	0 (primary node communication) 2 (primary controller) 1 (backup node communication) 3 (backup controller)

Example:

43-25-2 (primary controller)
43-25-3 (backup controller)

The communication module addresses are for compatibility. Use the primary controller module address when referencing the controller for configuration, tag definition, module details, etc.

User-definable function block addresses range from 30 to 31,998. The maximum number of configurable function blocks, however, depends on the purchased software license. The address range remains the same no matter what the maximum number of licensed function blocks.

Tuning

Tuning is the process of changing certain function code specifications while the controller executes. Not all specifications are tunable however. Refer to the specification tables in the ***Function Code Application Manual*** to determine whether a specification is tunable or not.

Function Codes

The process control strategy executed by a Harmony area controller is created using function codes. Function codes are fixed function algorithms that can monitor analog and digital inputs, process data, communicate among themselves, and send control output signals. Harmony I/O blocks and Harmony rack I/O modules handle the actual input and output for the controller. Function codes are also available to facilitate Cnet and peer-to-peer communication between controllers either in the same or different enclosures.

Function codes linked together and downloaded to a Harmony area controller create a function block configuration (Fig. 4-1). Each Harmony area controller is scalable from small to large

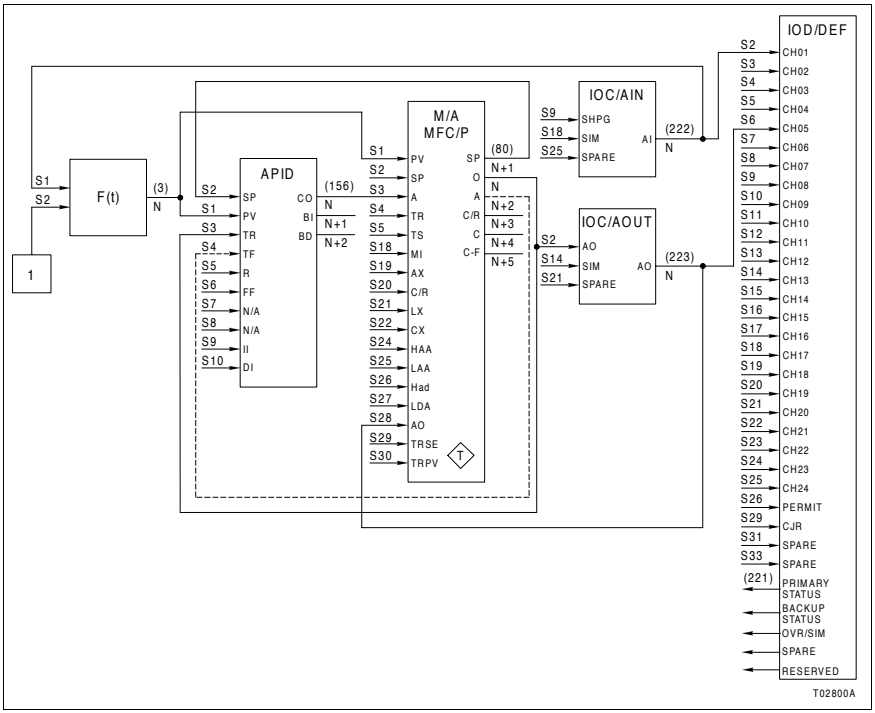

Figure 4-1. Function Block Configuration Example

function block capacity through software licensing (refer to ***Software Licenses*** in this section). Nonvolatility is provided for both the function code library and the user-defined function block configuration. The function codes are resident in flash-ROM memory and are retained even during a power loss. The function block configuration resides in NVRAM memory which is also retained during a power loss.

Controller Execution

Function Code 81 (Executive), Function Code 82 (Segment Control), and Function Code 90 (Extended Executive) define variables that affect controller operation, function code execution, and alarming. Additionally, the outputs of these blocks

provide important information concerning controller operation.

Function code 81 resides in fixed block address zero and occupies 15 function block addresses (0 to 14). Block address 15 contains one permanently configured function code 82 which occupies five function block addresses (15 to 19); seven additional segments (i.e., function code 82) can be configured. Function code 90 resides in fixed block 20 and occupies 10 function block addresses (20 to 29).

Exception Reporting

Exception reporting function codes automatically send process point data over the Cnet to make the data available to other system nodes such as human system interfaces. Tags defined in a tag database access the exception reported data. Exception reported data appears as dynamic values, alarms, and state changes. Exception reports are time-stamped to reflect their processing sequence. Refer to the ***Function Code Application Manual*** for a list of exception reporting capable function codes.

Exception reporting is automatic. Exception reports are sent periodically to update values, after a process point reaches a defined alarm limit or changes state, or after a significant change in value occurs. There are several alarm indicators that can be communicated in an exception report message.

Function Code 82 (Segment Control) and the individual exception reporting function codes define exception reporting parameters for the controller. Maximum and minimum report time parameters insure that an exception report is generated for both stable and rapidly changing data. The minimum report time parameter controls the quantity of exception reports a single rapidly changing point generates. The maximum report time parameter generates a periodic report of data items that change slowly or remain stable for extended periods. Additionally, a significant change parameter in function code 82, and in some of the exception reporting capable function codes, defines the percent of span a point value must change to cause a report to be generated.

NOTE: If a point goes into or out of alarm, the time parameters in function code 82 are ignored and the value is reported immediately.

The controller packages together exception reports having a common node destination. Packing places all exception reports for a destination (or multiple destinations) into one message. The controller sends them to other Cnet nodes as a single message. This reduces the number of transmissions required, and adjusts the message size for maximum Cnet efficiency.

Time-Synchronization

Cnet time synchronization establishes a common system time (absolute time) for all nodes on the loop. The controller includes a one-millisecond resolution time-stamp with data it acquires and stores.

Time-Sync Master

A node designated as the time-sync master maintains system time for all nodes on the Cnet loop. The time-sync master maintains the time by periodically issuing a time-sync message directed to each node on the loop. When the controller receives the time-sync message, it verifies then relays the time in the message to its I/O devices.

The controller processes a time-sync message only while in execute mode. The controller sends a time-sync message to its I/O devices when the device first starts up and after the controller receives a new time-sync message.

The controller can become the time-sync master on a loop through an arbitration process. Normally, however, a human system interface such as a Conductor workstation assumes the time-sync master role. The arbitration process insures that the node with the most accurate clock assumes the responsibility of maintaining the system time.

Time-Stamp

A time-stamp is included with all exception reported data from the controller. For all data the controller sources, this time-stamp is based on the system time. Externally sourced time-stamp data can also be written to the controller by a C program. The C program has the ability to write data including a time-stamp directly to an exception reporting function block.

Timestamp Filtr (Table 5-1) allows setting up how externally sourced time-stamps are handled by the controller. When the

filtering option is enabled, time-stamped data received from an external source is adjusted to controller time if the time varies from the controller time by more than ±5 seconds. When disabled, the externally sourced time-stamp is used.

I/O Communication

I/O Hnet and I/O expander bus communication can be active simultaneously if enabled allowing the controller to utilize both Harmony I/O blocks and Harmony rack I/O modules to control a process. Function Code 90 (Extended Executive) controls which combination of I/O interfaces are active. Two selections are available: enable Hnet and I/O expander bus, and enable I/O expander bus only.

There are a series of function codes identified in the ***Function Code Application Manual*** that are dedicated to process I/O interface and relate to Harmony I/O blocks and rack I/O modules.

Peer-to-Peer Communication

The following function codes support peer-to-peer controller communication:

- Function Code 25, Analog Input (Periodic Sample).
- Function Code 41, Digital Input (Periodic Sample).
- Function Code 63, Analog Input List (Periodic Sample).
- Function Code 64, Digital Input List (Periodic Sample).
- Function Code 95, Module Status Monitor.

Stations

Function Code 80 (Control Station) is used to interface IISAC01 Analog Control Stations. This function code provides options for basic, cascade, and ratio mode operation. Station control allows changing the mode, set point, ratio index, and control output from a human system interface.

Sequence of Events

The Harmony controller supports the following types of sequence of events (SOE) recording:

- Harmony I/O block HSOE:
  Function Code 221, I/O Device Definition.
  Function Code 224, Digital In/Channel.
  Function Code 241, DSOE Data Interface.
- Harmony rack DSOE:
  Function Code 241, DSOE Data Interface.
  Function Code 242, DSOE Digital Event Interface.

Simulation

The controller supports the I/O channel simulation available in Harmony I/O block function codes. It also supports the I/O expander bus simulation LAN using LMUSM01, LMUSM02, and LMUSM04 Universal Simulation Modules. *Simulation* (Table 5-1) is used to put the controller into simulation mode.

The simulation modules serve as links between the simulation network and the I/O expander bus. The simulation modules simulate the presence and behavior of Harmony rack I/O modules. They are configured by the simulation network API software when a simulation is started. The redirection of control system I/O to simulation I/O does not require any changes to the controller function block configuration.

Node Performance Statistics

Function Code 57 (Node Statistics Block) is located at function block address 31,999. This function code performs two functions. It marks the end of the function block configuration space, and its outputs provide node performance statistics (block outputs 32,001 through 32,019). The statistics can be observed to optimize controller operation and also for network diagnostics purposes. Statistics include:

- Total number of bytes transmitted by the node per second. This includes messages forwarded by the node.
- Total number of messages transmitted by the node per second.

- Total number of bytes received by (destined for) the node per second.
- Total number of bytes sent by (originated by) the node per second.
- Total number of messages received by the node per second.
- Total number of messages sent by the node per second.
- Total number of exception reports received by the node per second.
- Total number of exception reports sent by the node per second.
- Total number of GMI (general messaging interface) messages received by the node per second.
- Total number of GMI messages sent by the node per second.
- Percentage of node processing power currently being used.
- Total number of bytes transferred from the network I/O to the CPU per second.
- Total number of bytes transferred from the CPU to the network I/O per second.
- Total number of messages transferred from the network I/O to the CPU per second.
- Total number of messages transferred from the CPU to the network I/O per second.
- Total number of bytes received from the peer-to-peer Hnet network per second.
- Total number of bytes sent to the peer-to-peer Hnet network per second.
- Total number of messages received from the peer-to-peer Hnet network per second.
- Total number of messages sent to the peer-to-peer Hnet network per second.

C Language Support

The controller provides the ability to download and execute a C language program. The C programming environment provides an interface between a user program and the module function codes. The RS-485 and RS-232-C serial ports are available for C program application usage. The C application tool (CAT) is needed to compile then download the C program.

The following function codes support C program capability:

- Function Code 137, C and BASIC Program Real Output with Quality.
- Function Code 138, C and BASIC Program Boolean Output with Quality.
- Function Code 143, Invoke C.
- Function Code 144, C Allocation.

Batch 90 Language Support

The Batch 90 language provides sequential control for batch applications. Any function code can be declared and its value read by a batch program. The following function codes along with the Batch 90 application software support batch program capability:

- Function Code 137, C and BASIC Program Real Output with Quality.
- Function Code 138, C and BASIC Program Boolean Output with Quality.
- Function Code 148, Batch Sequence.
- Function Code 219, Common Sequence.
- Function Code 220, Batch Historian.

There are several additional function codes that perform various batch functions.

UDF Language Support

The UDF language is used primarily to create function blocks that perform unique algorithms. Any function code can be

declared and its value read by a UDF program. The following function codes along with the UDF application software support UDF program capability:

- Function Code 190, User Defined Function Declaration.
- Function Code 191, User Defined Function One.
- Function Code 192, User Defined Function Two.
- Function Code 193, User Defined Data Import.
- Function Code 194, User Defined Data Export.
- Function Code 198, Auxiliary Real User Defined Function.
- Function Code 199, Auxiliary Digital User Defined Function.

Firmware

The Harmony area controller firmware runs in flash-ROM memory. This provides the ability to upgrade controller firmware over Cnet without having to perform physical modifications to each controller such as replacing ROM chips or swapping modules. The Composer tools provide the ability to download firmware over the network. Refer to the Composer, ***Automation Architect*** instruction for the procedures.

Use *Read Firmware Rev* (Table 5-1) to determine the current controller firmware. This option shows the firmware revision levels for both the CPU and network I/O boards.

NOTE: Online configuration must be disabled to perform firmware download from Composer.

Online Configuration

Online configuration allows changing the function block configuration during controller execution without interrupting the control process. This method can be used to modify the configuration without having to take the controller offline before making any changes. Online configuration requires redundant controller modules. The ability to perform online configuration can be enabled or disabled through *On-Line Config* (Table 5-1).

Operation

In redundant controller module configurations, the primary module executes the process control logic while the backup module tracks the configuration of the primary. Online configuration allows removing the backup module from the tracking mode and making configuration changes without interrupting the process control operation of the primary module. It also supports conventional offline changes. When the backup module has been reconfigured, it can assume control with the new configuration while the original primary module assumes the backup role.

During startup of the new configuration in the backup module, it uses the current values of all process outputs in the primary module. This feature permits bumpless transfer of control to the new configuration.

Procedure

Composer provides functions to guide the operator through the online configuration process. These functions use the enhanced status information contained in byte 10 of the module status report. Refer to the Composer documentation for specifics.

Important

Online configuration allows function blocks to be added, modified, or deleted anywhere within a control segment. Unless stated otherwise, modification should be limited to changes that do not affect the function code checkpoint utilization. Refer to the checkpoint utilization table in the ***Function Code Application Manual*** to determine utilizations that will change due to function code specification changes. Making changes that affect the checkpoint utilization could lead to a process upset.

Table 4-1 describes the controller conditions that occur during the online configuration process. The table assumes a redundant controller in execute mode.

Table 4-1. Online Configuration Conditions

Step	Module[1]	LCD Message	Description
1	Primary	Primary: Execute	Normal operating mode for primary controller module.
	Backup	Backup: Ready	Normal operating mode for backup controller module.

Table 4-1. Online Configuration Conditions *(continued)*

Step	Module[1]	LCD Message	Description
2	Primary	Primary: Execute	Normal operating mode for primary controller module.
	Backup	Backup: Online Config No Changes Made	Backup controller module changed to online configuration mode. No changes have been made to the configuration.
3	Primary	Primary: Execute	Normal operating mode for primary controller module.
	Backup	Backup: Online Config Reconfigured	Configuration changes are being made to the backup controller module. An error message will appear if an error exists in the new configuration.
4	Primary	Primary: Execute	Normal operating mode for primary controller module.
	Backup	Backup: Online Config New Configuration Ready	Configuration changes complete in backup controller module. Backup module is in execute mode with the new configuration and is ready to be tested on the process. **NOTE**: The test on process can be initiated by a reset of the backup module.
5	Primary	Primary: Execute	Normal operating mode for primary controller module.
	Backup	Backup: Online Config Starting New Configuration	Test mode; backup controller module is acquiring current process data from primary controller module in preparation for testing the changes on the process.
6	Primary	Backup: Standby Old Configuration	Test mode; primary controller module is taken offline with original configuration and process data preserved. This allows returning to original configuration.
	Backup	Primary: Execute New Configuration	Test mode; backup controller module assumes primary controller module role with new configuration and current process data. **NOTE**: Resetting the new primary module (this module) abandons the new configuration. Resetting the new backup module accepts the new configuration.
7	Primary	Backup: Ready	Normal operating mode for backup controller module (previously primary controller module).
	Backup	Primary: Execute	Normal operating mode for primary controller module (previously backup controller module).

NOTE:
1. In this column, backup always refers to the original backup controller module and primary always refers to the original primary controller module. A role reversal occurs during the online configuration process as described in the table.

Operating Procedures

Section 5

Introduction

This section details the Harmony area controller (HAC) front panel features and HAC operation.

Controller Module

Figure 5-1 shows the controller front panel. The front panel communicates a considerable amount of information. At a glance, the following information can easily be discerned:

- Hardware type.
- Operating mode.
- Primary/backup status.
- Operating status.
- Power status.

NOTE: The diagnostic port located behind the front access cover is for Bailey service personnel use only. The port has the following fixed characteristics: 9,600 baud, no parity, eight data bits, and one stop bit.

LCD Screen and Keypad

A liquid crystal display (LCD) and three-key keypad are standard front panel features of the controller module. The LCD screen and keypad operate together to provide local operator interface to information such as controller type, status messages, and setup options. The LCD screen provides four lines of text. It has two primary display presentations: main status display and main menu display.

Main Status Display

The main status display (Fig. 5-2) is the default display when the controller first starts up.

The bottom two lines of the main status display are the status lines. The last status message that occurred displays on these lines. If there is more than one message the status line blinks. The complete list of status messages can be viewed by

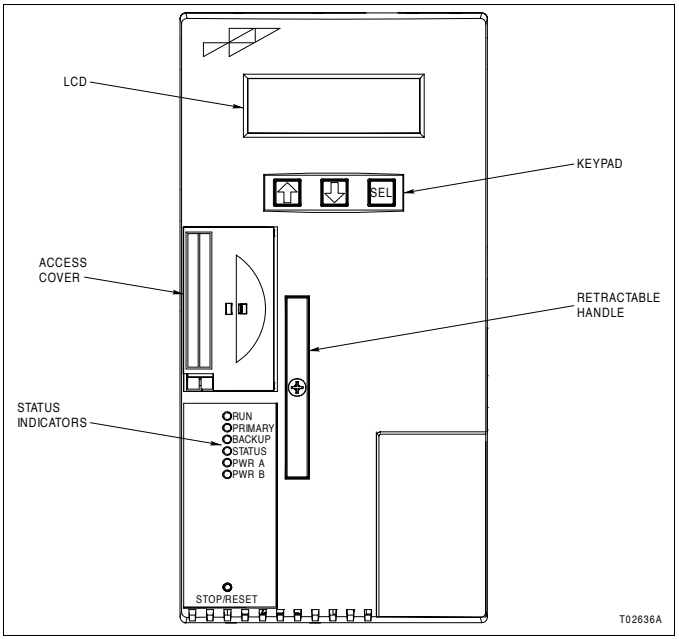

Figure 5-1. Controller Module Front Panel

Figure 5-2. Main Status Display

selecting *Status*. Table 6-3 provides an explanation of the status messages and gives corrective actions if necessary.

Main Menu Display

The main menu display (Fig. 5-3) provides the ability to select various controller options. Several different menu options are available from this display:

- Setup.

- Status.
- Configuration.
- Options.
- Diagnostics (for Bailey service personnel use only).
- Save setup.

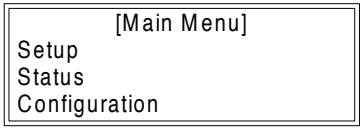

Figure 5-3. Menu Display – Main Menu

Table 5-1 summarizes the main menu options. The parameters that can be modified using these options depend on the current controller operating mode. Refer to ***Operating Modes*** in this section for an explanation.

Table 5-1. Main Menu Options

Main Menu	Submenu/Field	Description	Default	Mode[1]		Save[2]
				E	C	
Setup	Select language	Scroll/select list used to choose the screen display language. Refer to ***Language Selection*** in this section.	English	•	•	•[3]
	Loop address	Loop address edit field. Valid range is from 1 to 250. The address must be unique.	0		•	•
	Node address	Node address edit field. Valid range is from 1 to 250. The address must be unique.	0		•	•
	Loop mode	Scroll/select list used to choose the Cnet mode: 10 MHz or 2 MHz. All nodes on a loop must operate with the same mode.	10 MHz		•	•
	Read electronic IDs	Scroll list showing the electronic IDs for all internal circuit boards (*CPU*, *PIO*, *NIO*) and the docking station backplane (*Bck*).	—	•	•	
	Read licenses	Scroll list showing purchased licenses: maximum number of user-configurable function blocks, and programming language support (C and Batch 90/UDF).	—	•	•	
	Read firmware revision	Scroll list showing the firmware revisions for the *CPU* and network I/O (*NIO*) boards.	—	•	•	
Status	None	Scroll list of status messages.	—	•	•	

Table 5-1. Main Menu Options *(continued)*

Main Menu	Submenu/Field	Description	Default	Mode[1]		Save[2]
				E	C	
Configuration	Module mode	Scroll/select list used to change between execute and configure modes. Refer to ***Operating Modes*** in this section.	Configure	—	—	
	Initialize NVRAM	Scroll/select list. Initializing NVRAM erases (destroys) any existing function block configuration; this leaves the C, batch, and UDF files and the file system intact. Refer to ***NVRAM Initialization*** in this section.	—		•	
	Format NVRAM	Scroll/select list. Formatting NVRAM erases (destroys) any existing function block configuration and C, batch, and UDF files. It also initializes the file system. Refer to ***NVRAM Formatting*** in this section.	—		•	
Options	Screen saver	Screen saver time edit field. Valid range is from 1 to 31 hours or 0 to turn screen saver off. Refer to ***Screen Saver*** in this section.	24 hrs	•	•	•[3]
	Online configuration	Scroll/select list used to enable or disable online configuration ability. Selectable from the primary module only. Refer to ***Online Configuration*** in Section 4.	Enabled		•	•
	Segment modification	Scroll/select list used to permit segment modification. Permitting removes the tune and modify lock set in function code 82, specification S1. Refer to ***Segment Modification*** in this section.	—		•	
	Simulation	Scroll/select list used to disable simulation mode or enable INFI 90 OPEN I/O expander bus simulation or Symphony Hnet simulation. Refer to ***Simulation*** in Section 4. **Note**: Setting this option requires a module reset.	Disabled		•	
	Time-stamp filter	Scroll/select list used to enable or disable exception report time-stamp filtering. Refer to ***Time-Stamp*** in Section 4.	Enabled		•	•
	Compact configuration[4]	Scroll/select list used to turn configuration compacting on or off. Compacting moves configured function blocks to the top of the NVRAM while moving free space to the bottom. When on, the configuration will be compacted each time the controller starts up.	No		•	•

Table 5-1. Main Menu Options *(continued)*

Main Menu	Submenu/Field	Description	Default	Mode[1]		Save[2]
				E	C	
Diagnostics	Service	For Bailey service personnel use only. Use of the service diagnostics may affect proper controller operation.				
		CPU ROM checksum routine	On		•	•
		CPU NVRAM checksum routine	On			
		NIO ROM checksum routine	On			
		File system check	On			
		Memory management unit enable/disable	On			
		Branch cache enable/disable	On			
		Data cache enable/disable	On			
		Instruction cache enable/disable	On			
		Loop startup mode	Off			
Save setup	Save user setup	Saves all changes to NVRAM memory and resets the controller. Select this option as the last step after making any changes.	—		•	
	Save default setup	Restores the default settings, saves the changes to NVRAM memory, and resets the controller.	—		•	

NOTES:
1. E = execute; C = configure. The controller needs to be in the indicated operating mode to make a change. Use *Configuration* > *Module Mode* to change the operating mode.
2. *Save Setup* > *Save User Setup* required to implement and save the change permanently. Some changes take affect immediately but are still temporary until the save option is selected. Any saved changes affect both the primary and the backup controller modules.
3. A change to the option takes affect immediately but is temporary until *Save Setup* > *Save User Setup* is selected.
4. Leaving this option on causes the configuration to be compacted every time the controller module is reset which increases the startup time. This increase becomes more substantial as the size of the configuration increases. Do not leave this option on longer than necessary. Turning the option off stops any further compacting operations; it does not uncompact any previously compacted configuration.

Status Indicators

The front panel has several operating status indicators. Table 5-2 describes the indicators. Refer to Table 6-1 for error condition corrective actions.

Table 5-2. Front Panel Status Indicators

Indicator	State	Description
RUN	On green	Execute mode; normal operation.
	Flashing green[1]	Configure mode; normal operation.
		Error mode; configuration error.
		NVRAM checksum error; controller module continues to operate from RAM.

Table 5-2. Front Panel Status Indicators *(continued)*

Indicator	State	Description
RUN *(continued)*	Flashing green[1] *(continued)*	File system error.
		Backup controller halted due to NVRAM checksum error.
		Backup controller module NVRAM overrun; primary downloading configuration to backup again.
	On red[1]	Offline mode; controller module still responds to LCD menu changes. Typically occurs during some setup option changes.
		Fail mode; controller module has halted: 1. Stop/reset pressed. 2. Diagnostics have detected a hardware problem. 3. Machine fault timer time-out.
	Off	No power.
PRIMARY	On green	Primary module.
	On red	Primary module in offline or fail mode; execution segments are no longer running.
		Momentarily on red; Cnet communication has stopped and a restart of the network I/O is being attempted.
	Off	Backup module.
BACKUP	On green	Backup module in hot-standby; module has received configuration.
	On red	Backup module in offline or fail mode; current configuration will not run.
		Momentarily on red; Cnet communication has stopped and a restart of the network I/O is being attempted.
	Flashing red	Backup module waiting for configuration from primary.
	Off	Primary module.
STATUS	On green	Normal; no error conditions exist.
	On red	Nonfatal error has occurred; the module is still functioning properly. Turns on when there is a status message present.
	Off	No power.
PWR A	On	24 VDC power A good.
	Off	24 VDC power A bad.
PWR B	On	24 VDC power B good.
	Off	24 VDC power B bad.

NOTE:
1. If possible, a message indicating the problem will appear on the LCD screen; refer to Section 6 for corrective actions.

Termination Units

Figures 5-4 and 5-5 show the network termination unit (TU) and communications TU front panels respectively. The units are mounted in the docking station TU housing and are located behind an access door. TU LEDs show activity for the various serial channels.

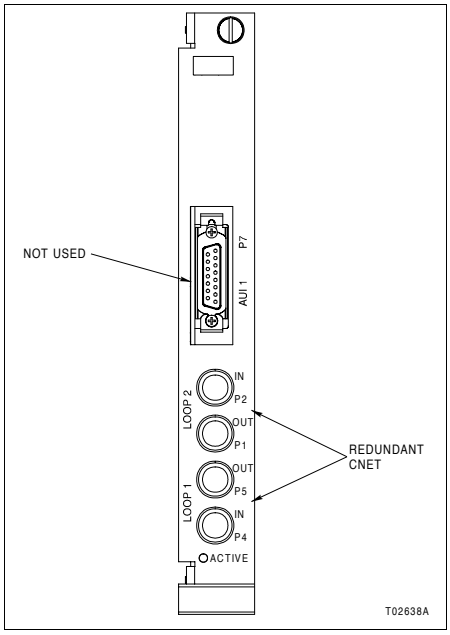

Figure 5-4. Network TU Front Panel

Controller Operation

This section details the controller:

- Operating modes.
- Startup.
- Stop/reset button.
- LCD screen and keypad operation.
- Language selection.

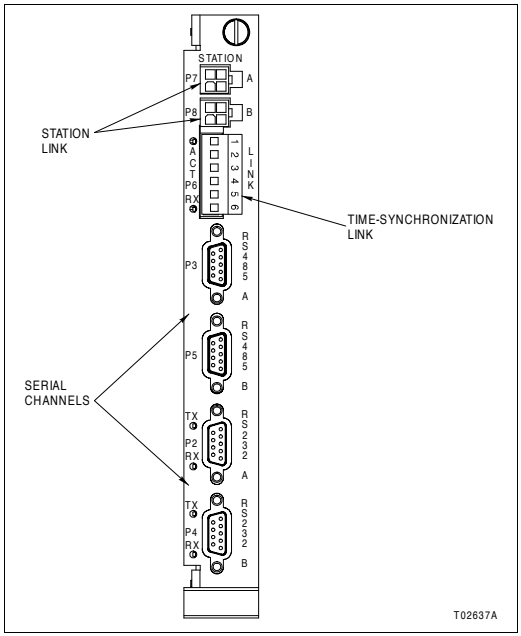

Figure 5-5. Communication TU Front Panel

- NVRAM initialization.
- NVRAM formatting.

Operating Modes

The Harmony area controller has five operating modes: execute, configure, error, fail, and offline. The controller mode can be changed between execute and configure or from error to configure using a front panel LCD menu option, Composer tools options, or Conductor human system interface options. The controller reports its current operating mode in status reports made accessible to Cnet nodes.

Table 5-3 lists the possible operating modes for the primary and backup controller modules. The LCD screen will indicate primary or backup operation and mode.

Table 5-3. Controller Module Modes

Mode		Description
Offline		Intermediate operating mode. Refer to ***Offline*** in this section.
Primary	Module Startup	Normal startup condition.
	Execute	Normal operation. Refer to ***Execute*** and ***Configure*** in this section.
	Configure	
	Error	Refer to ***Error*** in this section.
	Fail	Refer to ***Fail*** in this section.
	Simulation	Refer to ***Simulation*** in Section 4.
Backup	Module Startup	Normal startup condition.
	Downloading	Normal startup condition; downloading information from primary module.
	Ready	Normal operation; hot standby.
	Online Config	Refer to ***Online Configuration*** in Section 4.
	Standby	

If an NVRAM error is detected, the RUN indicator flashes, but the controller module continues to operate. This is possible because a copy of the configuration is held in and executed from DRAM memory. The next time the module is reset however, it will not start up but instead will fail with an NVRAM error.

Execute

Execute mode is the normal operating mode. In this mode the controller communicates with I/O blocks, rack I/O modules, other controllers, and other Cnet nodes. It executes its control configuration, reads inputs, and updates outputs. The controller also processes exception reports, and configuration (tune) and control messages. Tunable function block specifications can be adjusted while in this mode. The RUN, PRIMARY/BACKUP, and STATUS indicators lit green identify a properly executing controller.

Configure

Configure mode is used for several purposes. The RUN indicator flashes green when in configure mode. The controller must be in configure mode to change certain parameters through the LCD menu options (refer to Table 5-1). It must be in

configure mode to download and modify the function block configuration. All function block specifications can be modified in this mode. The controller receives configuration commands over Cnet to modify configuration data stored in NVRAM memory.

Error

The controller goes into error mode whenever the built-in system diagnostics detect a configuration error. If this type of error is detected, the controller module halts and displays an error message on the LCD screen. Refer to Table 6-3 for a description of the error messages and corrective actions. The RUN indicator flashes green when in error mode.

The controller checks the function block configuration when the mode is changed from configure to execute. If the controller enters error mode as a result, it must be returned to configure mode to correct any configuration errors.

Fail

The controller goes into fail mode whenever the built-in system diagnostics detect a hardware failure. If this type of error is detected, the controller module halts and displays an error message on the LCD screen, if possible. Refer to Table 6-3 for a description of the error messages and corrective actions. The RUN indicator lights red when in fail mode.

Offline

Offline mode is an intermediate operating mode that allows the controller module to respond to LCD menu changes. The controller module typically enters this mode during implementation of certain LCD menu option changes. For example, the controller module will enter offline mode during a phase of the initialize NVRAM sequence. It can also enter this mode for certain hardware errors. To indicate offline mode, the RUN indicator lights red and the LCD screen will show *OFFLINE MODE* and some message.

Startup

A startup sequence occurs after controller module power up or reset. Plugging the controller module into the docking station connects power and begins the startup. The controller

performs a series of online diagnostics tests, checks its configuration, and builds the necessary databases during startup. The module starts up in whatever mode it was in before a reset.

The LCD screen shows *Module Startup...* and a progress bar during the startup sequence. A good startup sequence completes with RUN and PRIMARY or BACKUP lit green. Also, the LCD screen will show the current module mode (i.e., configure, execute, ready, etc.)

> **NOTE:** PWR A and PWR B are not affected by the startup sequence and should always be on.

If the controller module detects any problems during startup, it will stop, display an error message indicating the problem if possible, and show error mode status indicators (refer to Table 5-2). Refer to Tables 6-2 and 6-3 for a description of the error messages and corrective actions.

Stop/Reset

> **NOTE:** Do ***not*** remove an operational controller module under power until the stop/reset button has been pressed once and the module has stopped (i.e., RUN on red). This allows the module to perform an orderly shutdown. In a redundant configuration, control passes to the backup module after the primary stops.

Use the STOP/RESET button (Fig. 5-1) to interrupt configuration execution and to initiate a hardware reset. The button is accessed through the small opening on the front panel. A thin rod, preferably nonmetallic, is required to press the button.

First Press Stop

Press the button once to halt operation. The electronics conducts an orderly shutdown after stop is initiated to prevent any inadvertent process upsets:

1. Save process configuration.
2. Complete any nonvolatile memory write operations.
3. Transfer control from the primary controller module to the backup module in redundant configurations.
4. Deactivate all communication links.
5. Light RUN red.

Second Press Reset

Press the button a second time to initiate a hardware reset. A hardware reset is required to recover from a controller module time-out or a manual stop (single press). After the hardware reset completes, the controller module then begins its startup sequence. Refer to ***Startup*** in this section.

NOTE: If the controller module has already stopped due to an error (i.e., RUN on red), a single press resets the module.

LCD Screen and Keypad Operation

The LCD screen displays four lines of text. It provides operational feedback as dynamically updated data and gives access to menu options for setting up operation. Text can be scrolled and edit fields can be modified using the keypad. Depending on the type of display, two different keypad operations can be performed: scroll/select and edit.

Menu Mode

Press any key while the main status display (Fig. 5-2) is present on the screen. Either the main menu will appear (Fig. 5-3) or the last display selected will appear. The LCD screen returns to the main status display after approximately 30 seconds of no keypad activity or by pressing the up-arrow and down-arrow keys simultaneously. The up-arrow and down-arrow keys can be pressed to return to the main status display at any time and from any screen display.

Scroll/Select

Use the up-arrow and down-arrow keys to move the cursor and scroll through screen text. Another menu or editing display may be associated with each text string in a list. Press **SEL** to view the associated submenu or display for the currently selected text string. Submenus can be traversed in the same way.

To return to a previous menu, either press **SEL** or if available choose *Previous Menu*. The previous menu option is the last item in a list and may not be visible unless the text is scrolled.

Edit

When a display containing an edit field appears, *[Sel]* is present in the lower right corner of the display. The edit field may be blank or it may contain an initial value.

To select and edit data:

1. Use the down-arrow key to move the ∧ cursor right to the desired character to edit. Use the up-arrow key to move the cursor left.

2. Press **SEL**. *[Edit]* should appear in the lower right corner of the display.

3. Press the up-arrow and down-arrow keys until the desired character is visible at the cursor location.

4. Press **SEL**. This will enter the character, then advance the cursor to the next character location.

5. At this point, the display is still in edit mode. Either continue editing by repeating Steps 3 and 4, or press **SEL** to exit edit mode.

6. Select either *Accept* or *Reject* then press **SEL**, if necessary.

7. Depending on the field the controller will either immediately operate with the parameters just defined or will require a save before the change is implemented. Refer to Table 5-1 for a description of each field's operation and to determine its save requirements.

8. Changes are not permanently stored in memory until saved. Any changes will be lost if the controller module is removed or powered down. To permanently store any changes, select *Save Setup* > *Save User Setup* > *Yes*. This writes the values to NVRAM memory and resets the controller.

NOTES:

1. A save is not required when changing module mode.

2. Any saved changes affect both the primary and backup controller modules.

Screen Saver

To preserve the life of the LCD screen and its backlight, a built-in screen saver turns off both after a user-specified time. Select *Options* > *Scrn Saver (Hrs)* to set the screen saver time or to turn the screen saver off (refer to Table 5-1).

LCD Contrast

To adjust the LCD contrast:

1. Press and hold **SEL**.

2. Press and hold the up-arrow key to increase contrast or the down-arrow key to decrease contrast.

3. Release the keys when at the desired contrast.

Language Selection

Select Language allows choosing an alternate language for the LCD screen. English is the default language. To select an alternate language:

1. With the main status display on the screen press **SEL** three times. This will change to the main menu display, then choose *Setup* > *Select Language*.

2. Use the arrow keys to choose the desired language.

3. Press **SEL**. The text should immediately change to the alternate language selected.

NVRAM Initialization

NVRAM initialization erases the function block user space in controller memory and restores a known default configuration. An initialization first clears nonvolatile memory space, then restores a base set of function codes. An NVRAM initialization can only be performed while the controller is in configure mode. The controller can be initialized in two ways.

A software command from the Composer tools (initialize option) can be used to start the NVRAM initialization. Composer provides the ability to change the module mode before starting the initialization and also indicates completion.

An NVRAM initialization option is available from the LCD menus. To use the menu option method of initialization:

1. Verify the controller module is in configure mode. If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

2. Select *Configuration* > *Init NVRAM* > *Yes*.

3. After the screen shows *OFFLINE MODE*, select *Configuration* > *Init NVRAM* > *No*.

4. Select *Save Setup* > *Save User Setup* > *Yes*.

NVRAM Formatting

NVRAM formatting:

- Erases the function block user space in controller memory.
- Erases C, batch, and UDF files.
- Initializes the file system.
- Restores a known default configuration.

A new controller module should be formatted before being used. To format the controller module:

1. Verify the controller module is in either configure mode or offline mode. If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

2. Select *Configuration* > *Format NVRAM* > *Yes*.

3. After the screen shows *OFFLINE MODE*, reset the controller module by pressing the STOP/RESET button.

Segment Modification

A segment modification option provides the ability to remove the tune and modify lock set in segment control function codes. The option is a permit that resets function code 82, specification one to zero (tune and modify allowed). To use the option, select *Options* > *Segment Mod* > *Permit*.

The permit affects all segment control function codes in the controller function block configuration. Up to eight can be

defined. Refer to *Controller Execution* in Section 4 for additional information.

Station Interface

The Harmony area controller can interface IISAC01 Analog Control Stations in two ways: remote Hnet and local station link.

Remote Hnet Operation

The Hnet mode of operation requires the IISAC01 stations to be connected through an I/O block (CIO-100, CIO-110). This mode of operation allows stations to be placed at greater distances from the controller because the I/O block contains the physical RS-485 serial link to the station. The controller can communicate with a total of 128 IISAC01 stations connected to a total of 64 I/O blocks. Stations connected through an I/O block operate at a 40-kilobaud communication rate. Depending on the connection method, the IISAC01 stations can operate as indicator (no bypass) and bypass stations.

NOTE: The station maximum of 128 stations assumes that only Hnet communication mode is used.

Local Station Link Operation

The local station link is an RS-485 serial channel that operates at a 40-kilobaud communication rate. This station link requires the controller to be cable connected from its communication termination unit to an NTCS04 termination unit. The communication TU has two station link connectors. The IISAC01 station connects to the NTCS04 termination unit.

The controller can communicate with up to 64 stations over the local station link. These stations can be associated with up to 32 rack I/O modules (IMCIS12 or IMQRS12). Depending on the connection method, the IISAC01 stations can operate as indicator (no bypass) and bypass stations.

NOTE: The station maximum of 64 stations assumes that only local station link communication mode is used.

Bypass Stations

The controller supports bypass stations. A current bypass station requires either a CIO-100 block, or an IMCIS12 or IMQRS12 module and NTCS04 termination unit. An electric drive/pulse positioner bypass station requires CIO-100 and CIO-110 blocks, or an IMCIS12 or IMQRS12 module and NTCS04 termination unit.

Maintenance

Section 7

Introduction

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. 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 in establishing good preventive maintenance practices. Select the minimum steps required to meet the cleaning needs of your system.

Personnel responsible for maintenance should be familiar with the Harmony area controller, have experience working with process control systems, and know what precautions to take when working on live AC/DC systems.

Preventive Maintenance Schedule

Table 7-1 is the preventive maintenance schedule for the Harmony area controller. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Some tasks in Table 7-1 are intuitive or self explanatory. Instructions for tasks that require further explanation are covered in the indicated procedure section.

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

Table 7-1. Preventive Maintenance Schedule

Task	Procedure	Frequency
General cleaning. Use a lint-free cloth and mild, all-purpose, commercial spray cleaner to remove dirt, fingerprints, and grease from the equipment (e.g., LCD screen, keypad, housing assembly). Spray the cleaner on the cloth and not directly on the equipment.	N/A	As required
Check enclosure air filters. Clean or replace them as necessary. Check the air filter more frequently in excessively dirty environments.	N/A	3 months
Check controller faceplate and housing for dust. Clean as necessary using an antistatic vacuum. Insure air vents are free of dust and lint.	N/A	
Check all signal, power, ground, and cable connections associated with the controller; verify they are secure.	PR20	
Complete all tasks in this table.	N/A	Shutdown

Repair and Replacement

Section 8

Introduction

This section explains repair and replacement procedures for the Harmony area controller (HAC).

Repair

Harmony area controller repair is limited to assembly replacement. If a controller component such as the controller module fails, remove and replace it with another. Do not attempt to replace discrete components in any Symphony system assembly including the controller.

Replacement

The replacement procedures for most parts and assemblies are intuitive. Figure 8-1 is a replacement flowchart for those parts and assemblies that need some explanation.

In the flowchart, each flowchart block represents a single task. The PR code in the flowchart block identifies the procedure section that describes the steps to complete the indicated task. Some steps are self-explanatory and have no related procedure section. Complete all steps given in a procedure section before continuing to the next flowchart block. The procedure sections are located towards the back of the instruction.

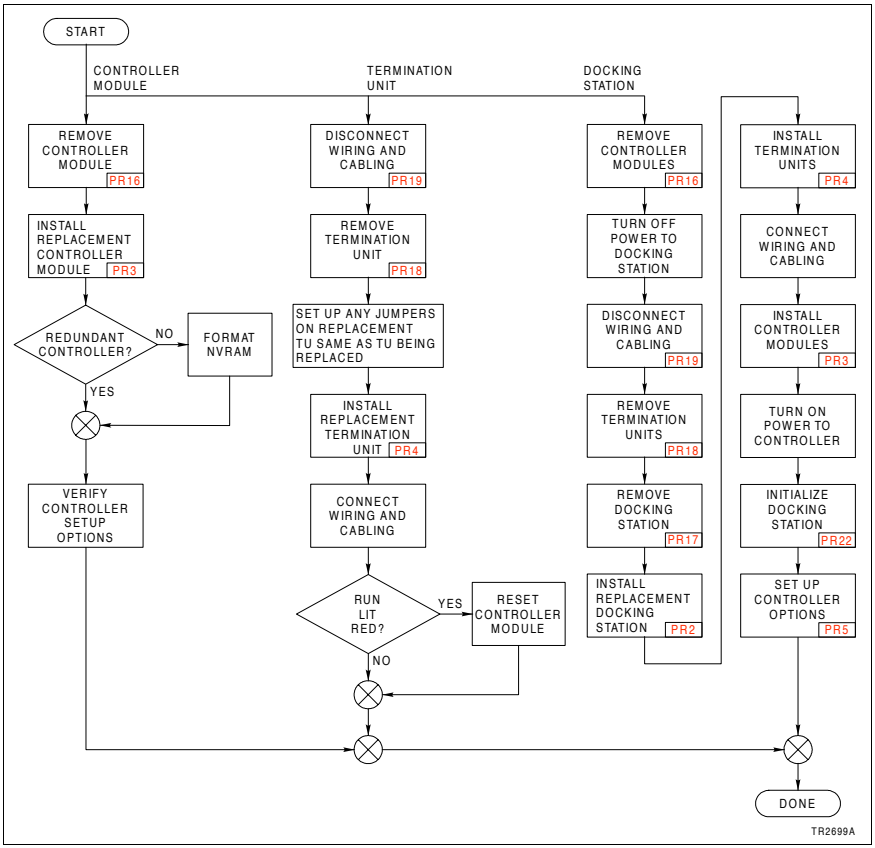

Figure 8-1. Replacement Flowchart

Replacement and Spare Parts

Section 9

Introduction

This section provides installation, replacement, and spare part nomenclature and part numbers. Contact Bailey for help determining the quantity of spare parts to keep on hand for your particular system.

Controller Hardware Nomenclature

Tables 9-1 and 9-2 list the Harmony area controller hardware nomenclatures: controller module and docking station.

Table 9-1. Docking Station Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
P	**-**	**H**	**C**	**-**	**D**	**O**	**C**	**-**	_	_	_	_	_	_	_	_	**Docking Station Base Nomenclature**
																	Docking Frame Option
									0	_	_	_	_	_	_	_	Without docking station frame
									2	_	_	_	_	_	_	_	Docking station frame[1]
																	Backplane
										0	_	_	_	_	_	_	Without backplane
										2	_	_	_	_	_	_	Backplane for Harmony area controller
																	Reserved for Future Use
											0	_	_	_	_	_	Must be zero
																	Network Termination Option
												0	_	_	_	_	Without termination unit
												1	_	_	_	_	Single termination unit
												2	_	_	_	_	Two termination units
																	Communication Termination Option
													0	_	_	_	Without termination unit
													1	_	_	_	Single termination unit
																	Reserved for Future Use
														0	0	0	Must be zeros

NOTE:
1. Power cable is included to connect controller module to power source – 1.4 meter (4.5 feet) in length. Refer to Table 9-5 for part number.

Table 9-2. Controller Module Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
P	**-**	**H**	**C**	**-**	**P**	**L**	**T**	**-**	**2**	**0**	**2**	**2**	**1**	**1**	**0**	**0**	**Controller Module Nomenclature**

Controller Software Nomenclature

Table 9-3 lists the Harmony area controller software nomenclature.

Table 9-3. Controller Software Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
S	**-**	**H**	**B**	**-**	**A**	**C**	**T**	**-**	**X**	**-**	_	_	_	_	_	_	_	_	_	_	**Base Software Nomenclature**
																					Number of Function Blocks
											0	_	_	_	_	_	_	_	_	_	4,000
											1	_	_	_	_	_	_	_	_	_	10,000
											2	_	_	_	_	_	_	_	_	_	20,000
																					C Language Run-Time License
												0	_	_	_	_	_	_	_	_	Disabled
												1	_	_	_	_	_	_	_	_	Enabled
																					Batch 90/UDF Run-Time License
													0	_	_	_	_	_	_	_	Disabled
													1	_	_	_	_	_	_	_	Enabled
																					Reserved for Future Use
														0	0	0	0	_	_	_	Must be zeros
																					Distribution Media
																		0	_	_	CD-ROM
																					Revision Level
																			x	x	Example: A0 = version A.0

Cable Nomenclature

Table 9-4 lists cable nomenclature.

Table 9-4. Cable Nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
N	**K**	**E**	**B**	**0**	**3**												**Controller to MMU I/O Expander Bus Cable** - 1.0 m (3.3 ft)

Table 9-4. Cable Nomenclature *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
N	**K**	**S**	**E**	_	_	**-**	_	_	_								**Controller to NTCS04 Station Link Cable**
																	Cable Type
				0	3	_	_	_	_								non-PVC
				1	3	_	_	_	_								PVC
																	Cable Length
							x	x	x								1 to 200 for 0.5 to 61.0 m (1 to 200 ft)
N	**K**	**T**	**L**	**0**	**1**	**-**	_										**Cnet Termination Cable**
																	Cable Length
							x										1 = 305 mm (12 in.) 3 = 0.9 m (3 ft)
N	**K**	**T**	**T**	_	_	**-**	_										**Node to Node Cnet Termination Cable**
																	Cable Type
				0	1	_	_										non-PVC
				1	1	_	_										PVC
																	Cable Length
							3										0.9 m (3 ft)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**H**	**A**	**C**	**1**	**0**	**0**	**0**	_	**Controller to Block Mounting Column Hnet Cable**
																	Cable Length
																1	850 mm (33.5 in.)
																2	1.8 m (6 ft)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**H**	**A**	**C**	**1**	**T**	**0**	**0**	_	**Redundant Controller to Block Mounting Column Hnet Cable**
																	Cable Length
																1	2.3 m (7.4 ft)
																2	4.2 m (13.8 ft)
																3	6.3 m (20.6 ft)
																4	8.2 m (27.0 ft)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**P**	**T**	**P**	**1**	**0**	**0**	**0**	_	**Redundant Controller to Redundant Controller Hnet Cable**
																	Cable Length
																1	0.8 m (2.6 ft)
																2	2.5 m (8.2 ft)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**P**	**T**	**P**	**1**	**T**	**0**	**0**	**1**	**Redundant Controller Module Hnet Cable** - 301 mm (11.9 in.)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**P**	**T**	**P**	**2**	**0**	**0**	**0**	**1**	**Nonredundant Controller to Nonredundant Controller Hnet Cable** - 1.5 m (4.9 ft)

Table 9-4. Cable Nomenclature *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**P**	**T**	**P**	**3**	**0**	**0**	**1**	**A**	**Hnet Cable to Hnet Cable Adapter** - 100 mm (3.9 in.)
P	**-**	**M**	**K**	**-**	**H**	**R**	**M**	**-**	**P**	**W**	**R**	**1**	**0**	**0**	**0**	_	**Power Cable Extension**[1]
																	Cable Length
																x	1 to 8 for 1.0 to 8.0 m (3.3 to 26 ft)

NOTE:
1. Extends the power cable that is attached to the docking station.

Miscellaneous Parts

Table 9-5 lists miscellaneous part numbers.

Table 9-5. Miscellaneous Parts

Number	Part
6643633A1	Docking station power cable
EL 2089	M6 Phillips-head screw (CAB-04/12)
EL 2094	M6 captive nut (CAB-04/12)
NIDHA16008	10-32 × ½-inch, Phillips-head screw (CAB-01)
NMPCC16002	10-32 cage nut (CAB-01)

Hardware Drawings

Appendix A

Dimensions

This section provides drawings showing dimensions for the controller module (Fig. A-1) and the docking station (Fig. A-2) of the Harmony area controller.

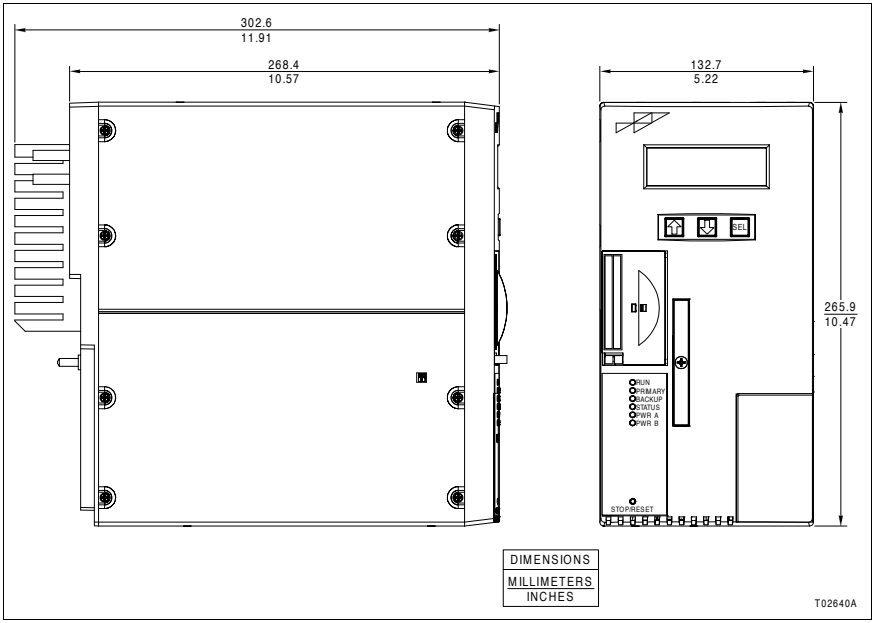

Figure A-1. Controller Module Dimensions

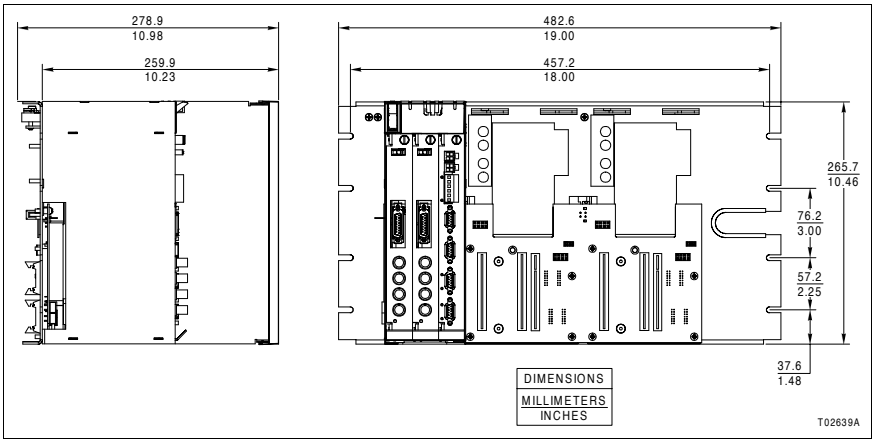

Figure A-2. Docking Station Dimensions

Software License Entry

Appendix B

Introduction

Licensing procedures described in this section are necessary for proper operation of the Harmony area controller (HAC). The controller is licensed by relating a software key for each controller feature with a unique machine identifier (ID). A software key is an encoded string that indicates a feature has been properly obtained from Bailey. Software keys are obtained from the software license administration system.

The controller functions requiring software keys are:

- Number of function blocks (BLOCKS).
- C language support (C-LANGUAGE).
- Batch 90 and UDF language support (BATCH-UDF).

This section provides the procedures necessary to obtain the controller machine ID, the steps to request software keys, and the procedure to enter the software keys. Additionally, the procedures to install and run the license entry program are provided.

An overview of the software licensing procedure is shown in Figure B-1.

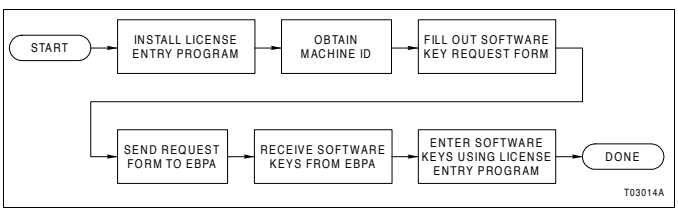

Figure B-1. Software Licensing Procedure

License Entry Program

The Bailey license entry program is used to activate controller features once the necessary software keys have been obtained from the software license administration system. Version 2.0

and later of the license entry program supports controller licensing.

Requirements

Software

The license entry program can be installed and run on a Windows® 95 or Windows NT® 4.0 computer.

Hardware

The license entry program requires either of the following communication interfaces:

- Harmony Network Communications Coupler.
- INICI03 Cnet-to-Computer Interface.

Refer to the appropriate product instruction for communication interface setup and installation.

Install/Uninstall

A previous version of the license entry program may already be installed on the computer. If the program does not exist on the computer or an earlier version of the program is installed, perform the installation procedure that follows. This installs the license entry program, and newer versions of semAPI and the ICICONF program if necessary.

To install the license entry program:

1. Insert the software license program CD-ROM into the CD-ROM drive.

2. Run:

   CD-ROM drive:**\license\setup.exe**

3. Follow the prompts to complete the installation.

4. Configure the communications interface if necessary. Refer to ***Communications Interface Configuration*** in this appendix.

The license entry program uses the standard Microsoft® uninstall procedure. To uninstall:

1. Select *Start* > *Settings* > *Control Panel* > *Add/Remove Programs*.

2. Select the license program for removal.

Communications Interface Configuration

This section describes how to use the ICICONF program to create a configuration file for a communications interface. The ICICONF program must be executed prior to the first time an application such as the license entry program attempts to connect to a specific communications interface.

The computer may have access to more than one interface (e.g., INICI03 interface, Harmony network communications coupler, etc.). An application program references each interface by its logical ICI number. The configuration file created with the ICICONF program is used to cross reference logical ICI devices with physical interface devices. Each known interface will have a different logical ICI number.

Run the ICICONF program by selecting:

Start > *Programs* > *ElsagBailey* > *ICICONF*

The first time the ICICONF program is executed, it creates a default configuration. The default configuration sets the:

- Node name *(Name/Address of Node*) to the local computer node name.
- Physical device (*Physical ICI Device*) to *COM2:*.
- Communication protocol (*Network Communication Protocol*) to *TCP/IP*.
- Device driver *TCP/IP Port* to *3001*.

Figure B-2 shows the logical ICI definition window. When any part of a configuration is changed, save it by clicking *SAVE*. Click *RESET* to return to the previously saved configuration. Click *QUIT* to exit the ICICONF program.

The following paragraphs explain each of the entries within the logical ICI definition window.

Application Logical ICI

The *Application Logical ICI* is an assigned logical ICI number that is required by a client application. There are 20 possible ICI configurations in the list.

When a new logical ICI is selected, the ICICONF program displays the settings for that logical ICI. To keep track of multiple

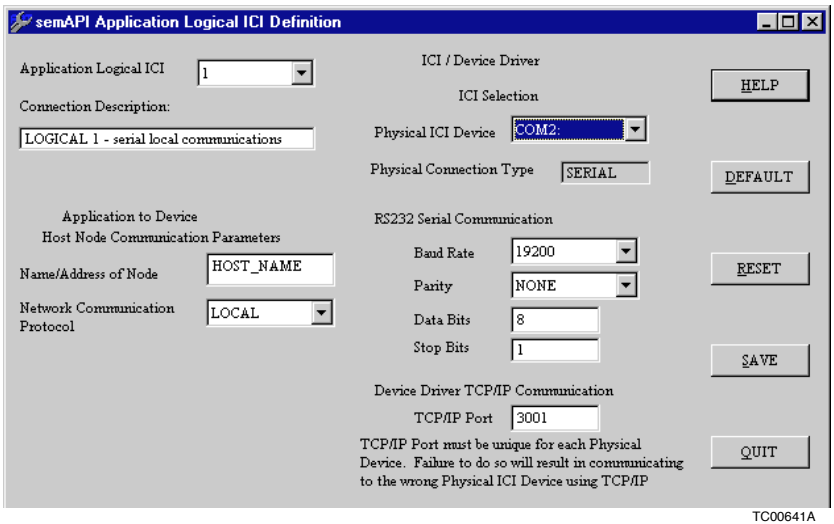

Figure B-2. Logical ICI Definition

ICI configurations, a text string describing each connection can be entered in the *Connection Description* field.

Physical ICI Device

For *Physical ICI Device*, the program verifies which types of devices can be connected and displays the applicable devices (e.g., *COM2:*, *S003:*, *HNCC:*, etc.). Select the appropriate ICI device to configure a particular communication interface. The remaining fields that require definition depend on this selection.

In the case of a SCSI INICI03 interface connection, the list identifies which INICI03 interfaces are currently connected to the computer and are functioning properly. For example, if *S003:* appears in the *Physical Connection Type*, a SCSI INICI03

interface is connected to the computer on the first SCSI card on its first SCSI bus at address 3.

> **NOTE:** When working with a previously configured SCSI INICI03 interface that was red-lighted or not connected to the computer on reboot, the warning *SCSI ICI cannot be detected* will appear. If the same SCSI physical ICI device is changed and configured, the list does not display the physical ICI device nor can it be selected until the computer is rebooted with a functioning SCSI INICI03 interface.

Name/Address of Node

Enter the name or IP address of the computer executing the device driver in the *Name/Address of Node* field.

Network Communication Protocol

Select the appropriate *Network Communication Protocol* from the list (i.e., *LOCAL* or *TCP/IP*). The list contains the network communication protocol being used by client applications using this logical ICI and the device driver for the device listed in *Physical ICI Device*. Other unique logical ICIs using different network communication protocols can be defined to talk to the same physical ICI device.

RS232 Serial Communication Parameters

The *RS232 Serial Communication Parameters* are only enabled when physical ICI device is *COM1:* or *COM2:*. Enter the appropriate parameters for *Baud Rate, Parity, Data Bits,* and *Stop Bits* based on the switch selections set on the communication module. When changing any of the RS-232-C serial communication parameters for a specific physical device, all logical ICIs using the same device will adopt the same values for the parameters.

Device Driver TCP/IP Communication Port

If TCP/IP network protocol is the communication protocol between the client application and server tasks, then a service port number must be assigned for all physical ICI devices being used, whether serial or SCSI. The selection and assignment of a port number to each physical ICI device is arbitrary, but each port number must be unique and not already in use by other TCP/IP services. Port numbers must be greater than or equal to 1,024 and less than or equal to 65,535. Additionally, each logical ICI must have a unique port number. Enter the port number in the *Device Driver TCP/IP Communication Port* field. When changing the TCP/IP port for a specific physical device, all logical ICIs using the same device will adopt the same port number.

Obtaining the Machine ID

The machine ID is needed when requesting software keys. The machine ID used for licensing is the electronic ID stored in the docking station backplane (i.e., backplane ID). There are two ways to obtain the backplane ID: LCD menus or license entry program. The controller must be installed and operating before the machine ID can be obtained. Refer to Section 3 for controller installation procedures. The machine ID can be read from the controller while it is in either execute or configure mode.

Machine ID from LCD Menu

The machine ID can be accessed using LCD menu options. To access the machine ID (i.e., backplane ID), select *Setup* > *Read Electronic IDs* from the LCD menus; refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD menu operations. Record and use the *Bck* ID number for requesting software keys.

Machine ID from License Entry Program

To obtain the machine ID using the license entry program:

1. Run the license entry program by selecting:

   Start > *Programs* > *ElsagBailey* > *License Entry*

   NOTE: The computer may have access to more than one communications interface. The license entry program can access any supported and configured communications interface to perform controller licensing. The default is to use logical ICI one. Select *RunTime* > *Set Logical ICI* to choose a different interface.

2. Select the *Licenses* tab (Fig. B-3).

3. Choose the *Harmony Area Controller License Group*.

4. Enter or select the *Loop* and *Node* address of the desired controller.

5. Click *Read*. This will update the displayed fields including the machine ID (Fig. B-4). The message dialog that appears shows the progress of the read operation. Click *Close* when complete.

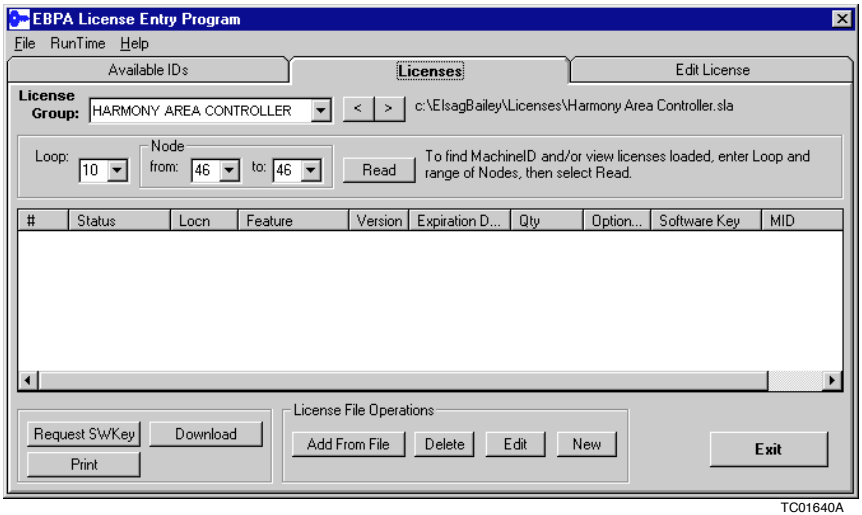

Figure B-3. Licenses Tab

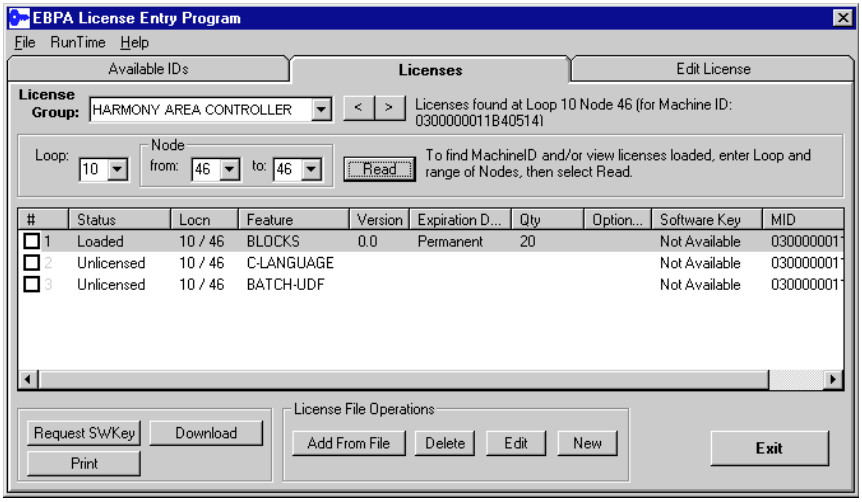

Figure B-4. Example Licenses Tab

6. The machine ID of the selected controller appears at the upper right of the window and in the *MID* column. Record and use this number for requesting software keys.

Requesting Software Keys

To request software keys for the controller:

1. Obtain the machine ID of the specific controller; refer to ***Obtaining the Machine ID*** in this section.

2. Locate and have available the registration number and validation number. These are recorded on the registration form shipped with the controller software (S-HB-ACT).

3. Complete the registration form provided, or generate and complete a new request form using the license entry program; refer to ***Software Key Request Form*** in this section.

4. Send the registration form to the Bailey software license administrator using one of the methods described on the registration form.

5. Wait for the software keys to be sent. The method by which the software keys will be returned is selected on the request form. The choices are Internet mail, postal mail, or fax. A mail address or fax number must be included on the form.

Software Key Request Form

The registration form provided with the controller can be completed to request software keys. Optionally, a software key request form can be generated from the license entry program. The registration number, validation number, and the machine ID are needed to complete the generated request form. The registration number and the validation number are on the registration form shipped with the controller software (S-HB-ACT).

To generate a software key request form:

1. Run the license entry program by selecting:

   Start > Programs > ElsagBailey > License Entry

2. Select the *Licenses* tab (Fig. B-3).

NOTE: Steps 3 through 5 only need to be performed if the machine ID is not already known or if the program is to automatically insert the machine ID into the request form. Skip these steps if manually entering the machine ID.

3. Choose the *Harmony Area Controller License Group*.

4. Enter or select the *Loop* and *Node* address of the desired controller.

5. Click *Read*. This will update the displayed fields including the machine ID (Fig. B-4). The message dialog that appears shows the progress of the read operation. Click *Close* when complete.

6. Click *Request SWKey*.

7. Verify the machine ID is correct. If not, enter a new machine ID. Click *OK* to continue.

8. Enter the registration number sent with the controller, then click *OK*.

9. Enter the validation number sent with the controller, then click *OK*.

10. Edit the form as necessary. Either save the form to a file or print the form.

11. Send the registration form to the Bailey software license administrator using one of the methods described on the registration form.

Entering and Downloading Licenses

NOTE: The controller must be in configure mode to accept a software key. The mode can be changed through an LCD menu option or can be changed from a Composer or Conductor platform.

To install a software key:

1. Verify the controller is in configure mode. If not, select *Configuration* > *Module Mode* > *Configure* from the LCD menu; refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD menu operations.

2. Run the license entry program by selecting:

   Start > Programs > ElsagBailey > License Entry

   NOTE: The computer may have access to more than one communications interface. The license entry program can access any supported and configured communications interface to perform controller licensing. The default is to use logical ICI one. Select *RunTime > Set Logical ICI* to choose a different interface.

3. Select the *Licenses* tab (Fig. B-3).

4. Choose the *Harmony Area Controller License Group*.

5. Enter or select the *Loop* and *Node* address of the desired controller.

6. Click *Read*. This will update the displayed fields including the machine ID (Fig. B-4). The message dialog that appears shows the progress of the read operation. Click *Close* when complete.

7. Three controller features require software keys to function properly: BLOCKS, C-LANGUAGE, and BATCH-UDF. Each feature has its own software key. The license information can be manually entered or it can be automatically added from a file.

To manually enter the license information:

   a. Choose a *Feature*.

   b. Click *Edit*. This opens the *Edit License* tab (Fig. B-5).

   c. Enter the following license parameters:

   Version.
   Expiration date.
   Licensed quantity.
   Software key.
   Option string.

   This information can be found in the software keys form received from the software license administration system. Verify the parameters match the machine ID shown.

   d. Click *Validate*. Correct any errors found.

   e. Click *Save* to save the entered license information. This saves the information locally on the computer.

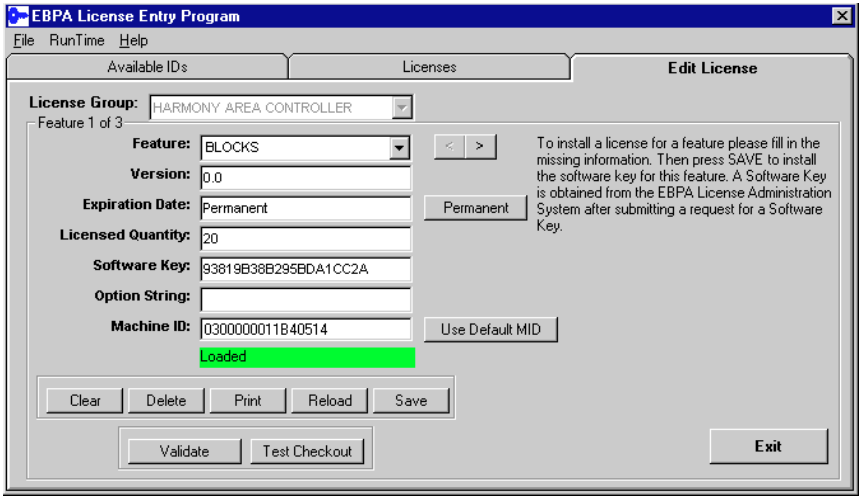

Figure B-5. Edit License Tab

f. Choose another feature, then repeat Steps c through e. Continue to the next step after all software keys have been entered.

To add license information ***automatically*** from a file:

a. Click *Add From File*.

b. Select the file that contains the license information.

c. Click *Open*. The program reads the file and gives the number of licenses found in the file.

d. Click *Yes* to proceed with the license installation. The procedure prompts to verify each license before being installed.

8. Select the *Licenses* tab.

9. Click *Read*.

10. Click *Download* to send the license information to the controller. The message dialog that appears shows the progress of the download operation. Click *Close* when complete. *Loaded*

will appear for each feature when license information is successfully downloaded.

Licensing Troubleshooting

Bailey licenses are kept in a license file for each license group. Basic troubleshooting steps are to locate the license file and view the contents of the license file.

Locating the License File

To locate the license file:

1. Run the license entry program by selecting:

   Start > *Programs* > *ElsagBailey* > *License Entry*

2. Select the *Licenses* tab.

3. Select the desired *License Group*.

4. The expected license file name is displayed in addition to all of the licenses entered (Fig. B-3). Use the Windows Explorer to check if the specified directory and file exist.

Error Codes

Table B-1 lists and describes license software error messages.

Table B-1. Licensing Error Codes, Messages, and Descriptions

Code	Message	Description/Action
0	Success	
-1	Can't find license file	Determine the expected location of the license file. Verify the file does not exist. Install the product.
-2	License file corrupted	Delete the license file then re-install the product.
-3	No machine IDs found	None of the valid machine IDs could be found. Purchase any of the valid machine ID types, or install the software on a machine with a valid machine ID type.
-4	Maximum number of users reached	Purchase additional licenses.
-5	No such feature exists	Occurs when checking out a feature that has not been licensed.
-6	No licenses checked out	Not an error. This message may occur if the software attempts to check in a license when it has not checked out a license yet.

Table B-1. Licensing Error Codes, Messages, and Descriptions *(continued)*

Code	Message	Description/Action
-7	Format of feature line is invalid	Indicates an invalid license has been found in the license file. This may be due to a program other than the license entry program being used to edit the license file. Delete the license for the feature using the license entry program, *License* tab. Then add the feature.
-8	Bad encryption code	Indicates an invalid license has been found in the license file. Re-enter the software key.
-9	Feature found but machine ID mismatch	A license for the feature was found, but not for this computer. If the license is for a moveable machine ID, such as the Rainbow SentinelSuperPro dongle, move the dongle to this computer. Otherwise get a license for this computer. Use the license entry program, *Available IDs* tab to view the machine IDs found on this computer.
-10	Feature found but wrong version	A license for the feature was found, but for a different version of the software. Obtain a license for this version of the product.
-11	Feature found but wrong option string	A license for the feature was found, but for a different option string of the software. Obtain a license for this option string of the product. Not all products utilize an option string.
-12	Software expired	The license for the feature was a temporary license, which has since expired. Ensure the date on your computer is correct, or obtain a current license.
-13	Bad date	The license entered had an invalid date.
-14	Duplicate license entry	When adding a new license, an existing license for the same feature, version, number of users and machine ID was found.
-15	Software key does not match parameters	Occurs with an invalid license entry. The software key entered does not match the features, version, etc. Check all fields in the license; one or more parameters must be incorrect.
-16	License entry not found	When the license entry program deleted a license, the specified feature was not found.
-17	Cannot write to license file	Determine the expected location of the license file. Verify the file does not exist or is not read-only. Install the product.
-18	Too many licenses requested	A program requested more licenses than were available. This error indicates that licenses for the desired feature are available, but not in the quantity requested. Request fewer licenses, if possible, or obtain more licenses.
-19	Cannot read license file	Determine the expected location of the license file. Verify the file does not exist or is not read-only. Install the product.
-20	Start date for feature not reached	

Table B-1. Licensing Error Codes, Messages, and Descriptions *(continued)*

Code	Message	Description/Action
-21	Machine ID not found	A license was found, but for a machine ID that is not present in this computer. If the license is for a moveable machine ID, such as the Rainbow SentinelSuperPro dongle, move the dongle to this computer. Otherwise get a license for this computer. Use the license entry program, *Available IDs* tab to view the machine IDs found on this computer.
-22	Machine ID type not found	A request for a specific machine ID type was made, but that machine ID type could not be found on this computer.
-23	Machine ID Type not supported	A request for a specific machine ID type was made, but that machine ID type could not be found on this computer.
-24	Could not read machine Ethernet address	Check the Ethernet card.
-25	Could not open network device	
-28	Error in registry for license file	Ensure you have administrator privilege on the computer. Re-install the product.
-29	Error in registry for machine ID	

Installation Preparation

PR1

Purpose/Scope

2 min.

This procedure gives steps that should be performed in preparation for Harmony area controller installation and connection.

Parts None.

Tools None.

Safety Considerations

WARNING	**1. Verify the main power and power entry panel circuit breakers/switches are turned off before starting installation, retrofit, upgrade, replacement, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, replacement, or wiring procedures are complete.**

Procedure

☐ 1. Verify the enclosure is prepared and ready for controller installation. The internal enclosure arrangement must be determined before installation can begin.

The enclosure will contain a power system and may include Harmony network communication couplers, I/O blocks, and rack modules (installed in module mounting units). Placement of these system components in the enclosure must be considered. The controller mounts below the power system and below any module mounting units. Refer to the product instructions for these system components for complete installation information.

☐ 

2. Turn off all primary and auxiliary power to the enclosure where installation will occur.

Docking Station Installation

PR2

Purpose/Scope

15 min.

This procedure describes the steps necessary to install the docking station.

Parts

Number	Qty	Description
EL 2089	8	M6 Phillips-head screw (CAB-04/12)
EL 2094		M6 captive nut (CAB-04/12)
NIDHA16008		10-32 × ½-inch, Phillips-head screw (CAB-01)
NMPCC16002		10-32 cage nut (CAB-01)

Tools

- Phillips screwdriver.

NOTE: For cooling purposes, the docking station (i.e., controller) can only mount in a stand-alone enclosure or primary bay of a multibay enclosure that contains Modular Power System II.

Procedure

☐ Align then attach the docking station to the side rails as shown in Figure PR2-1. When installing in a CAB-01 enclosure use eight 10-32 screws and cage nuts. When installing in a CAB-04 or CAB-12 enclosure use eight M6 screws and captive nuts.

NOTES:

1. When mounting a docking station either directly below the modular power system (MPS II) or below the module mounting unit, a minimum gap of 0.76 millimeters (0.03 inches) must be allowed. A properly installed docking station with controller module will have a visible air gap between the controller and the equipment mounted above or below it. Verify there is no mechanical interference with equipment above or below.

2. When multiple docking stations are mounted in the same enclosure with one below the other, a 1.52-millimeter (0.06-inch) gap should be provided between the docking stations to assure no mechanical interferences.

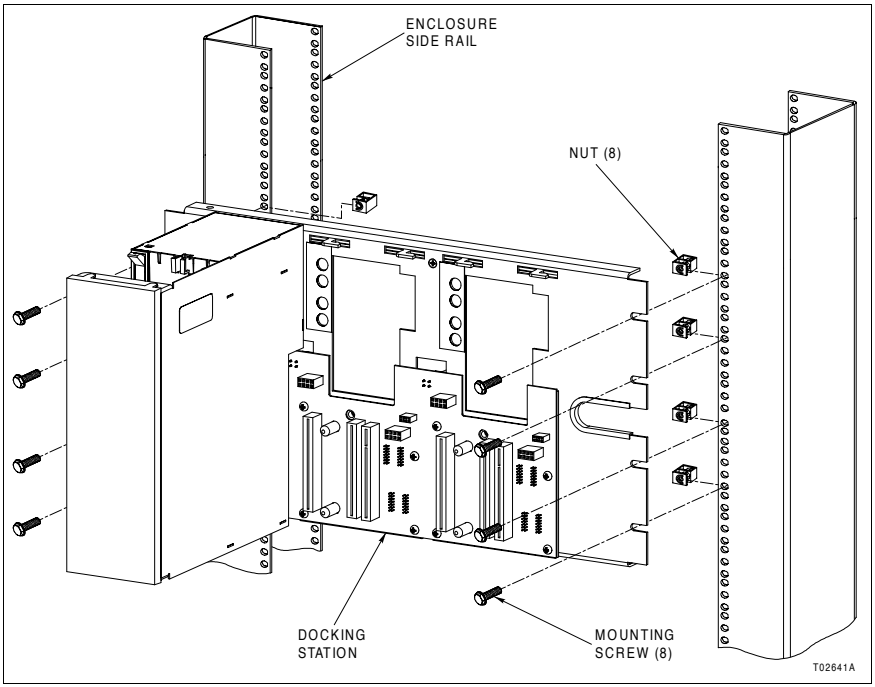

Figure PR2-1. Docking Station Attachment

Controller Module Installation

PR3

Purpose/Scope

2 min.

This procedure describes the steps necessary to install a controller module onto the docking station. The procedure is the same for both controller modules in a redundant pair.

Parts None.

Tools
- Phillips screwdriver.

Safety Considerations

WARNING	**1. A controller module should not be inserted or removed with power applied when located in a class I, division 2 hazardous location unless the area is known to be nonhazardous.**

CAUTION	**1. Release the latching mechanism by flipping the locking switch located behind the access door up to remove a controller module. Insure the latching mechanism is engaged (locking switch in down position) when a controller module is installed.**

Procedure

NOTES:
1. A controller module can be installed with power applied.
2. If the network TU associated with the controller module is installed in the first slot (from the left) of the termination assembly, then the controller module must be installed in the first slot (from the left).

☐ 1. Verify the controller location. Controller modules are keyed to compatible docking stations to prevent a mismatch. Look for a HAC label on the docking station to be sure it is compatible.

☐ 

2. Flip the locking switch located on the termination unit assembly up to unlock the controller module latching mechanism (Fig. PR3-1).

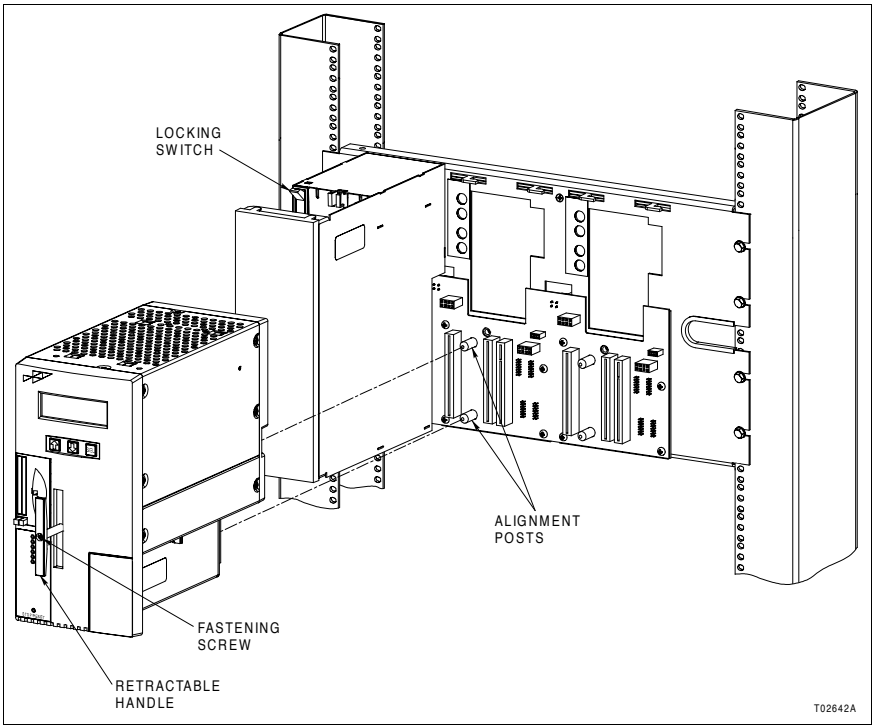

Figure PR3-1. Controller Module Attachment

☐ W1 3. Position the module on the docking station. The module is properly positioned when the posts protruding from the docking station line up with the alignment holes on the back of the module.

NOTE: Do not use the fastening screw to align the controller module.

☐ 4. Push the module in until it is flush with the docking station. If the module cannot be pushed in flush with the docking station, then either it is not properly aligned or it is not compatible with the particular docking station.

☐ C1 5. Flip the locking switch down to lock the controller module in place.

☐ 6. The controller module connectors fit snugly into the docking station connectors to maintain good connections. To insure the module is fully seated and good connections exist, push firmly at the bottom, front of the controller module.

☐ 7. Tighten the captive front panel fastening screw.

Termination Unit Installation

PR4

Purpose/Scope

2 min.

This procedure describes the steps necessary to install a communication termination unit (TU) or a network TU. The procedure is the same for either type of termination unit.

Parts None.

Tools
- Flat-blade screwdriver.

Safety Considerations

WARNING	**1. A termination unit should not be inserted or removed with power applied when located in a class I, division 2 hazardous location unless the area is known to be nonhazardous.**

Procedure

NOTE: A termination unit can be installed with power applied.

☐ 

1. Align the TU circuit board with the guide rails in the TU housing (Fig. PR4-1).

☐ 2. Push the termination unit in until it is completely inserted and seated. The unit should be flush with the housing.

☐ 3. Tighten the captive front panel fastening screw.

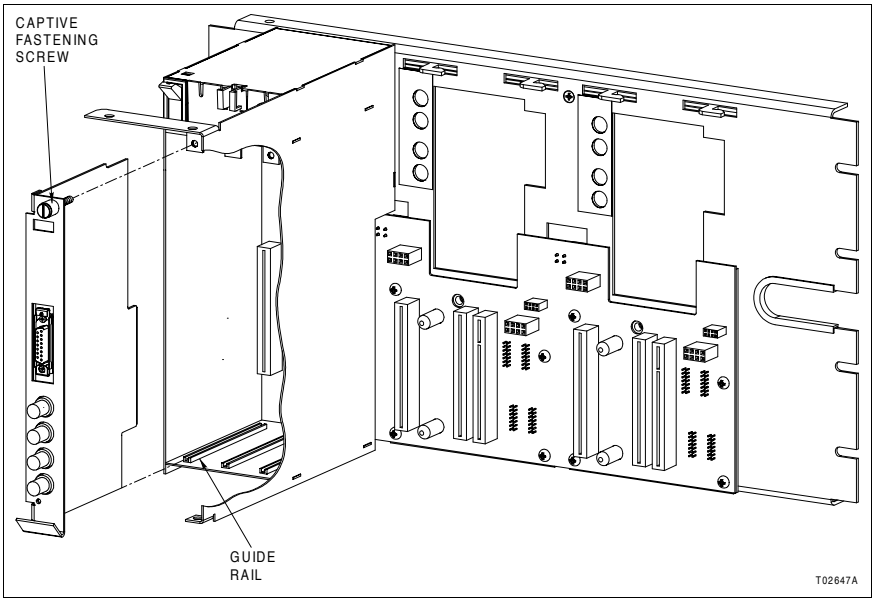

Figure PR4-1. Termination Unit Installation

Controller Setup

PR5

Purpose/Scope

10 min.

This section describes the steps necessary to set up the controller for operation after installation and powerup. This section only covers those setup options available through LCD menus that are necessary to begin operation. Refer to Table 5-1 for a description of these and other LCD menu options.

NOTE: The docking station stores the controller setup including the loop address, node address, and loop mode. If the controller module is being replaced, the setup parameters do not have to be reentered. They will be automatically retrieved by the replacement module.

Parts None.

Tools None.

Procedure

☐ 1. Refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD screen and keypad operation.

NOTE: Perform the following steps on the primary controller module (PRIMARY indicator on green).

☐ 2. If necessary, adjust the LCD contrast. Refer to ***LCD Contrast*** in Section 5.

☐ 3. If necessary, choose an alternate language for the LCD screen by pressing **SEL** three times. This key sequence will change to the main menu display, then will choose *Setup* > *Select Language*. From here select the desired language.

☐ 4. Set the controller loop address.

a. Select *Setup* > *Loop Address*.

b. Enter an address from 1 to 250.

☐ 5. Set the controller node address.

a. Select *Setup* > *Node Address*.

b. Enter an address from 1 to 250.

NOTE: The controller has several module addresses. The primary controller module has module addresses of zero and two by default. The backup module has module addresses of one and three by default. These addresses do not need to be set nor can they be changed.

☐ 6. Set the controller loop mode.

a. Select *Setup* > *Loop Mode*.

b. Select 10 megahertz or two megahertz. All nodes on the same Cnet loop must operate with the same mode selection.

☐ 7. Set any additional controller *Options* as desired. Refer to Table 5-1 for a description of the options.

☐ 8. Download a function block configuration using the Composer tools.

☐ 9. Put the controller in execute mode. Select *Configuration* > *Module Mode* > *Execute*. The RUN indicator should be on solid green.

☐ 10. If the controller enters some error condition (RUN on red or STATUS on red):

a. Observe the LCD status message. If the status message is flashing there is more than one message. Select *Status* from the LCD menu to view all status messages.

b. Refer to ***Troubleshooting Procedures*** in Section 6 for corrective actions.

Serial Port Setup

PR6

Purpose/Scope

15 min.

This section describes the steps necessary to set up the serial ports of the communication termination unit (TU). The controller supports two serial channels (A and B) that can be set up for either RS-485 or RS-232-C operation. Channel A connection is at P2 or P3; channel B connection is at P4 or P5. Jumpers enable either RS-485 or RS-232-C operation and configure the RS-232-C ports if enabled (Fig. PR6-1).

NOTES:

1. Baud rate, data bits, parity, and stop bits for RS-232-C communication are software configured.

2. The diagnostic port located behind the front access cover is for Bailey service personnel use only. The port has the following fixed characteristics: 9,600 baud, no parity, eight data bits, and one stop bit.

Parts None.

Tools
- Needlenose pliers (optional).

Procedure

☐ 1. Determine how the serial channels will operate.

- RS-485 for channel A - connection to P3.
- RS-232-C for channel A - connection to P4.
- RS-485 for channel B - connection to P5.
- RS-232-C for channel B - connection to P6.

☐ 2. Enable either RS-485 or RS-232-C for the serial ports by setting jumpers J3 and J4. Refer to Figures PR6-2 and PR6-3 for the settings.

☐ 3. Determine the serial device RS-232-C communication requirements (i.e., DCE or DTE and handshaking).

☐ 4. Set jumpers J1, J2, and J5 through J12 accordingly. Refer to Figures PR6-4 through PR6-8 for the settings.

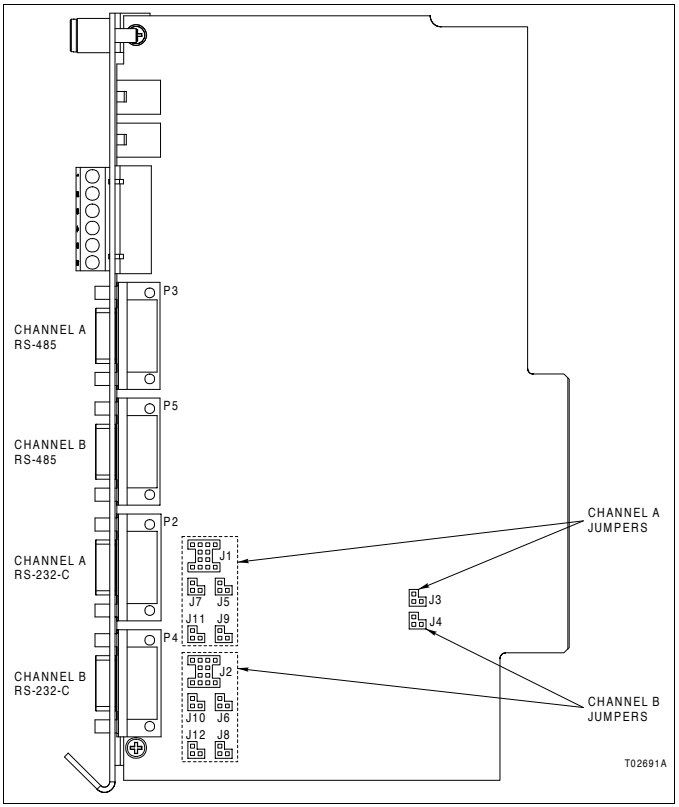

Figure PR6-1. Communication TU Serial Port Jumpers

☐ 5. Make a copy of Table PR6-1 and record the jumper settings.

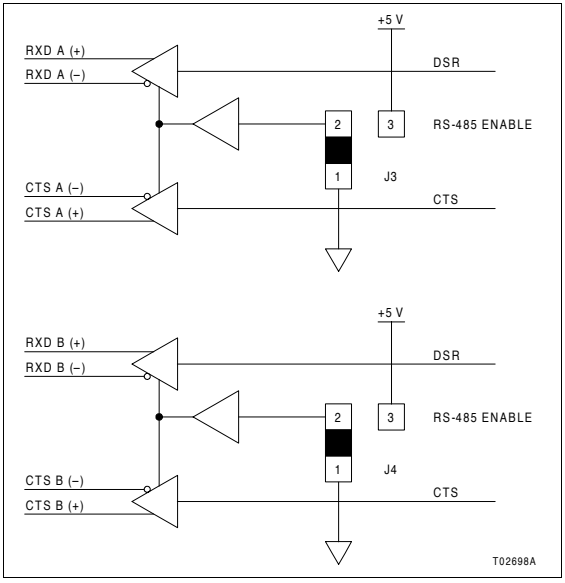

Figure PR6-2. RS-485 Enable - J3 and J4

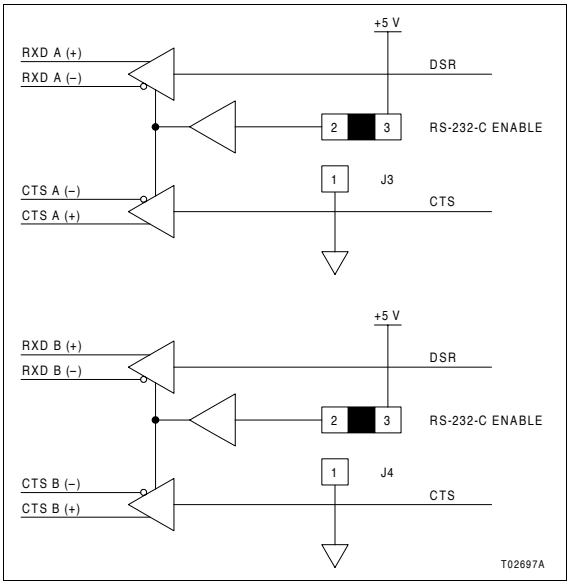

Figure PR6-3. RS-232-C Enable - J3 and J4

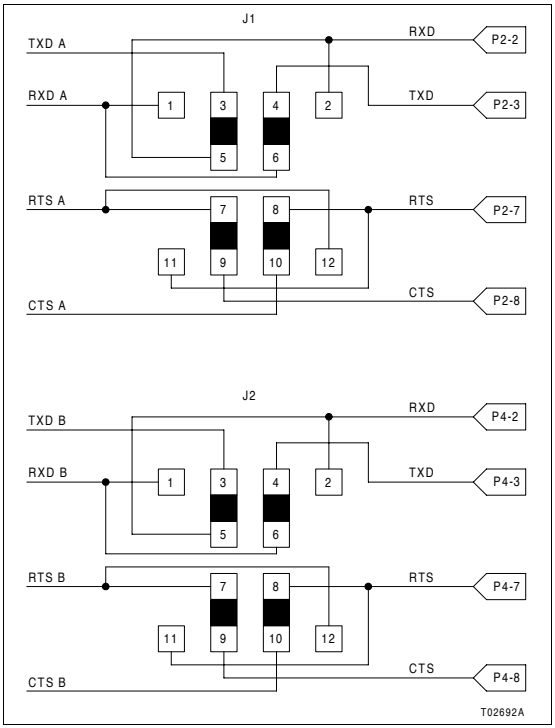

Figure PR6-4. DTE - J1 and J2

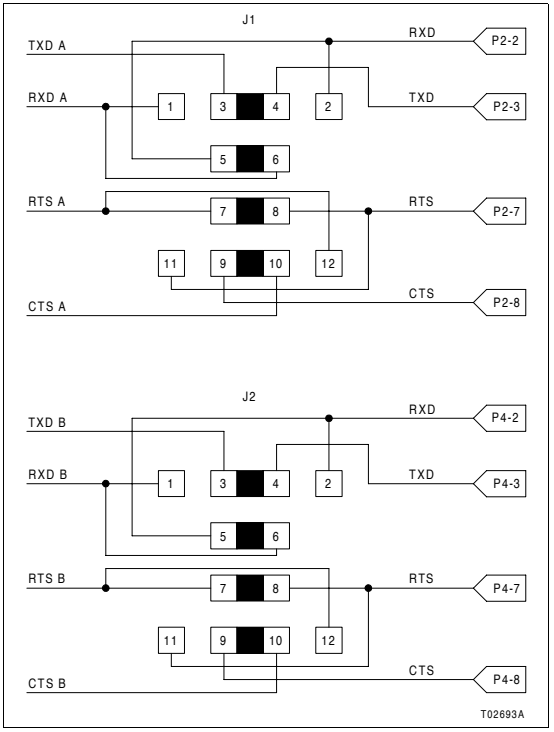

Figure PR6-5. DCE - J1 and J2

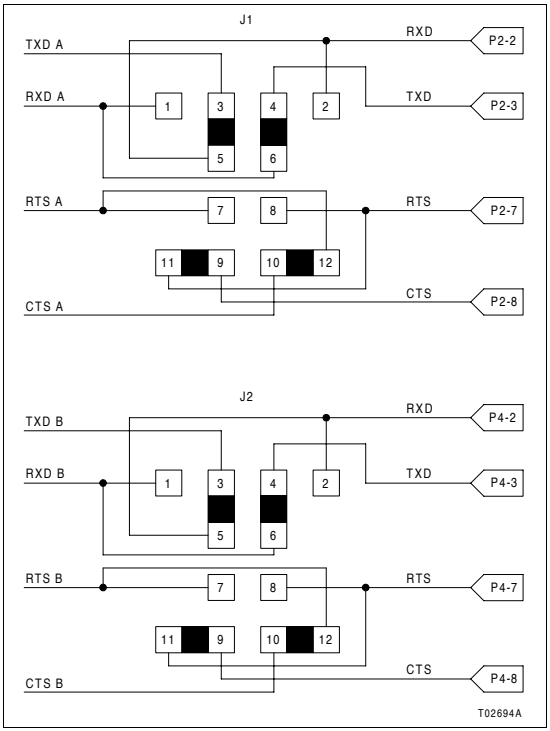

Figure PR6-6. Non Handshake - J1 and J2

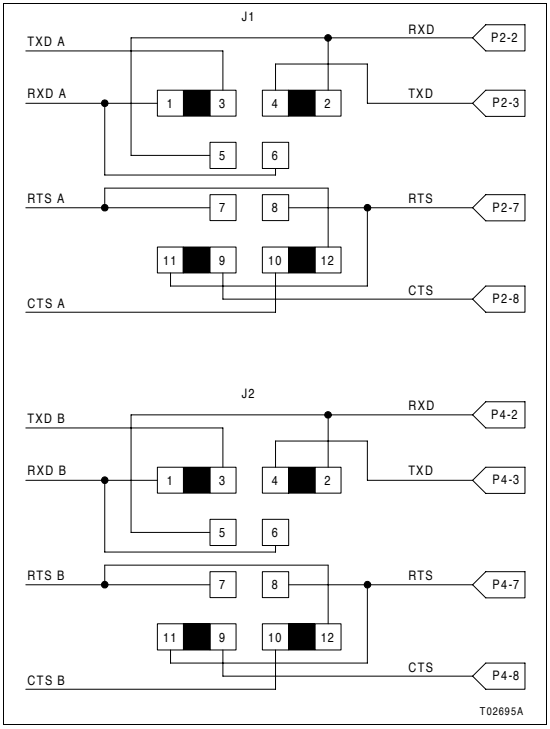

Figure PR6-7. Loopback - J1 and J2

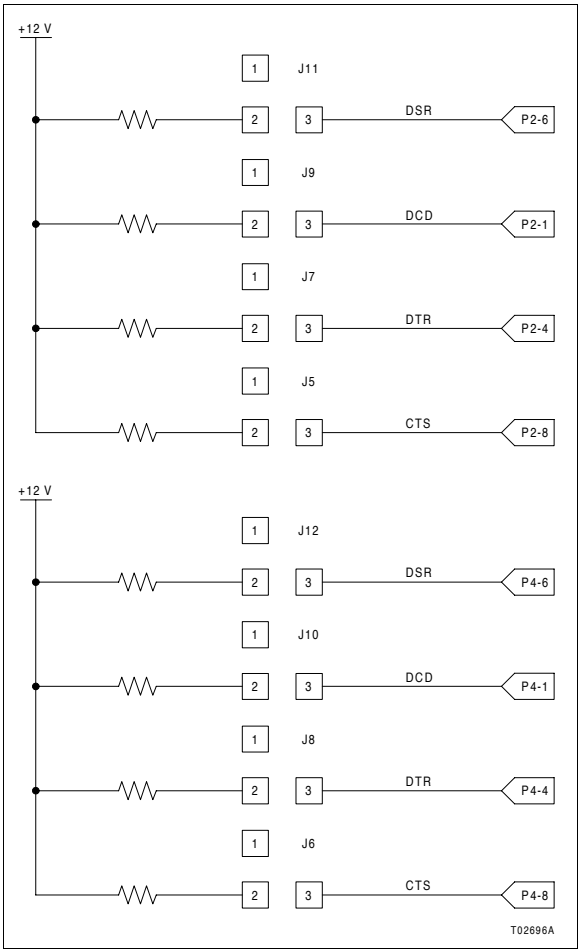

Figure PR6-8. Handshake Control Signals - J5 through J12

Table PR6-1. User-Configured Serial Port Jumper Settings

Channel A		Channel B	
Jumper	**Setting[1]**	**Jumper**	**Setting[1]**
J1	1 3 4 2 5 6 7 8 11 9 10 12	J2	1 3 4 2 5 6 7 8 11 9 10 12
J3	1 2 3	J4	1 2 3
J5	1 2 3	J6	1 2 3
J7	1 2 3	J8	1 2 3
J9	1 2 3	J10	1 2 3
J11	1 2 3	J12	1 2 3

NOTE:
1. Draw lines between post numbers to indicate jumper connections.

24 VDC Power Connection

PR7

Purpose/Scope

10 min.

This procedure gives the steps required to connect 24 VDC power to operate the controller. The controller is typically powered by the Modular Power System II.

Prerequisites

- Modular Power System II installed.

Parts

Number	Qty	Description
6643633A1	1 per controller module	Power cable
P-MK-HRM-PWR1000x	System dependent	Power cable extension; requirement explained in procedure

Tools

- Modular Power System II instruction.

Typically, redundant 24 VDC power directly cable connects from the IPCHS02 Power Module Chassis of the power system to the controller docking station. The docking station power cable is approximately one meter (3.5 feet) long. There is a separate power connection for each controller module slot.

The docking station power cable can be extended to up to 9.0 meters (29.5 feet) for direct cable connection to the power system by using an HRM-PWR1 cable. The cable attaches between the power system chassis and the docking station power cable.

Procedure

☐ 1. The power cable should already be connected to the docking station. If not, attach the four-pin connector end of the power cable to the P10 (slot one) or P11 (slot two) connector on the back of the docking station (Fig. PR7-1) depending on which slot the controller module will be installed in.

☐ 2. Connect the other cable end (eight-pin connector) to the power source as described in the following paragraphs.

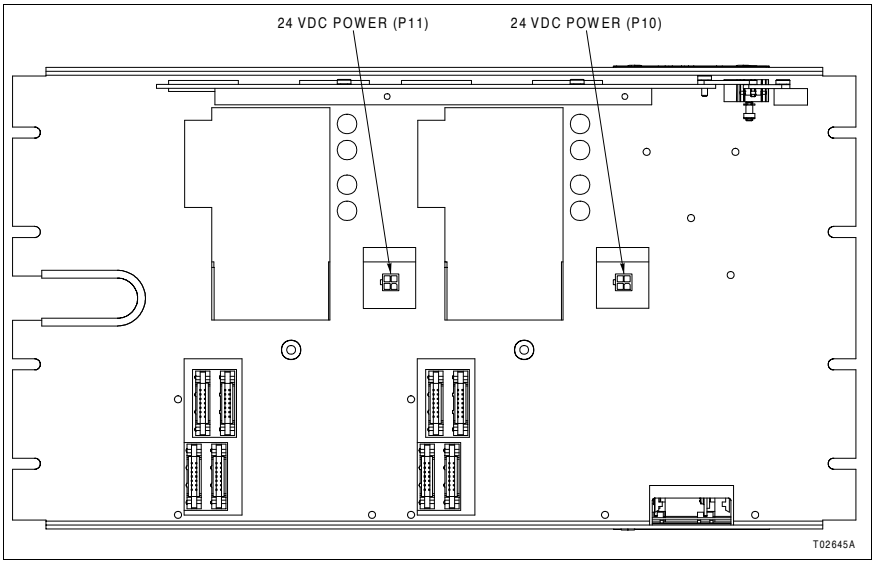

Figure PR7-1. 24 VDC Power Connectors

- If connecting directly to the Modular Power System II, attach the docking station power cable to an available connector (P1 through P10) on the IPCHS02 Power Module Chassis. Refer to the ***Modular Power System II*** instruction.
- If extending the power cable to connect directly to the power system, attach an HRM-PWR1 cable between the IPCHS02 chassis (P1 through P10) and the docking station power cable.

☐ 3. Repeat Steps 1 and 2 to connect power to the other controller module slot. Make the power cable connection to the unused P12 or P13 connector on the back of the docking station (Fig. PR7-1).

SOA Connection

PR8

Purpose/Scope

20 min.

This procedure gives the steps required to connect the status output alarm (SOA) to the power system. This provides the ability to tie power system status into the SOA status reported by the controller.

Parts None.

Tools
- Small flat-blade screwdriver.
- Phillips screwdriver.

Procedure

NOTE: P27 and P28 can only be used to connect the power system status output when I/O Hnet is terminated using the P19 Hnet terminator (refer to Figure PR10-1). Optionally, the connection can be made at the TB1 or TB2 terminals of an MSC-TER Hnet terminator. Refer to the ***Harmony Communications Network (Hnet)*** instruction for information about the MSC-TER Hnet terminator.

☐ 1. Connect two ring-lug terminated wires to the TB3-OUT and TB3-COM terminals of the IPCHS02 Power Module Chassis. Use 0.32 to 0.83 square-millimeter (22 to 18 AWG) wire to connect the SOA signal.

☐ 2. Connect the other ends of the wires to P27 or P28 on the docking station (Fig. PR8-1).

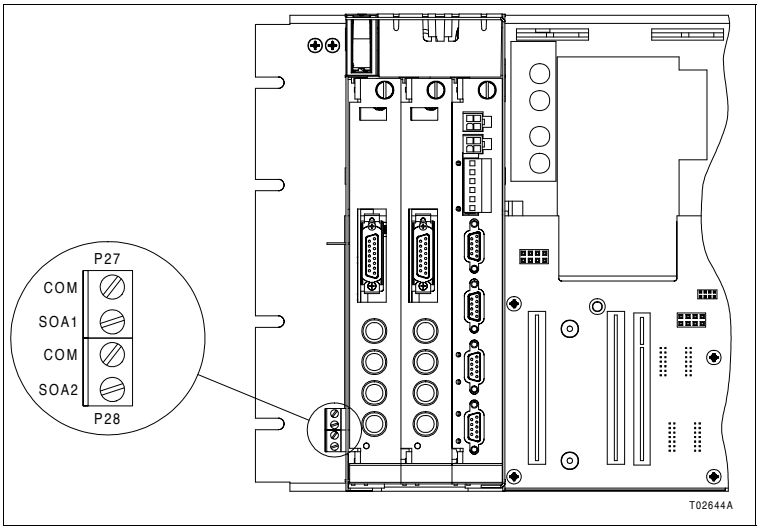

Figure PR8-1. Docking Station SOA Connectors

Peer-to-Peer Hnet Connection

PR9

Purpose/Scope

20 min.

This procedure describes peer-to-peer Hnet connection. It includes the connections:

- For a single redundant controller.
- Between two controllers (nonredundant and redundant) located in the same enclosure.
- Between a single controller (nonredundant and redundant) and Hnet repeaters.
- Between two controllers (nonredundant and redundant) and Hnet repeaters.

The Hnet repeaters are located in repeater mounting unit blocks attached to a block mounting column. Repeaters provide remote communication.

Prerequisites

- Block mounting column installed if required.

Parts

Number	Qty	Description
P-MK-HRM-HAC1000x	System dependent	Controller to block mounting column Hnet cable
P-MK-HRM-PTP1000x		Redundant controller to redundant controller Hnet cable
P-MK-HRM-PTP1T001		Redundant controller module Hnet cable
P-MK-HRM-PTP20001		Nonredundant controller to nonredundant controller Hnet cable
P-MK-HRM-PTP3001A		Hnet cable adapter for connecting two Hnet cables together.

Tools

- Harmony Communications Network (Hnet) instruction.
- Block Power and Mounting Hardware instruction.

Refer to the ***Harmony Communications Network (Hnet)*** instruction for a complete description of Hnet including architecture options and termination requirements, and for Hnet

repeater and repeater mounting unit installation procedures. Refer to the ***Block Power and Mounting Hardware*** instruction for the block mounting hardware installation procedures.

NOTES:

1. The I/O Hnet and peer-to-peer Hnet must be completely separate which means they require separate block mounting columns.

2. Hnet repeaters are required to connect Hnet between enclosures (i.e., intercabinet Hnet) even if the distance between enclosures is short. Any time Hnet leaves the protection of the enclosure, repeaters must be used. This practice insures that the Hnet remains secure at all times. In the case of multibay enclosures, Hnet can extend to each bay without the use of repeaters as long as the 30 m (100 ft) limit for intracabinet Hnet is not exceeded. This limit includes the mounting column length and jumper cables.

Procedure

☐ 1. Figure PR9-1 shows the location of the peer-to-peer Hnet connectors on the docking station: P23 and P26 Hnet terminators, P24 and P25 peer-to-peer Hnet. Refer to Figures PR9-2 through PR9-8 to determine which peer-to-peer Hnet connection method is appropriate and to determine the cables needed to make the connections.

NOTES:

1. No peer-to-peer Hnet connections are required for a single, nonredundant controller that does not communicate with other controllers.

2. Peer-to-peer Hnet must be properly terminated even if not used (Fig PR9-2).

3. Redundant controller modules communicate over the peer-to-peer Hnet. Therefore, the redundant controller modules must be connected for peer-to-peer communication even if the controller does not communicate with other controllers (Fig PR9-2).

4. Depending on the connection method not all ribbon cable connectors may be used.

☐ 2. Make the necessary cable connections as shown in these figures. Refer to the ***Harmony Communications Network (Hnet)*** instruction for a description of the MSC-TER Hnet Terminator.

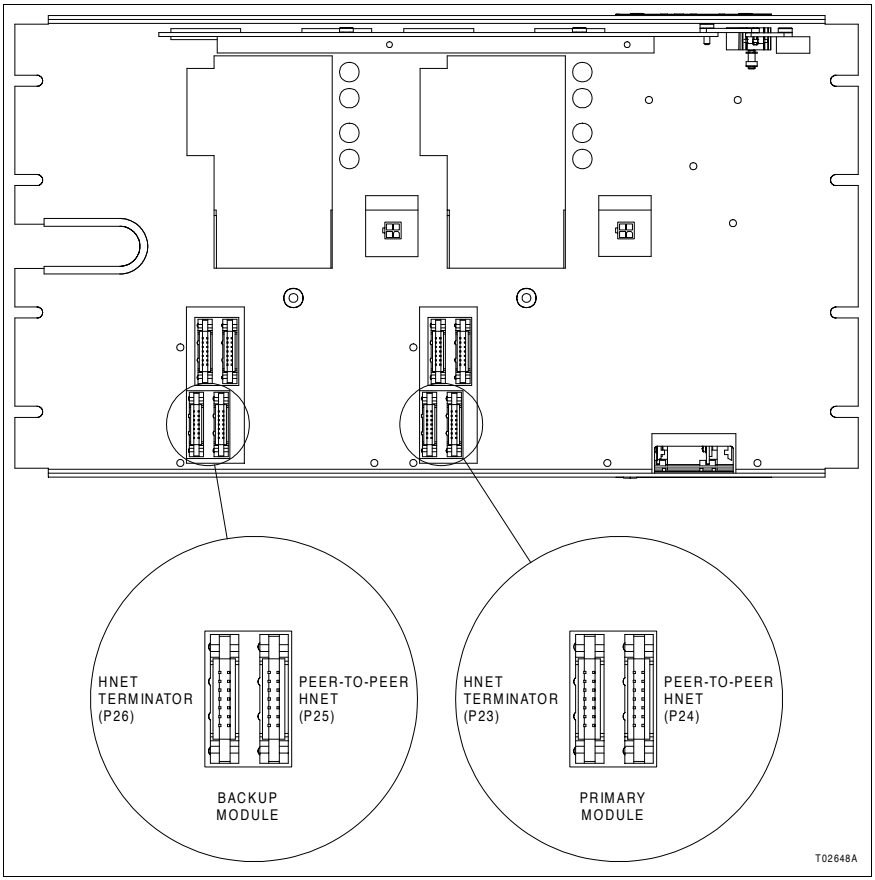

Figure PR9-1. Peer-to-Peer Hnet Connectors

An HRM-PTP3 cable adapter can be used to connect two Hnet cables together for additional cable connection options. For example, the HRM-PTP3 cable would be required when using the standard Hnet cables to connect more than two controllers.

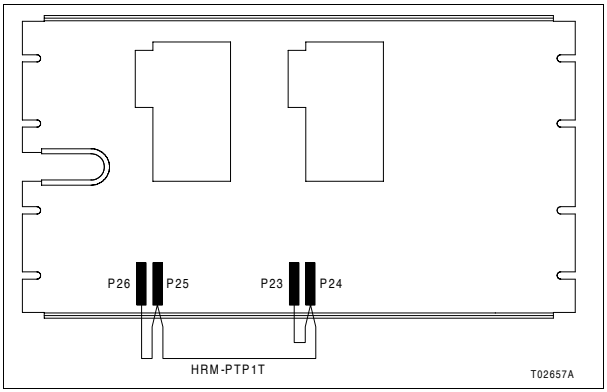

Figure PR9-2. Controller with Peer-to-Peer Hnet Not Used

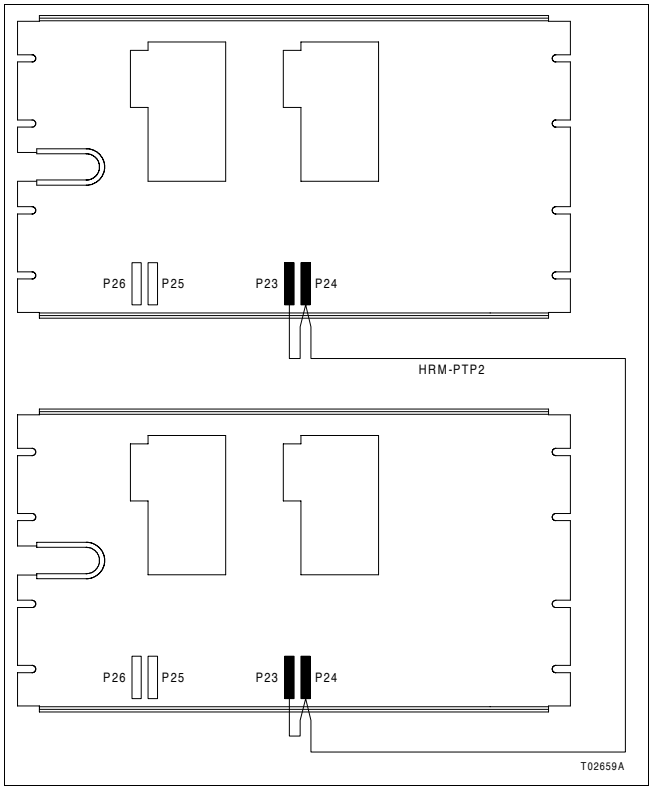

Figure PR9-3. Two Nonredundant Controllers

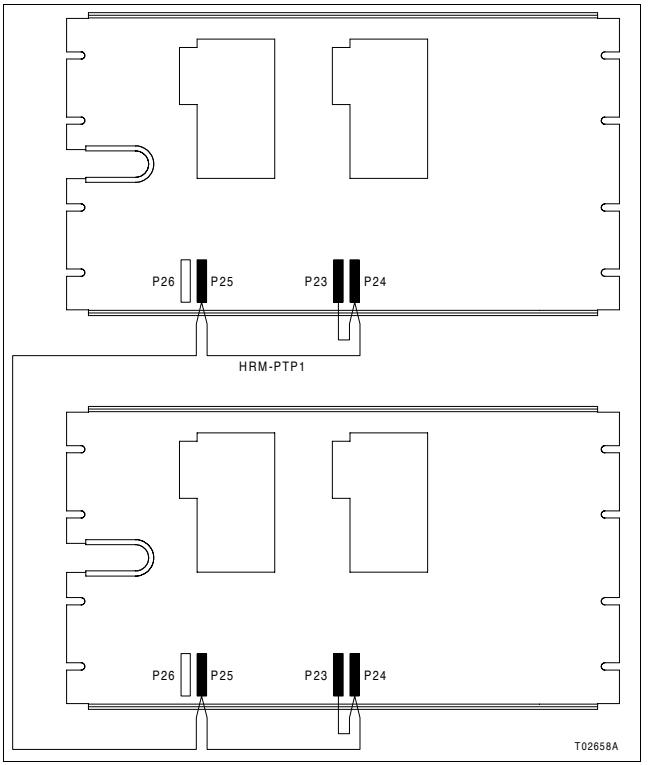

Figure PR9-4. Two Redundant Controllers

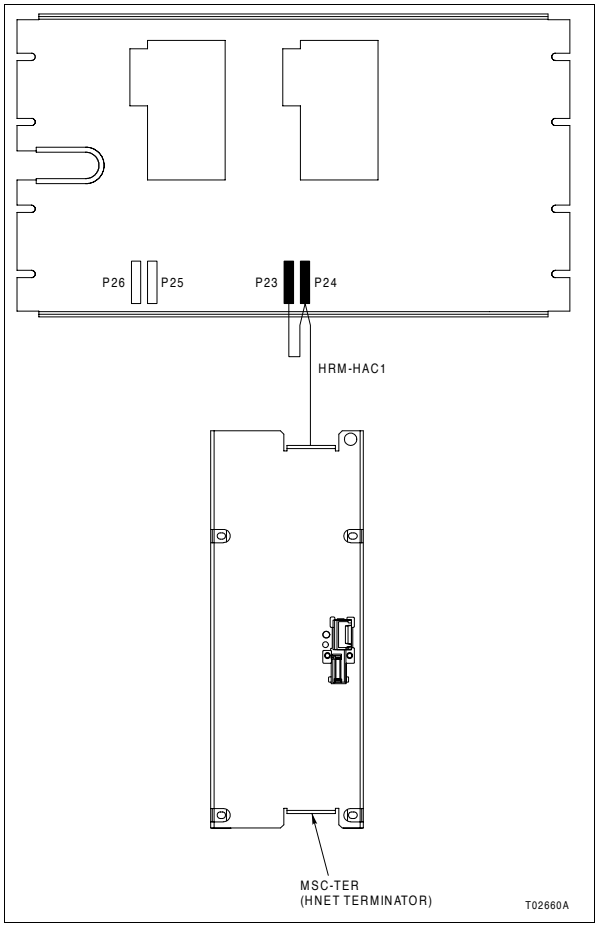

Figure PR9-5. Single Nonredundant Controller with Hnet Repeaters

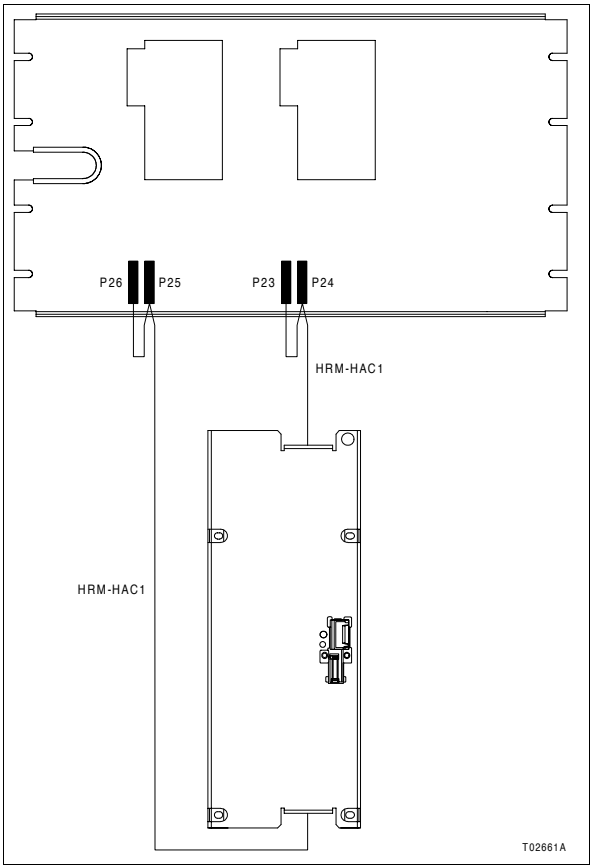

Figure PR9-6. Single Redundant Controller with Hnet Repeaters

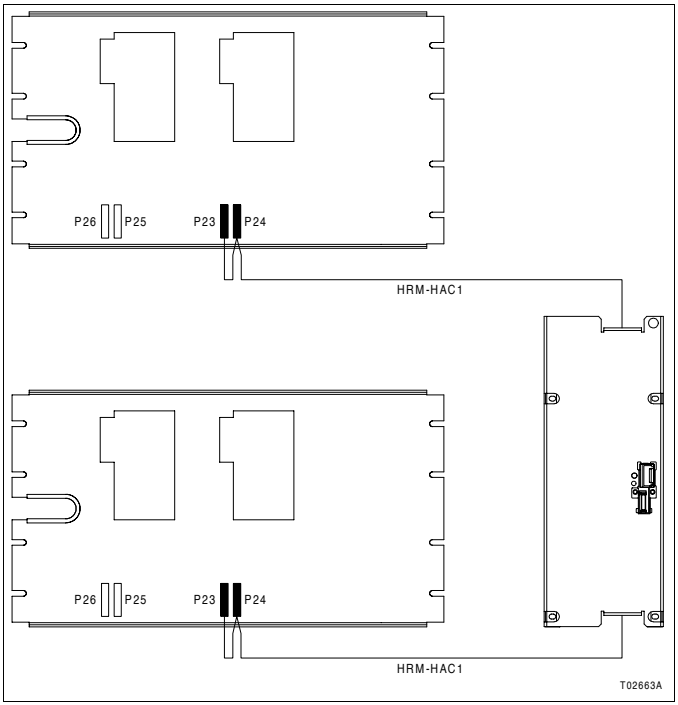

Figure PR9-7. Two Nonredundant Controllers with Hnet Repeaters

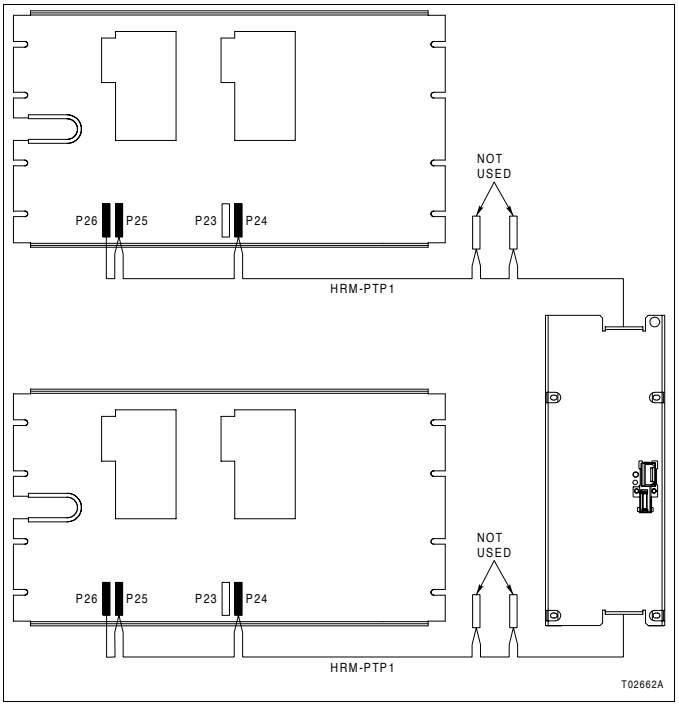

Figure PR9-8. Two Redundant Controllers with Hnet Repeaters

I/O Hnet Connection

PR10

Purpose/Scope

20 min.

This procedure describes I/O Hnet connection. It includes the connections between a nonredundant controller and block mounting column and a redundant controller and block mounting column.

NOTE: The I/O Hnet and peer-to-peer Hnet must be completely separate which means they require separate block mounting columns.

Refer to the ***Harmony Communications Network (Hnet)*** instruction for a complete description of Hnet including architecture options and termination requirements, and for Hnet repeater and repeater mounting unit installation procedures. Refer to the ***Block Power and Mounting Hardware*** instruction for the block mounting hardware installation procedures.

Prerequisites

- Block mounting column installed.

Parts

Number	Qty	Description
P-MK-HRM-HAC1000x P-MK-HRM-HAC1T00x	System dependent	Controller to block mounting column cable.
P-MK-HRM-PTP1T001		Redundant controller module Hnet cable.
P-MK-HRM-PTP3001A		Hnet cable adapter for connecting two Hnet cables together.

Tools

- Harmony Communications Network (Hnet) instruction.
- Block Power and Mounting Hardware instruction.

Procedure

☐ 1. Figure PR10-1 shows the location of the I/O Hnet connectors on the docking station: P19 and P22 Hnet terminators, P20 and P21 I/O Hnet. Refer to Figures PR10-3 through PR10-5 to determine which I/O Hnet connection method is

appropriate and to determine the cables needed to make the connections.

NOTES:

1. No I/O Hnet connections are required for a single, nonredundant controller that does not communicate with I/O blocks.

2. Verify Function Code 90 (Extended Executive), specification 3 is set properly to enable Hnet communication.

☐ 2. Make the necessary cable connections as shown in these figures. Refer to the ***Harmony Communications Network (Hnet)*** instruction for a description of the MSC-TER Hnet Terminator.

NOTE: Depending on the connection method not all ribbon cable connectors may be used.

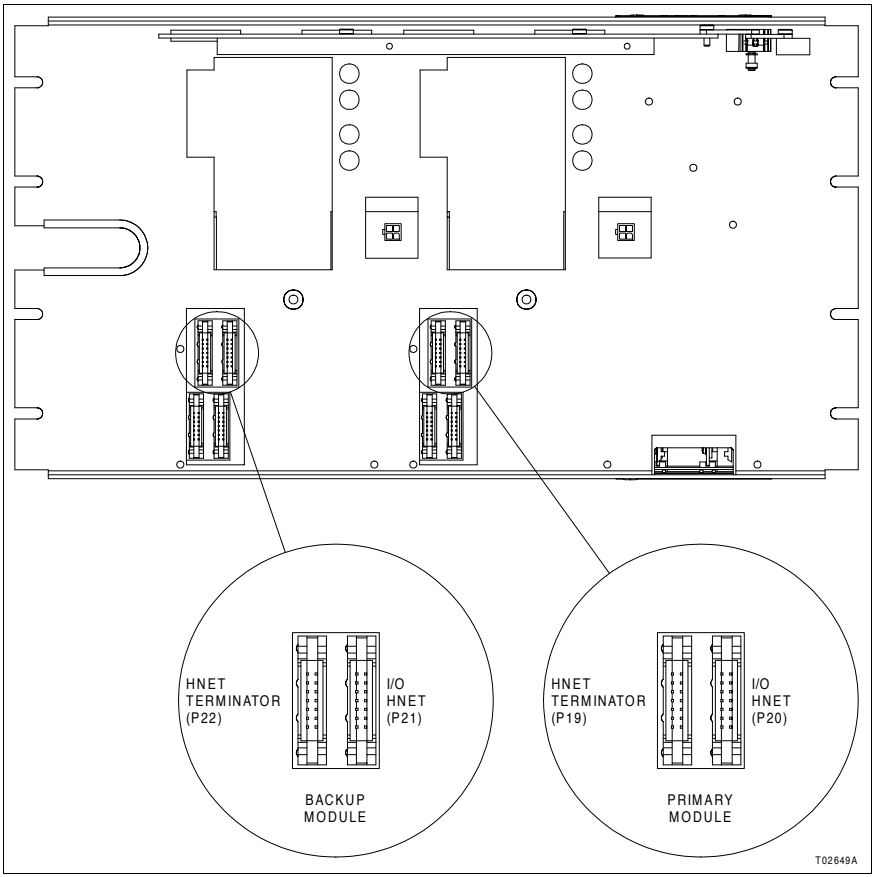

Figure PR10-1. I/O Hnet Connectors

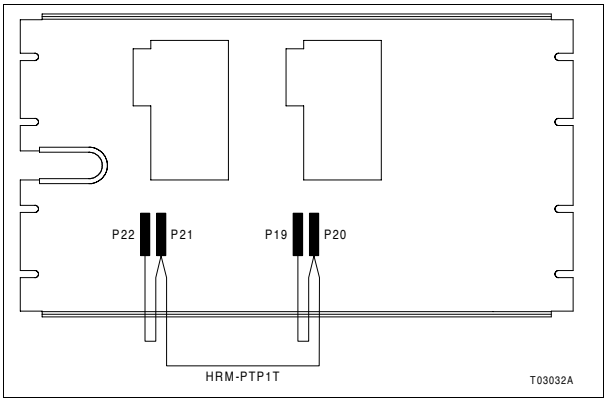

Figure PR10-2. Controller with I/O Hnet Not Used

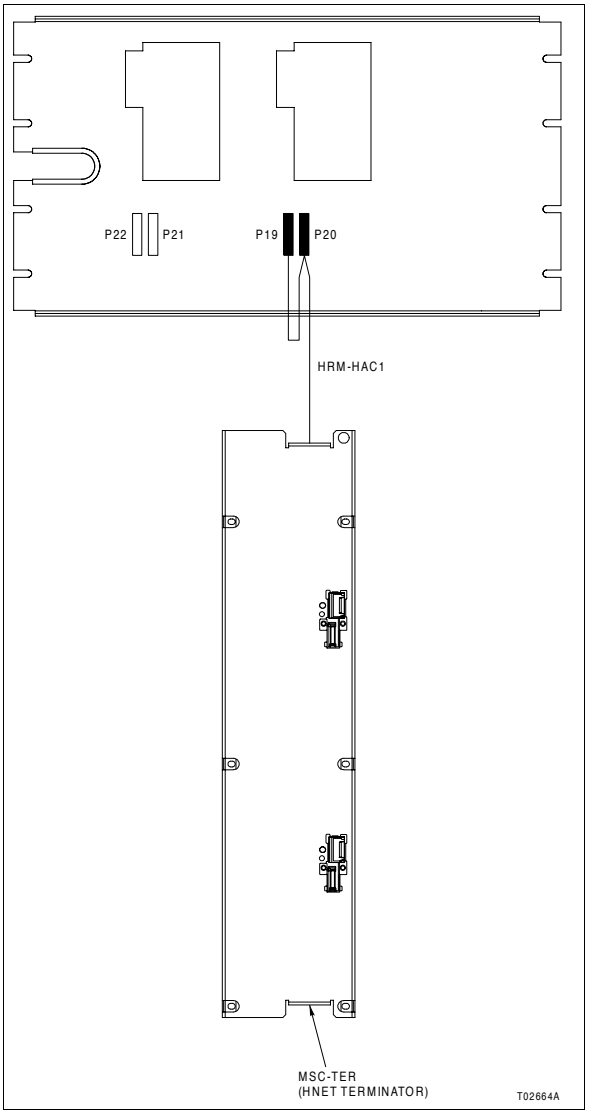

Figure PR10-3. Nonredundant Controller

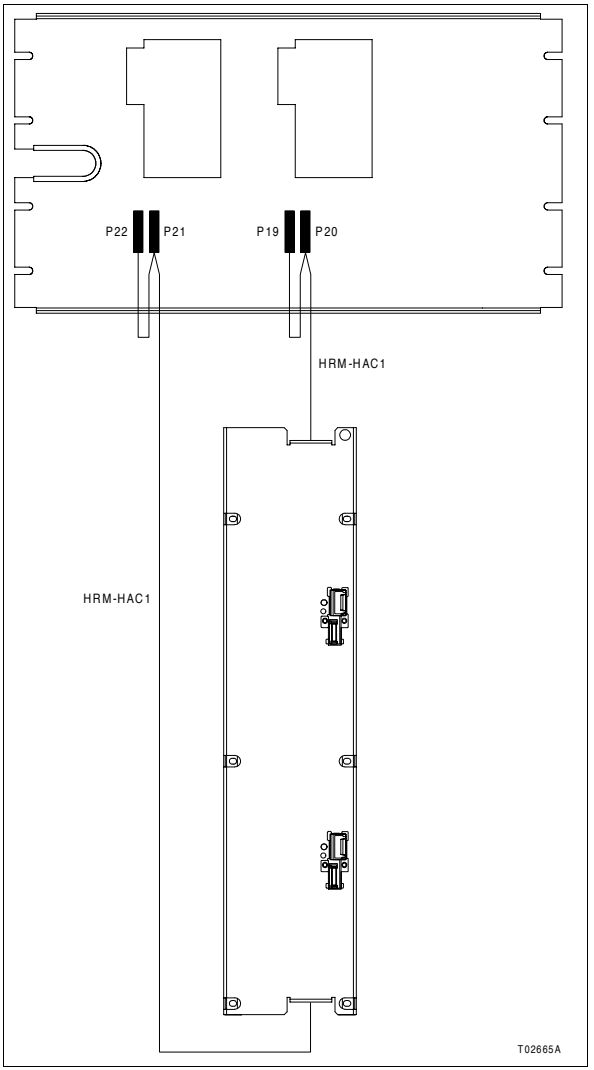

Figure PR10-4. Redundant Controller (Option 1)

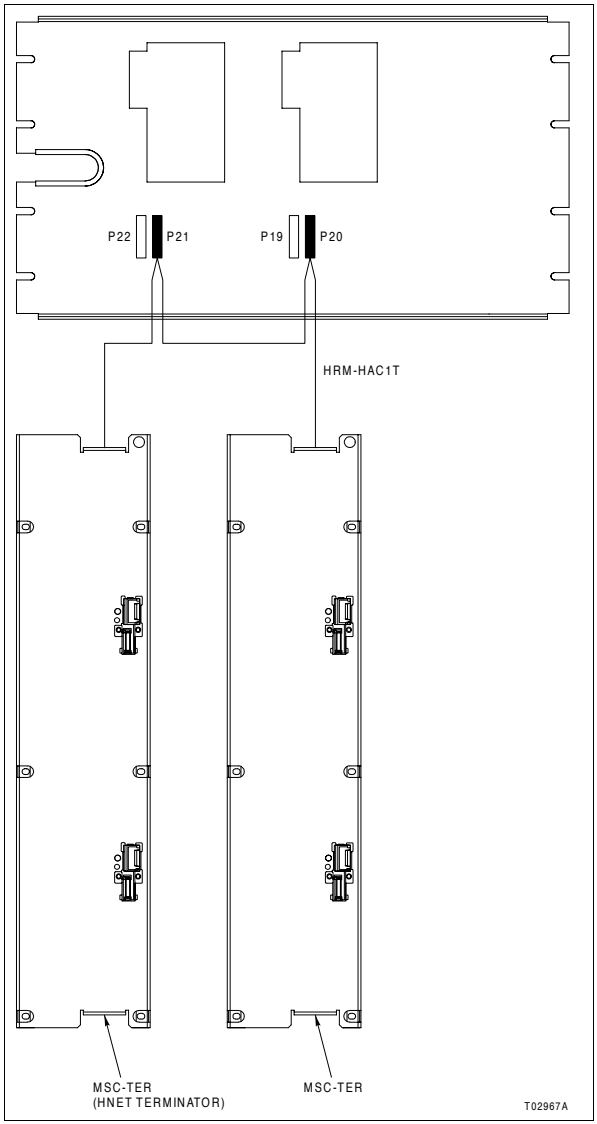

Figure PR10-5. Redundant Controller (Option 2)

I/O Expander Bus Connection

PR11

Purpose/Scope

5 min.

This procedure describes I/O expander bus connection to an IEMMU11, IEMMU12, IEMMU21, or IEMMU22 Module Mounting Unit.

Parts

Number	Qty	Description
NKEB03	1	Controller to MMU cable

Tools

- Module Mounting Unit instruction.

Refer to the ***Module Mounting Units*** instruction for a complete description of the unit, and its installation, setup, and connection.

Procedure

☐ 1. Figure PR11-1 shows the location of the I/O expander bus connector (P18) on the docking station. Connect one end of the NKEB03 cable to this connector.

☐ 2. Connect the other end of the cable to P57, P58, P59, or P60 on the back of the module mounting unit (Fig. PR11-2).

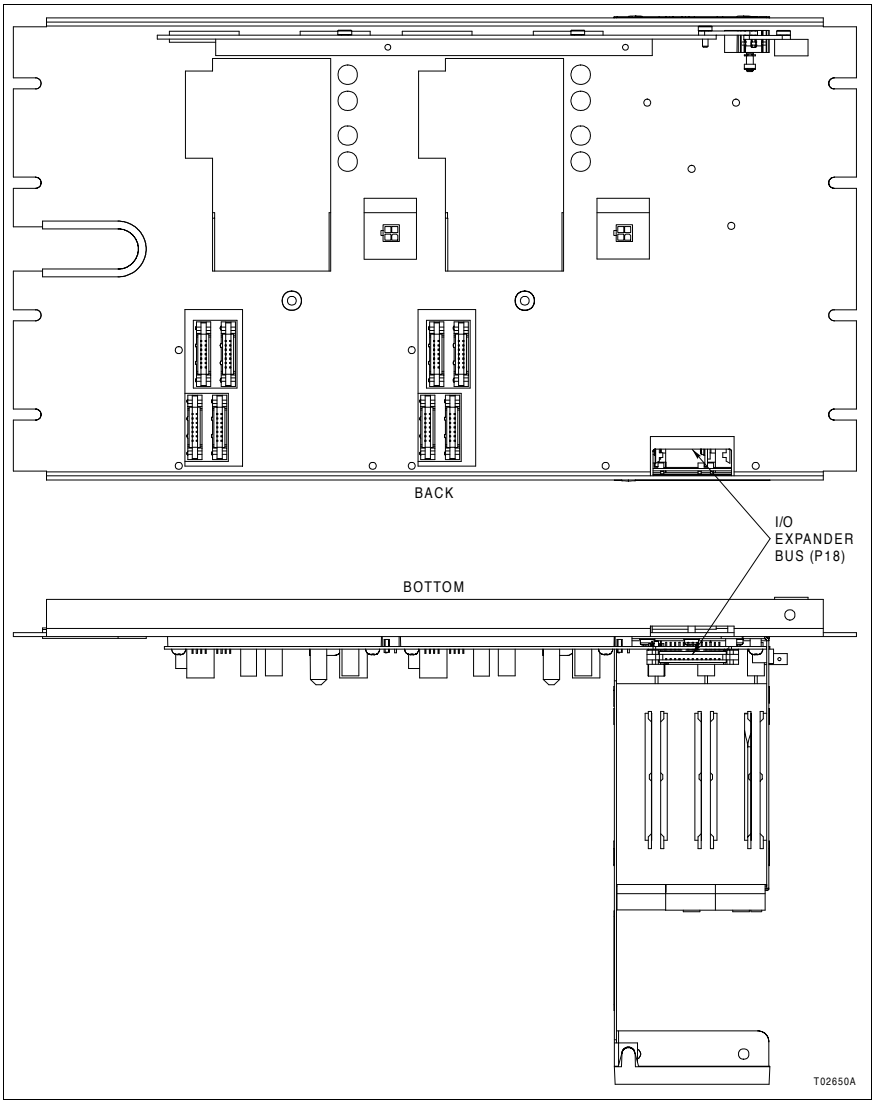

Figure PR11-1. I/O Expander Bus Connector

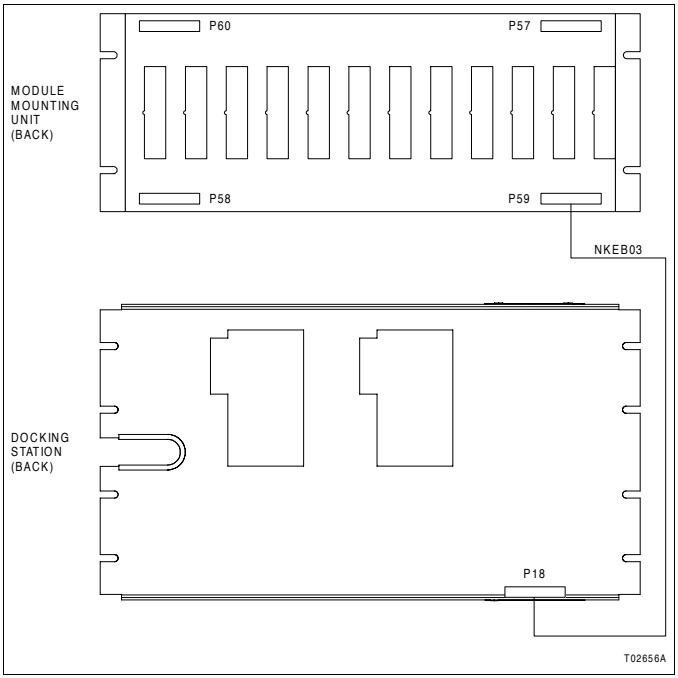

Figure PR11-2. I/O Expander Bus Cable Connection

Cnet Connection

PR12

Purpose/Scope

10 min.

This procedure describes Cnet connection. It includes the connections between:

- Redundant network termination units (TU).
- Nodes located within the same enclosure (intracabinet).
- Nodes located in different enclosures (intercabinet).

Parts

Number	Qty	Description
NKTL01-x	System dependent	Cnet termination cable
NKTT01-3		Node to node Cnet termination cable[1]
NKTT11-3		

NOTE:
1. Used when controller docking stations are within 914 mm (3 ft).

Tools None.

Procedure

NOTE: All figures in this section show nonredundant Cnet loop one connection only. Connect both loop one and loop two in the same way for redundant Cnet.

☐ 1. If setup with redundant controller modules, connect the network termination units with an NKTL01-1 cable as shown in Figure PR12-1.

☐ 2. Connect intracabinet Cnet using an NKTT01-3 or NKTT11-3 cable as shown in Figure PR12-2. Use this cable when connecting nodes which are located within 914 millimeters (3 feet) of each other and within the same enclosure. For greater distances connect Cnet as shown in Figure PR12-3.

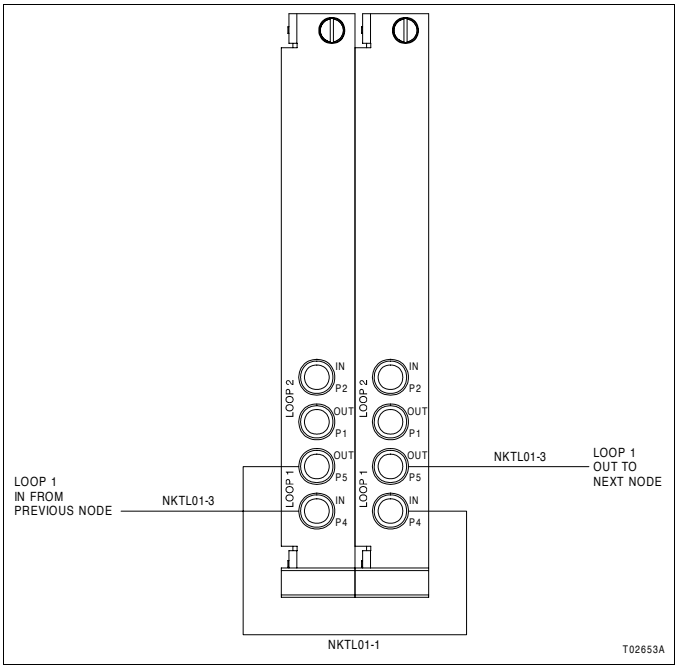

Figure PR12-1. Redundant Controller Module Cnet Connections

☐ 3. Connect intercabinet Cnet using an NKTL01-3 cable as shown in Figure PR12-3. Use this method when the:

- NKCL01 or NKCL11 cable enters from another node in another enclosure.
- NKCL01 or NKCL11 cable leaves the enclosure to connect to a node in another enclosure.

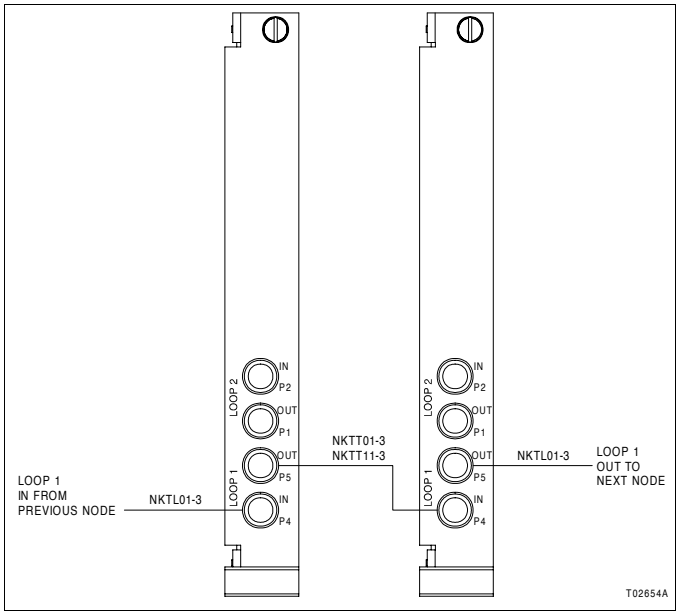

Figure PR12-2. Intracabinet Cnet Connections

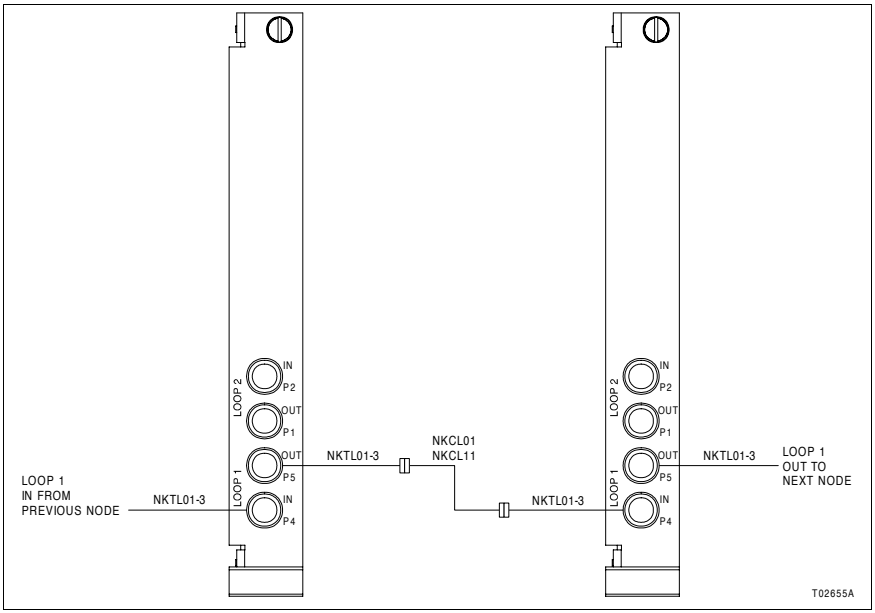

Figure PR12-3. Intercabinet Cnet Connections

Serial Port Connection

PR13

Purpose/Scope

5 min.

This procedure describes external serial device (e.g., computer, printer, or modem) connection. The controller has two serial channels (A and B) and supports two serial port connections: two RS-485, two RS-232-C, or one RS-485 and one RS-232-C.

Parts None.

Tools None.

Procedure

☐ 1. Turn off power to the serial device.

☐ 2. Attach an RS-485 cable to the DB-9 P3 or P5 connector on the communications termination unit (TU). Attach an RS-232-C cable to the DB-9 P2 or P4 connector. Refer to Tables 6-12 and 6-13 for the serial port pin assignments.

☐ 3. Connect the other end of the cable to the serial device.

Station Link Connection

PR14

Purpose/Scope

20 min.

This procedure describes station link connection. Each station connected must have a unique address from zero to 63.

Prerequisites

- NTCS04 Termination Unit installed.

Parts

Number	Qty	Description
NKSE03	1 per station connector	Controller to NTCS04 station link cable
NKSE13		

Tools

- IISAC01 Analog Control Station instruction.
- NTCS04 Termination Unit instruction.

Procedure

☐ 1. Connect the four-pin connector end of the NKSE03 or NKSE13 cable to the P7 connector on the communications termination unit (Fig. PR14-1).

☐ 2. Connect the other cable end (six-pin connector) to either P4 or P5 of the NTCS04 termination unit.

☐ 3. Repeat the previous steps to use the second station link. Make the NKSE03 or NKSE13 connection to the P8 connector on the communications termination unit.

Refer to the ***IISAC01 Analog Control Station*** instruction for station to NTCS04 connection information.

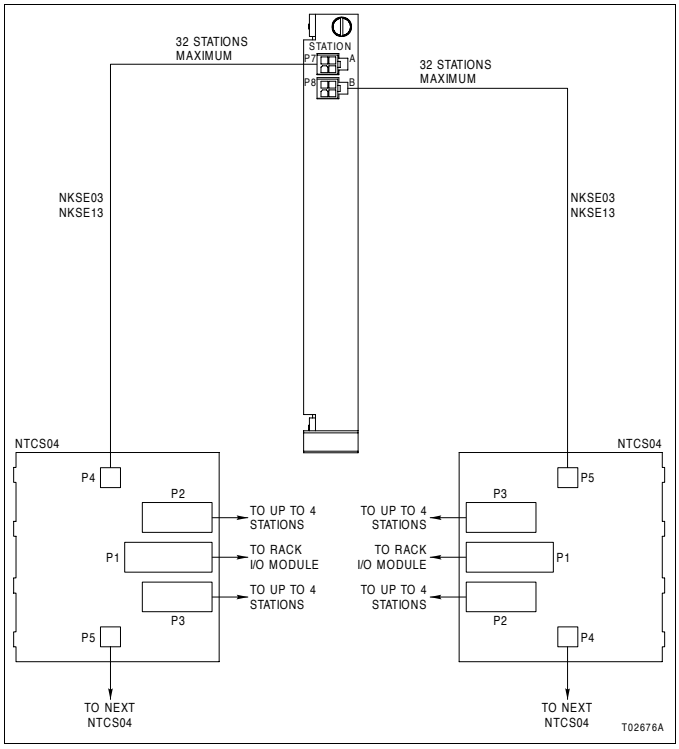

Figure PR14-1. Station Link Cable Connection

Time-Synchronization Link Connection

PR15

Purpose/Scope

15 min.

This procedure describes time-synchronization link connection.

Prerequisites

- NTST01 Termination Unit installed if required.

Parts

None.

Tools

- Flat-blade screwdriver.
- Distributed Sequence of Events instruction.

Procedure

☐ 1. Connect the time-sync signal input (twinaxial cable) to P6, terminals one through three of the communications termination unit (Fig. PR15-1). The input can connect from another controller or from the distributed sequence of events (DSOE) system.

Figure PR15-2 shows the time-sync connection from the NTST01 termination unit that is part of the distributed sequence of events (DSOE) system. Refer to the ***Distributed Sequence of Events*** instruction for complete DSOE system information including terminal locations and assignments.

☐ 2. Connect the time-sync signal output (twinaxial cable) to P6, terminals four through six of the communications termination unit. This can be used to daisy-chain the time-sync signal to another controller.

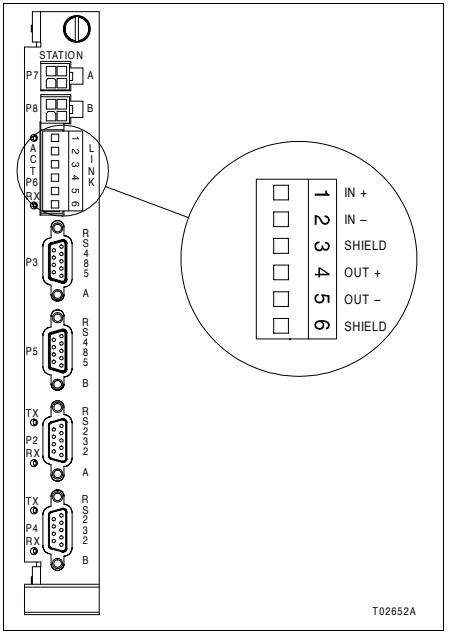

Figure PR15-1. Time-Synchronization Link Connector

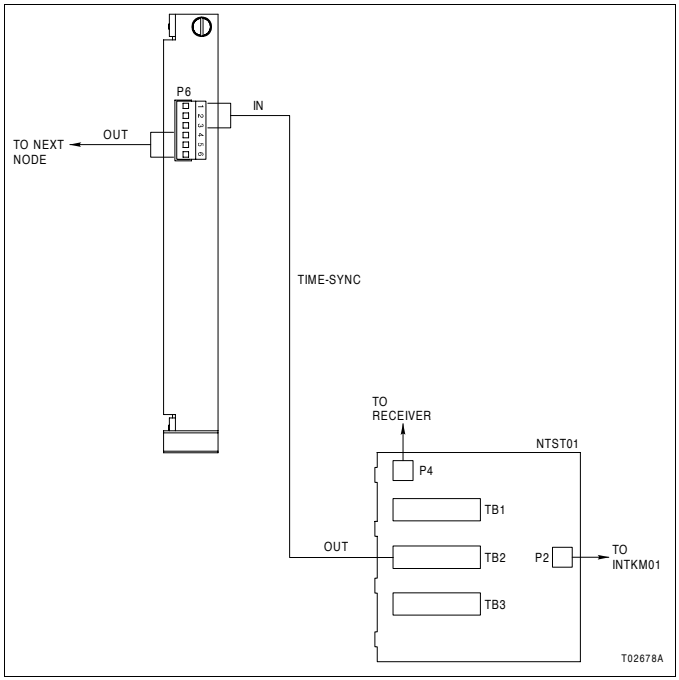

Figure PR15-2. DSOE Time-Sync Connection

Controller Module Removal

PR16

Purpose/Scope

1 min.

This procedure describes the steps necessary to remove the controller module from the docking station. The procedure is the same for both controller modules in a redundant pair.

Parts None.

Tools
- Phillips screwdriver.
- Thin rod, preferably nonmetallic.

Safety Considerations

WARNING	**1. A controller module should not be inserted or removed with power applied when located in a class I, division 2 hazardous location unless the area is known to be nonhazardous.**

CAUTION	**1. Release the latching mechanism by flipping the locking switch located behind the access door up to remove a controller module. Insure the latching mechanism is engaged (locking switch in down position) when a controller module is installed.**

Procedure

NOTE: A controller module can be removed with power applied.

☐ 1. Depress the STOP/RESET button once to halt controller module operation if not already halted.

☐ W1 2. Loosen the captive front panel fastening screw (Fig. PR16-1).

☐ C1 3. Hold the controller module and flip the locking switch located on the termination unit assembly up to unlock the controller module latching mechanism.

☐ 4. Grasp the module by its handle and pull.

☐ C1 5. Flip the locking switch down to return to the locked position.

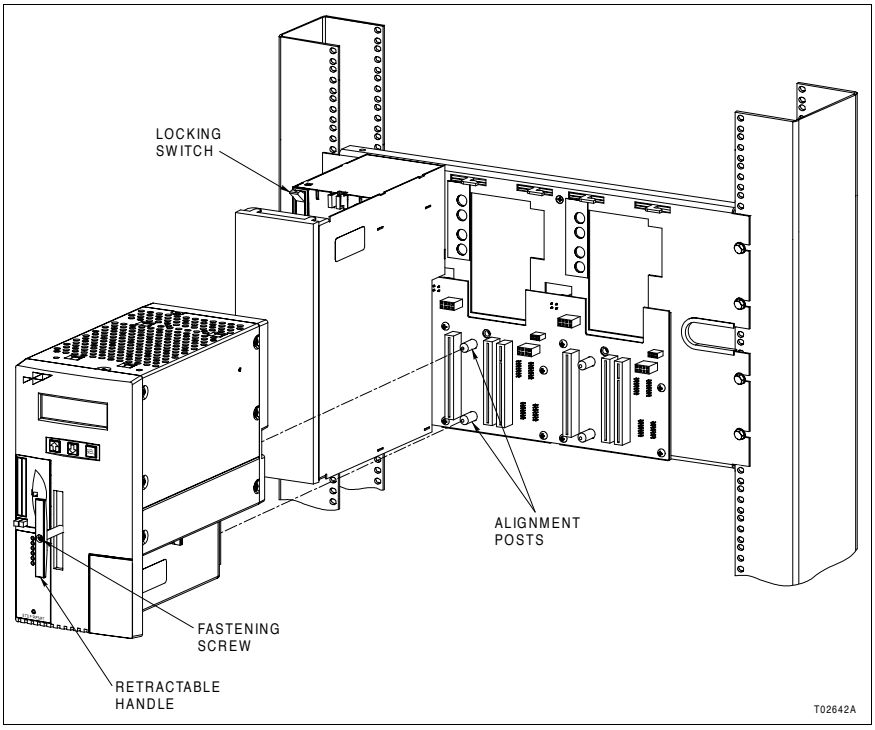

Figure PR16-1. Controller Module Removal

Docking Station Removal

PR17

Purpose/Scope

10 min.

This procedure describes the steps necessary to remove the docking station.

Parts None.

Tools
- Phillips screwdriver.

Procedure

☐ 1. Verify all cables are disconnected.

☐ 2. Remove the eight screws that attach the docking station to the side rails (Fig. PR17-1).

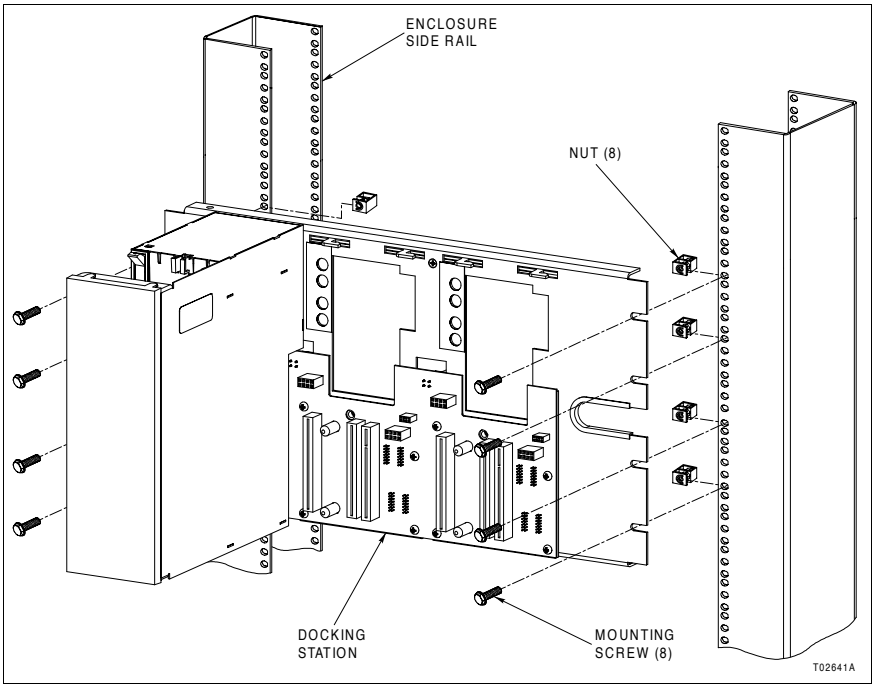

Figure PR17-1. Docking Station Removal

Termination Unit Removal

PR18

Purpose/Scope

2 min.

This procedure describes the steps necessary to remove a communication termination unit (TU) or a network TU. The procedure is the same for either type of termination unit.

Parts None.

Tools
- Flat-blade screwdriver.
- Thin rod, preferably nonmetallic.

Safety Considerations

WARNING	**1. A termination unit should not be inserted or removed with power applied when located in a class I, division 2 hazardous location unless the area is known to be nonhazardous.**

Procedure

NOTES:
1. A termination unit can be removed with power applied.
2. Cables can remain connected if the communication TU is only being removed to change jumper settings.

☐ 1. If removing a network TU, depress the STOP/RESET button of its associated controller module once to halt operation if not already halted.

☐ 

2. Loosen the captive front panel fastening screw (Fig. PR18-1).

☐ 3. Slide the termination unit out of the TU housing.

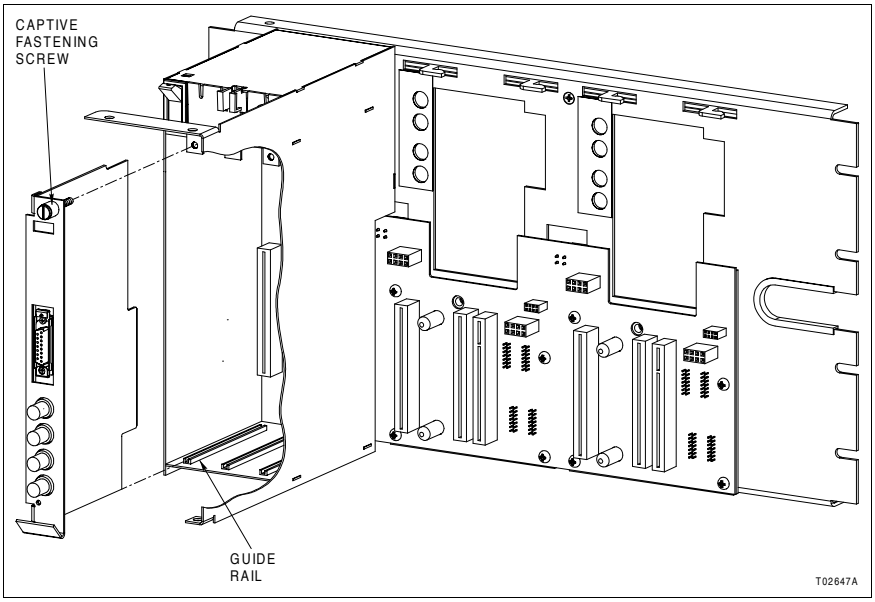

Figure PR18-1. Termination Unit Removal

Wiring and Cabling Disconnection

PR19

Purpose/Scope

15 min.

This procedure describes the steps necessary to disconnect all wires and cables from the docking station.

Parts None.

Tools
- Flat-blade screwdriver.
- Phillips screwdriver.

Safety Considerations

WARNING	**1. Verify the main power and power entry panel circuit breakers/switches are turned off before starting installation, retrofit, upgrade, replacement, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, replacement, or wiring procedures are complete.**

Procedure

☐ W1 1. Verify power to the docking station is turned off.

☐ 2. Record any wiring and cabling information necessary so the wiring and cabling can be easily reconnected.

☐ 3. Disconnect the power cables from the back of the docking station (Fig. PR19-1). Or, disconnect the power cables from the IPCHS02 Power Module Chassis.

☐ 4. Disconnect the I/O Hnet cable.

☐ 5. Disconnect the peer-to-peer Hnet cable.

☐ 6. Disconnect the I/O expander bus cable.

☐ 7. Disconnect all wires and cables from the termination units.

a. Disconnect the station link cables.

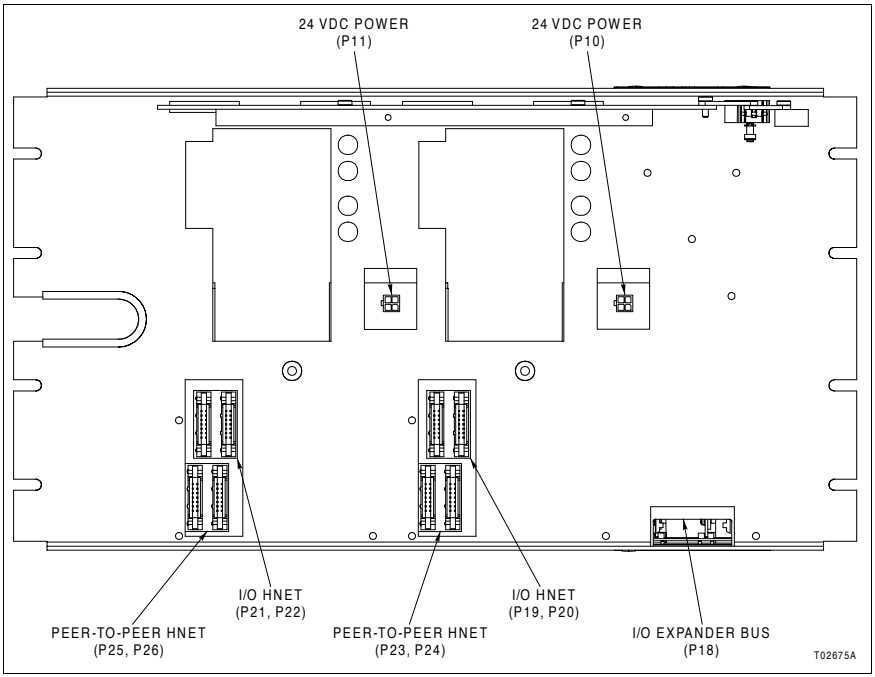

Figure PR19-1. Docking Station Connectors

b. Disconnect the serial port cables.

c. Disconnect the time-synchronization link wires.

d. Disconnect the Cnet loop one and loop two cables. Use a splice connector to maintain continuity if communication needs to be maintained.

Connections Check

PR20

Purpose/Scope

30 min.

This procedure describes the connections check maintenance procedure. Check all signal wiring, power, ground, and cable connections within the enclosure to verify their integrity.

Parts None.

Tools
- Flat-blade screwdriver.
- Phillips screwdriver.

Safety Considerations

WARNING	**1. Turn off all power before attempting the connections check maintenance procedure. Failure to do so could result in severe or fatal shock, or equipment damage.**

Procedure

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 should not be any motion done to loosen the connection.

NOTE: It is recommended that preventive maintenance task be performed during power supply preventive maintenance while the power to the enclosure is off.

☐ 

1. Verify that power is removed before checking any connections for tightness.

☐ 2. Verify that all termination unit wiring connections are secure.

☐ 3. Check all cable connections.

Controller Initialization

PR21

Purpose/Scope

20 min.

This procedure describes the steps necessary to initialize the controller hardware: docking station and controller modules. Initializing sets the docking station and controller modules to known default conditions. Two procedures are described: redundant controller and nonredundant controller.

NOTE: This procedure should only be performed when installing a new controller. Hardware initialization clears all configuration and setup information and sets the hardware to default conditions.

Parts None.

Tools
- Thin rod, preferably nonmetallic.

Procedure (Redundant Controller)

☐ 1. Verify the controller is powered up.

☐ 2. Refer to *LCD Screen and Keypad Operation* in Section 5 for an explanation of LCD screen and keypad operation.

☐ 3. Halt the right controller module by depressing its STOP/RESET button once.

☐ 4. Verify the left controller module is in either configure mode or offline mode (refer to Table 5-2). If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 5. Format the left controller module by selecting *Configuration* > *Format NVRAM* > *Yes*.

☐ 6. After the screen shows *OFFLINE MODE*, reset the left controller module by pressing the STOP/RESET button.

☐ 7. After the left controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 8. Halt the left controller module by depressing its STOP/RESET button once.

☐ 9. Reset the right controller module by depressing its STOP/RESET button.

☐ 10. After the right controller module comes up, verify it is in either configure mode or offline mode. If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 11. Format the right controller module by selecting *Configuration* > *Format NVRAM* > *Yes*.

☐ 12. Reset the right controller module by depressing its STOP/RESET button.

☐ 13. When the right controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 14. Reset the controller modules by pressing their STOP/RESET buttons.

Procedure (Nonredundant Controller)

☐ 1. Verify the controller is powered up.

☐ 2. Refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD screen and keypad operation.

☐ 3. Verify the controller module is in either configure mode or offline mode (refer to Table 5-2). If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 4. Format the controller module by selecting *Configuration* > *Format NVRAM* > *Yes*.

☐ 5. Reset the controller module by depressing its STOP/RESET button.

☐ 6. After the controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 7. Halt the controller module by depressing its STOP/RESET button.

☐ 8. Move the controller module to the other docking station slot. Refer to PR16 to remove the module and PR3 to install the module.

☐ 9. After the controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 10. Halt the controller module by depressing its STOP/RESET button.

☐ 11. Move the controller module back to its original position.

Docking Station Initialization

PR22

Purpose/Scope

10 min.

This procedure describes the steps necessary to initialize the docking station. Initializing sets the docking station to known default conditions. Two procedures are described: redundant controller and nonredundant controller.

Parts None.

Tools None.

Procedure (Redundant Controller)

☐ 1. Verify the controller is powered up.

☐ 2. Refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD screen and keypad operation.

☐ 3. Halt the right controller module by depressing its STOP/RESET button once.

☐ 4. Verify the left controller module is in either configure mode or offline mode (refer to Table 5-2). If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 5. Save the default setup for the left controller module to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 6. Halt the left controller module by depressing its STOP/RESET button once.

☐ 7. Reset the right controller module by depressing its STOP/RESET button.

☐ 8. After the right controller module comes up, verify it is in either configure mode or offline mode. If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 9. Save the default setup for the right controller module to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 10. Reset the controller modules by pressing their STOP/RESET buttons.

Procedure (Nonredundant Controller)

☐ 1. Verify the controller is powered up.

☐ 2. Refer to ***LCD Screen and Keypad Operation*** in Section 5 for an explanation of LCD screen and keypad operation.

☐ 3. Verify the controller module is in either configure mode or offline mode (refer to Table 5-2). If in execute or error mode, select *Configuration* > *Module Mode* > *Configure*. The RUN indicator should flash green.

☐ 4. Format the controller module by selecting *Configuration* > *Format NVRAM* > *Yes*.

☐ 5. Reset the controller module by depressing its STOP/RESET button.

☐ 6. After the controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 7. Halt the controller module by depressing its STOP/RESET button.

☐ 8. Move the controller module to the other docking station slot. Refer to PR16 to remove the module and PR3 to install the module.

☐ 9. After the controller module comes up, save the default setup to the docking station by selecting *Save Setup* > *Save Default Setup* > *Yes*.

☐ 10. Halt the controller module by depressing its STOP/RESET button.

☐ 11. Move the controller module back to its original position.

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