Honeywell

TotalPlant Solution (TPS) System

HPM
High-Performance Process Manager
Service

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Notices and Trademarks

About This Document

This document provides instructions for servicing the High-Performance Process Manager (HPM). The instructions consist of fault isolation and removal/replacement procedures at the Optimum Replaceable Unit (ORU) parts level.

> **ATTENTION**
>
> With TPN R684, Enhanced Universal Control Network (EUCN) is introduced. In EUCN, the traditional coaxial cable system is no longer utilized and is replaced with a Fault Tolerant Ethernet (FTE) based communication network.
>
> Throughout the document, unless specifically mentioned, the terms HPM, NIM, and UCN are interchangeably used with the terms **EHPM, ENIM**, and **EUCN** respectively.

> **ATTENTION**
>
> With TPN R686, the **Enhanced Network Bridge (ENB)** is introduced. The ENB is a variant of the NIM that allows communication between the LCN and both UCN and EUCN networks. It can communicate over coaxial-based UCN and FTE-based EUCN communication networks and provides a gateway function between the UCN and the EUCN. The ENB also facilitates on-process migration from HPM to EHPM (assuming you have redundant HPMs).

> **ATTENTION**
>
> Beginning with TPN R686, Fieldbus support is withdrawn.

Release Information

Document Name	Document ID	Release Number	Publication Date
High-Performance Process Manager Service - HP13	HP13	R690	September 2021

Document Category
Troubleshooting and Maintenance

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document Title	
HPM Specification and Technical Data	HP03-600
HPM Planning	HP02-600
HPM Installation	HP20-600
HPM Checkout	HP20-510
PM I/O Installation (PM/APM/HPM)	PM20-620

Support and Other Contacts

For support, contact your local Honeywell Process Solutions Customer Contact Center (CCC). To find your local CCC visit the website, https://www.honeywellprocess.com/en-US/contact-us/customer-support-contacts/Pages/default.aspx.

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	ATTENTION: Identifies information that requires special consideration.
	TIP: Identifies advice or hints for the user, often in terms of performing a task.
	REFERENCE -EXTERNAL: Identifies an additional source of information outside of the bookset.
	REFERENCE - INTERNAL: Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	WARNING, Risk of electrical shock: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	ESD HAZARD: Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	Protective Earth (PE) terminal: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.

Symbol	Definition
	Earth Ground: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

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1. Introduction

1.1 Overview

Introduction

This section describes the purpose of this manual and lists all available manuals that may be required when servicing the High-Performance Process Manager.

1.2 Purpose of this Manual

Service philosophy

The *High-Performance Process Manager Service* manual provides instructions for servicing the High-Performance Process Manager (HPM). The instructions consist of fault isolation and removal/replacement procedures at the Optimum Replaceable Unit (ORU) parts level. In addition, an ORU parts lists for current production hardware is provided.

2. Equipment Description

2.1 Overview

Introduction

This section describes the assemblies that comprise the High-Performance Process Manager (HPM) subsystem which is a node on the Universal Control Network (UCN). The UCN interfaces with the Local Control Network (LCN) through a Network Interface Module (NIM). The modules (nodes) on the LCN comprise the TPS system.

Component part numbers

The Honeywell part numbers for the items described in this section are listed in "Spare Parts". See subsections "Periodic Maintenance Parts" and "Optimum Replaceable Unit (ORU) Parts".

2.2 Power System Controls

Power Supply Module Control

Two methods of power controlling power

Control of ac power to the Power Supply Modules is provided by two methods when the High-Performance Process Manager cabinet contains the normal Standard Power System components.

AC power control

All ac power to the cabinet, which includes any Cabinet Fan assemblies, is controlled by a dedicated circuit breaker that is supplied by the user for each Power Supply Module in the Power System. Additional ac Power Supply Module control is provided by a power switch that is mounted at the front of each module.

DC power control

Since the Standard Power System can contain redundant Power Supply Modules, placing a module's power switch in the off position does not necessarily remove power from the card files and FTAs in the cabinet because the second module will continue to supply power unless its Power switch is in the off position.

If the Standard Power System contains a Battery Backup Pack, 24 Vdc power will continue to be supplied to the card files and FTAs unless the **BATTERY** switch is placed in the off position, or the Battery Backup Pack is discharged. All three switches must be in the off position to completely remove power from the card files.

AC Only Power System

In a cabinet that contains an AC Only Power System, no Battery Backup Pack exists to provide 24 Vdc power to the card files and FTAs, so control of dc power to the card files and FTAs is provided exclusively by user supplied ac circuit breakers. When redundant Power Supply Modules exist, each module has its own circuit breaker that is provided by the user. There is no on-off switch at the front of the Power Supply Module.

HPMM/IOP Card Power Interrupt Switches

24 Vdc power interruption

The HPMM High-Performance Comm/Control and High-Performance I/O Link cards, and each IOP card have a 24 Vdc power interrupt switch that is activated by unlocking and lifting the upper card extractor/insertion lever. Activating either HPMM card's interrupt switch removes power from both HPMM cards and the HPM UCN Interface module in the card file, while activating an IOP card power

interrupt switch removes power only from that IOP card. Power is removed only while the switch is activated.

⚠️ **WARNING**

The loss of power to an analog or digital output IOP causes the loss of the IOP's outputs to the field connections. Analog output IOP outputs drop to a nonpowered state (-6.9%), and the digital output IOP outputs are set to their off state.

The nonpowered state of the output IOPs should result in a safe condition for personnel, the plant, and the process under control.

2.3   HPM Subsystem Overview

Major assemblies

The High-Performance Process Manager subsystem (HPM) is comprised of the major assemblies that are described in the following subsections. Figure 1 is a view of a single cabinet containing a nonredundant HPMM and identifies some of the High-Performance Process Manager assemblies. The High-Performance Process Manager major assemblies are:

- Left 7-Slot Card File (Slots 1 through 7)
- Right 7-Slot Card File (Slots 9 through 15)
- 15-Slot Card File
- IOP Only Card File (in PM/APM upgraded cabinets)
- Input/Output Processors (IOPs)
- Field Termination Assemblies (FTAs)
- Power Systems

Card file types

Three types of card files can accommodate both High-Performance Process Manager Module (HPMM) and Input/Output Processor (IOP) cards, or may have IOP cards only. The HPMM card set occupies slots 1 and 2 in both the Left 7-Slot and 15-Slot card files. The HPMM card set occupies slots 9 and 10 in the Right 7-Slot card file. All card slots accept IOPs.

An older "IOP Only" card file may exist in a HPM cabinet that was upgraded to an HPM from a PM or APM. This older card file cannot support an HPMM card set. It is restricted to IOP cards and optional I/O Link Extender cards.

Card file designations

When a card file contains an HPMM card set, it is designated an HPMM card file. If the card file contains only IOP cards, the card file is designated 7-Slot or 15-Slot IOP card file. A card file can accommodate only one HPMM card set. A second HPMM card file must be added for HPMM redundancy.

Nonredundant 15-Slot HPMM card file

When configuring an HPM with a nonredundant HPMM by using a 15-Slot card file, the HPMM card file is typically installed in the bottom card file position of the cabinet.

Redundant 15-Slot HPMM card files

If an HPM is configured with redundant HPMMs by using 15-Slot card files, HPMM card files are installed in the bottom two card file positions in the cabinet. A redundancy cable is connected between the HPMM card files.

Nonredundant 7-Slot HPMM card file

When configuring an HPM with a nonredundant HPMM by using a 7-Slot card file, the HPMM card set are typically installed in a <u>Left</u> 7-Slot card file.

Redundant 7-Slot HPMM card files

If an HPM is configured with redundant HPMMs using 7-Slot card files, HPMM card sets are installed in both a Left 7-Slot card file and in a Right 7-Slot card file. The card files are normally mounted side-by-side in the bottom card file position of the cabinet. A redundancy cable is connected between the HPMM card files.

SHOCK HAZARD

Troubleshooting, opening any equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Nonredundant HPMM cabinet layout

The following figure is an illustration of an HPM cabinet that contains a nonredundant HPMM that is installed in left most card slots of the lower 15-Slot card file. IOPs are installed in the remaining slots of the lower card file and the 15-Slot card files above.

Figure 1 Cabinet Layout – HPM with Nonredundant HPMM
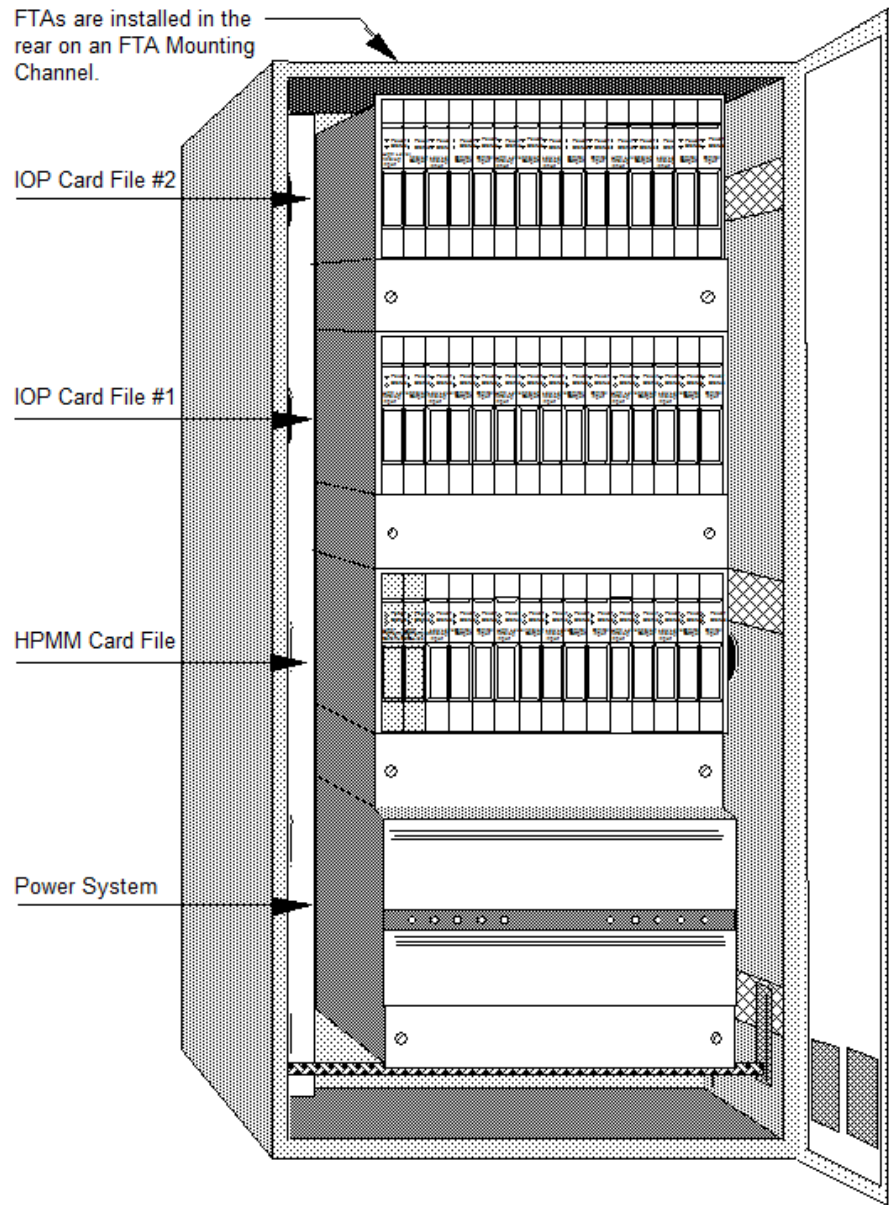
2.4   HPMM and IOP Card Files

Introduction

There are nine (9) card file models. Three models are not CE Compliant and six models are CE Compliant. The following table lists the nine card file models. All models are also available with conformal coating (a model number with a prefix of MC, rather than MU).

Table 1 Card File Models

Card File Description	CE Compliant	Non-CE Compliant
Left 7-Slot HPMM or IOP	N/A	MU-HPFH01
Right 7-Slot HPMM or IOP	N/A	MU-HPFH11
15-Slot HPMM or IOP	N/A	MU-HPFX02
Left 7-Slot HPMM	MU-HPFH03	N/A
Right 7-Slot HPMM	MU-HPFH13	N/A
15-Slot HPMM	MU-HPFX03	N/A
Left 7-Slot IOP	MU-HPFI03	N/A
Right 7-Slot IOP	MU-HPFI13	N/A
15-Slot IOP	MU-HPFI23	N/A

HPMM and IOP card file differences

An HPMM card file and IOP card file differ only in the application. Electrically, their backpanels are the same.

Non-CE Compliant card file models

The non-CE Compliant card file models can be designated as an HPMM card file or an IOP card file by either installing an HPMM card set in the two left-most card slots or installing IOP cards.

CE Compliant card file models

Unlike the non-CE Compliant card file models, the CE Compliant card file models are designated either an HPMM card file or an IOP card file because even though their is no electrical difference in the backpanel, they differ mechanically. The addition of a ground plate and filtered IOP connectors in the two left-most slots prohibits the installation of an HPMM card set.

The card file is designated an IOP card file when the ground plate and filtered connectors are present.

The card file is designated an HPMM card file when the ground plate and filtered connectors are absent.

Conversion kit

A CE Compliant HPMM card file can be converted to an IOP card file with a model MU-ZPFI03 upgrade kit. The kit adds 2 filtered IOP adapter connectors to the two left-most card slots and a ground plate extension.

2.5   HPMM Card Files

Introduction

A High-Performance Process Manager (HPMM) card file is a 7-Slot or 15-Slot card file that is populated with an HPMM card set. The HPMM card set consists of following assemblies.

- High-Performance Comm/Control card
- High-Performance I/O Link card

- HPM UCN Interface module

The HPMM assemblies occupy the two left-most slot positions in the card file. The HPM UCN Interface module mounts in the connector beneath the High-Performance Comm/Control card in the first slot.

HPMM card file configurations

There are 3 HPMM card file configurations. They are as follows:

- Left 7-Slot HPMM card file
- Right 7-Slot HPMM card file
- 15-Slot HPMM card file

15-Slot HPMM card file

The following figure is an illustration of a 15-Slot HPMM card file.

Figure 2 15-Slot HPMM Card File
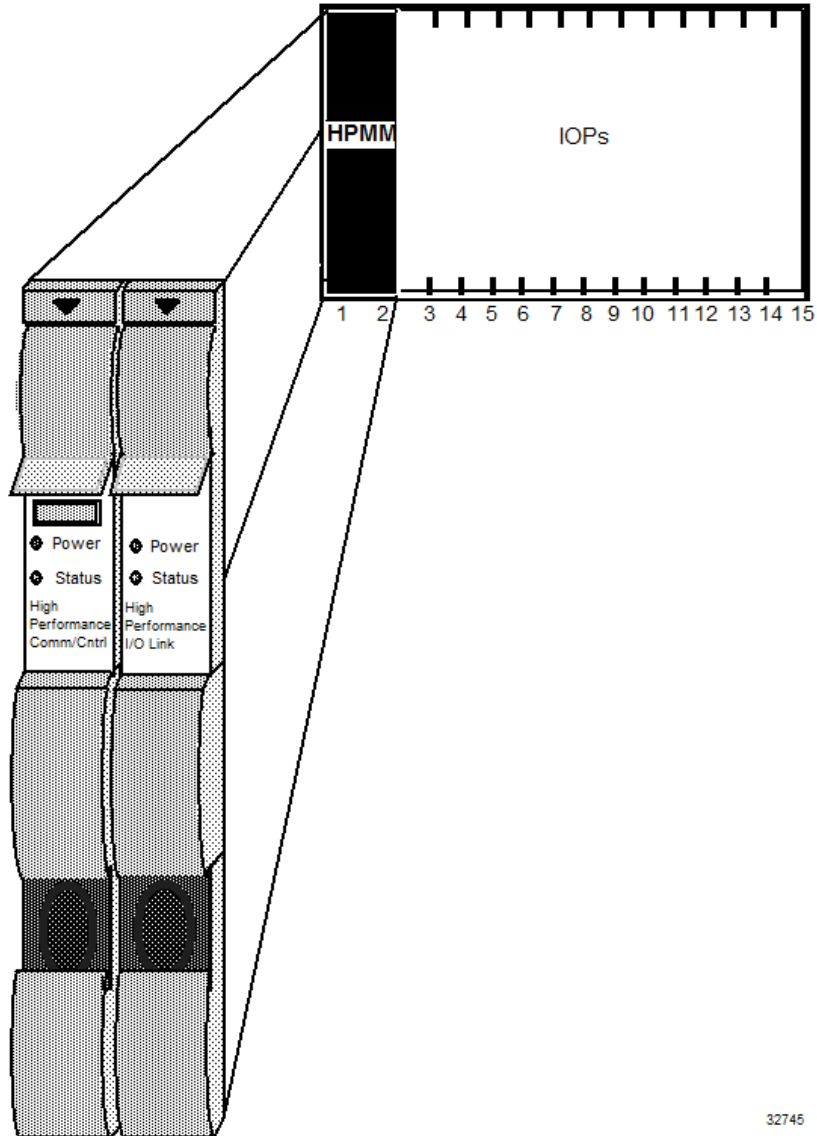
HPMM functionality

The High-Performance Process Manager Module (HPMM) provides:

- Communications with the Local Control Network (LCN) Network Interface Module (NIM) through the Universal Control Network (UCN)

- A Communications processor (Motorola 68LC040)

- Communications through the I/O Link Interface with Input/Output Processors (IOPs) and I/O Link Extenders

- A Control processor (Motorola 68040)

- Separate and shared memory for the Communications and Control processors

- An I/O Link processor (Motorola 80C32) with SRAM

- HPMM redundancy control

HPMM card/module types

The HPMM is composed of two card types and a UCN interface module that mounts in the 50-pin connector below the High-Performance Communications/Control card in the first left-most card file slot. The cards and the module are described in the following table.

Table 2 HPMM Card/Module Types

Card/Module Type	Function
High-Performance Comm/Control Card	Consists of a Communications (Comm) processor, Control processor (Control), separate and shared RAM for the processors, interface to the HPMM Global bus on the backpanel, TBC interface to the HPM UCN Interface module, redundancy interface to another HPMM, and front panel LEDs and a four character alphanumeric diagnostic display.
High-Performance I/O Link Card	Consists of an I/O Link processor, SRAM through which the processor communicates with the Communications/Control card, an I/O Link driver/receiver interface, and a +24 Vdc to +5 Vdc power converter that provides +5 Vdc for both HPMM cards and the HPM UCN Interface module.
HPM UCN Interface Module	Consists of 5 Mbps IEEE 802.4 compatible MAP carrier band modulator/demodulator circuitry that provides the interface with the Universal Control Network (UCN). Logically provides redundant UCN cable selection (transmit on both, receive on the selected cable) through redundant UCN cable driver/receivers.

ESD HAZARD

It is important that you wear a properly connected Electrostatic Discharge (ESD) wriststrap while touching or handling HPM components.

Card/module illustrations

These cards and interface module are shown in more details in the following figures.

- Figure 3 HPM UCN Interface Module (Front Panel)
- Figure 4 High-Performance Comm/Control Card (Front Panel)
- Figure 5 High-Performance I/O Link Card (Front Panel)

Refer to these figures for the discussion of HPMM indicators, diagnostic switch, and power margin jumper that follows.

Power indicators

When power is applied to the HPMM, the **Power** indicator on each HPMM card and the HPM UCN Interface module lights. The **Power** indicator is illuminated whenever 24 Vdc from the cabinet Power System is present.

Status indicators

The **Status** indicator on the High-Performance Communications/Control card illuminates momentarily after applying power. Internal test routines are executed upon applying power, and the **Status** indicator remains on if the tests are successfully completed. The steady illumination of the **Status** indicator signifies that no test failures were detected.

The High-Performance I/O Link **Status** indicator is not lit when the HPMM is in the Alive state. It will light (not blinking) after the HPMM is loaded with the operating personality software, and enters the OK state.

The UCN cables in use indicators are visible at the front of the HPM UCN Interface module (**Rx-A** and **Rx-B**) as well as under the front cover of the High-Performance Comm/Control card (**UCN A** and **UCN B**).

The Transmit (**Tx**) indicator at the front of the HPM UCN Interface module is an indication of UCN cable transmit activity.

Refer to the "FTA Redundancy Indicators"subsection in the "Fault Isolation" section. for additional information on the status indicators.

Diagnostic display

The 4-digit Diagnostic display at the front of the High-Performance Communications/Control card (below the upper extraction lever) provides additional status information as well as error code information if a failure occurs. After power is applied and the internal test routines have completed successfully, it will display a code that indicates the HPMM is in the Alive state, such as **Axxx.**

Diagnostic display analysis example

A diagnostic code of **AL09** is analyzed as follows:

First character = **A** = The HPMM is in the Alive state.

Possible first characters are:

A = Alive

B = Backup

I = Idle

F = Fail

L = Load

T = Test

Second character = **L** = The card file is a left 7-Slot file.

Possible characters are:

L = Left 7-slot HPMM card file

R = Right 7-slot HPMM card file

1 = First 15-slot HPMM card file

2 = Second 15-slot HPMM card file

Third and Fourth characters = **09** = The pinned UCN node number

Refer to subsection "Redundant Analog Output IOP Failure Diagnosis" in "Fault Isolation" for additional Diagnostic display codes and more detailed information.

Detailed Diagnostic display switch

A pushbutton switch (**Display**) under the front cover of the High-Performance Comm/Control card controls additional detailed diagnostic information displays. The additional diagnostic codes are presented in a fixed sequence.

This detailed diagnostic information becomes extremely useful when troubleshooting.

The switch effects only the behavior of the display and will not effect the operational capability of the High-Performance Comm/Control card.

Refer to the "Fault Isolation" section for troubleshooting information, failure code charts including suggested corrective actions, and additional information on detailed diagnostic displays and the sequences of presentation.

Debug connector

The High-Performance Comm/Control card has a debug connector (**Debug**) under the front cover. The connector is used by Honeywell engineering with specialized equipment and design level knowledge. The factory also uses the connector.

HPMM +5 volt power margins

HPMM +5 volt power margining can be accomplished by using the jumper positions under the front cover of the High-Performance I/O Link card. The possible settings are **Normal**, **High**, and **Low** margins. Power margining is used by manufacturing test and can also be used for troubleshooting intermittent hardware problems as a last resort. Power margining is effective as soon as the jumper is moved.

Honeywell does not recommend the use of power margins on any device that is on-process. Figure 5 High-Performance I/O Link Card (Front Panel) identifies the pinning selections on the High-Performance I/O Link card with a single jumper.

It is important that the jumper be placed in the **Normal** position when a nominal voltage level is required (rather than removing the jumper completely). The jumper in the **Normal** position is required to internally set the correct values for error detection (error trip points) at the nominal voltage level.

HPM UCN Interface module illustration

The following figure illustrates the front of the HPM UCN Interface module.

Figure 3 HPM UCN Interface Module (Front Panel)
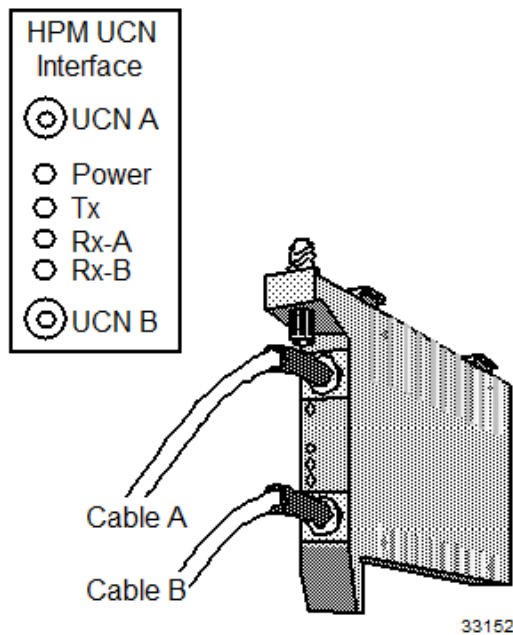
High-Performance Comm/Control card

The following figure illustrates the front of the High-Performance Comm/Control card as well as the indicators, Diagnostic display, Detailed Diagnostic switch, and Debug connector that are located under the front cover.

Figure 4 High-Performance Comm/Control Card (Front Panel)
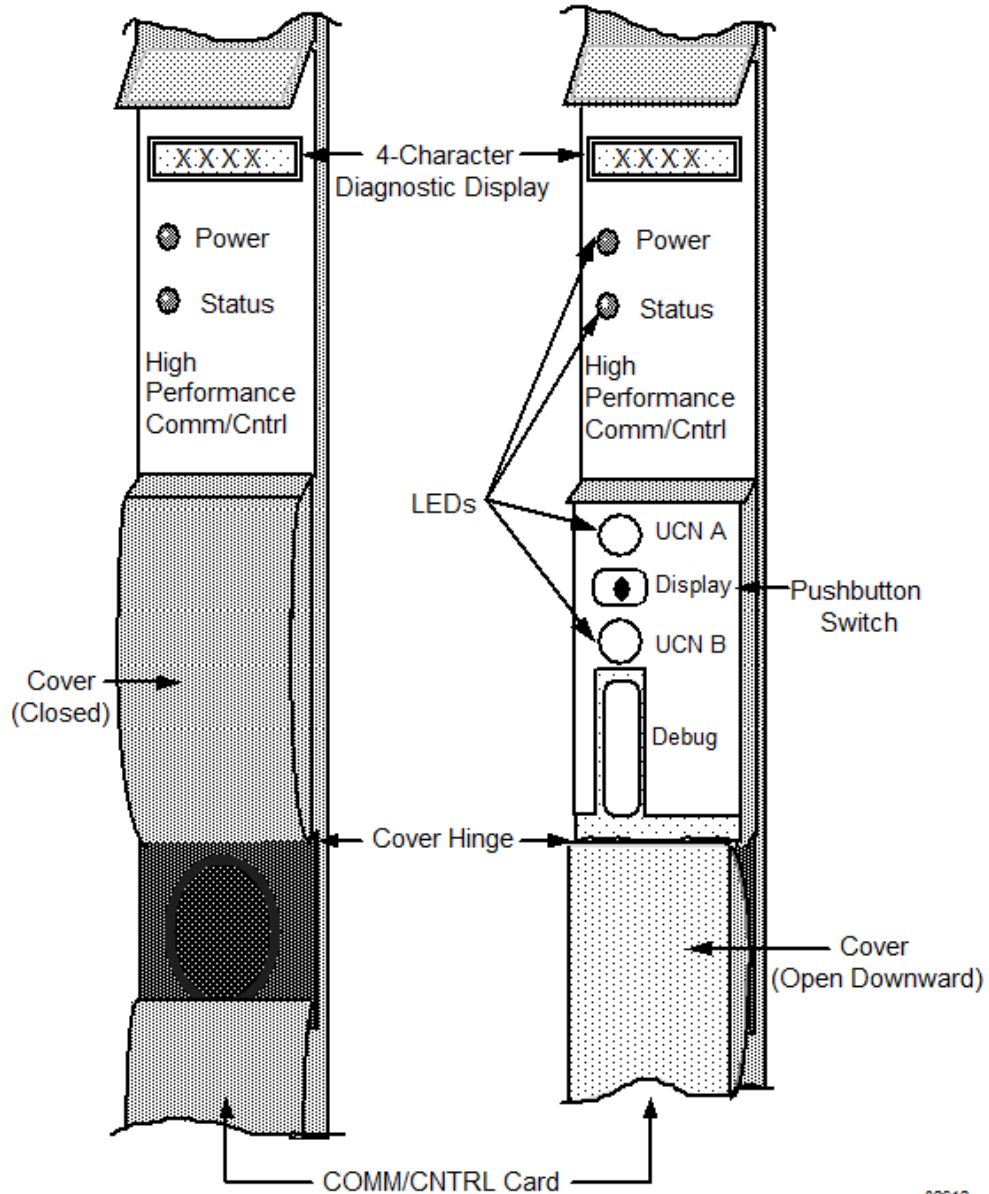
High-Performance I/O Link card

The following figure illustrates the front of the High-Performance I/O Link card as well as the voltage margin jumper pins that are located under the front cover.

Figure 5 High-Performance I/O Link Card (Front Panel)
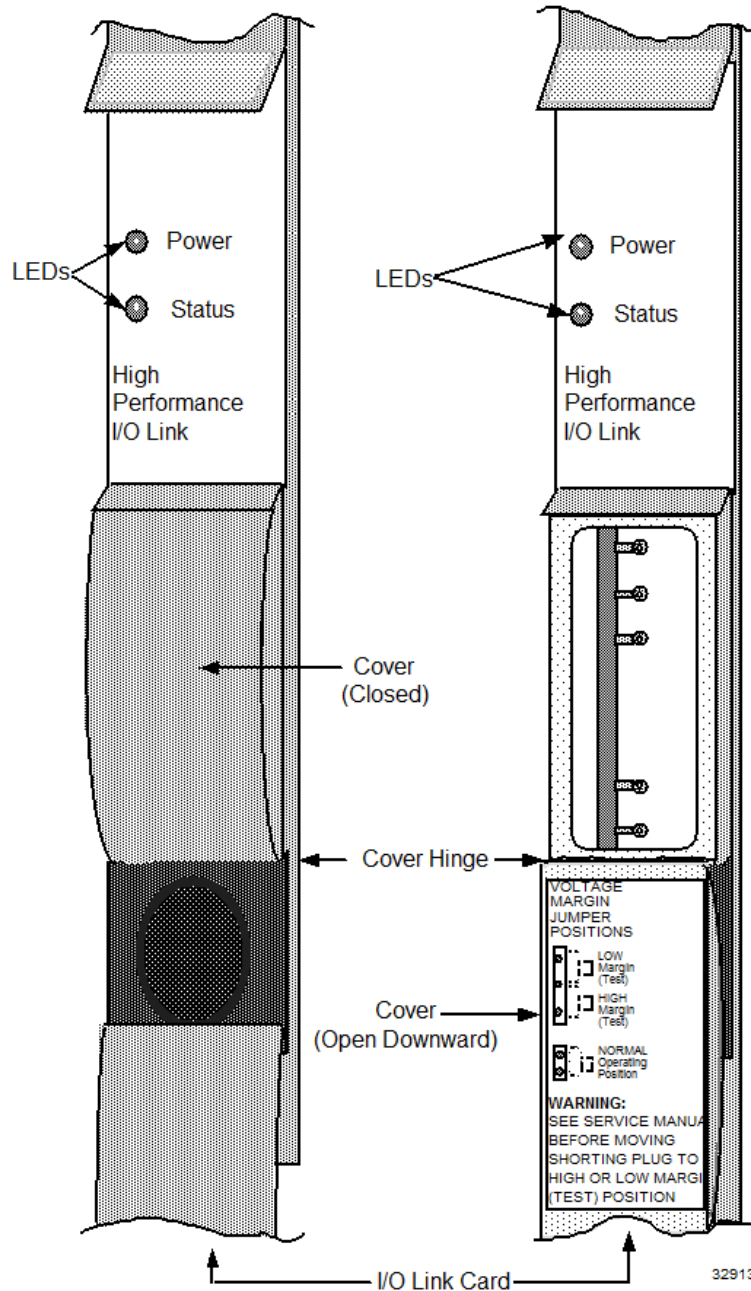
2.6 EHPM Card Files

Introduction

An Enhanced High-Performance Process Manager (EHPM) card file is a 7-Slot or 15-Slot card file that is populated with an EHPM card set. The EHPM card set consists of following assemblies.

- Enhanced High-Performance Comm/Control card
- High-Performance I/O Link card
- EHPM FTE Interface module

The EHPM assemblies occupy the left-most slot positions in the card file. The EHPM FTE Interface module mounts in the connector beneath the EHPM Comm/Control card in the first slot.

EHPM card file configurations

There are 3 EHPM card file configurations. They are as follows:

- Left 7-Slot EHPM card file
- Right 7-Slot EHPM card file
- 15-Slot EHPM card file

15-Slot EHPM card file

The following figure is an illustration of a 15-Slot EHPM card file.

Figure 5.1 15-Slot EHPM Card File
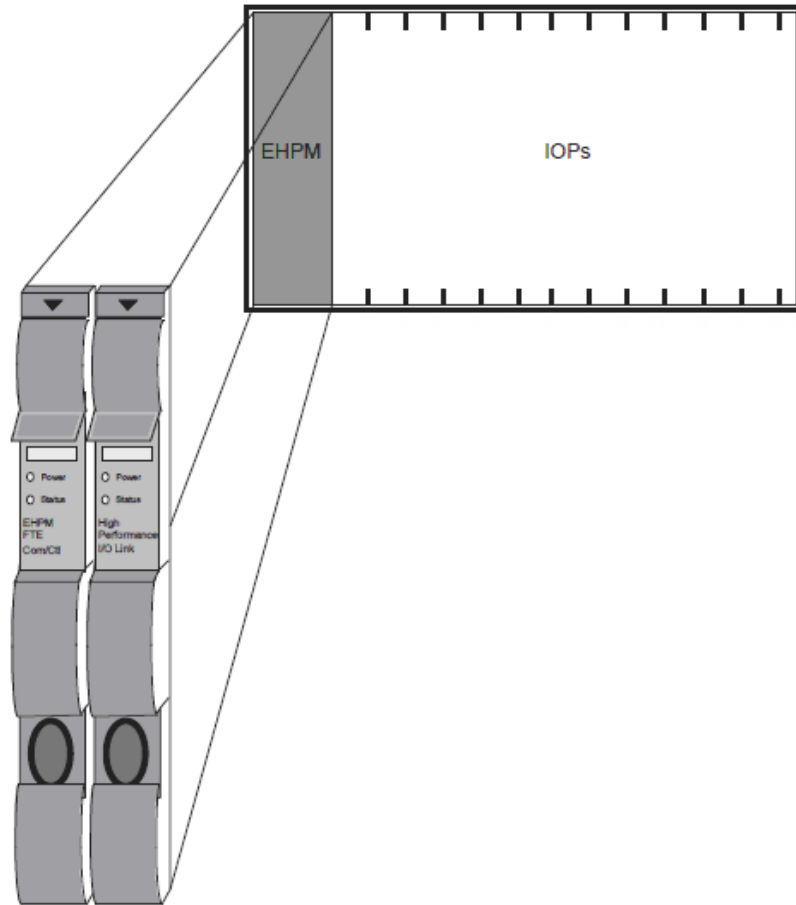
EHPM functionality

The Enhanced High-Performance Process Manager Module (EHPM) provides:

- A Control processor (Motorola 68040)

- Communications with the Local Control Network (LCN) Enhanced Network Interface Module (ENIM) through the Enhanced Universal Control Network (EUCN)

- A Communications processor (Motorola 68LC040)

- Communications through the I/O Link Interface with Input/Output Processors (IOPs) and I/O Link Extenders

- Separate and shared memory for the Communications and Control processors

- An I/O Link processor (Motorola 80C32) with SRAM

- EHPM redundancy control

EHPM card/module types

The EHPM board set consists of the Enhanced High-Performance Com/Control PWA, High Performance I/O Link PWA and FTE Interface Module. The interface module is mounted in the 50-pin connector below the Enhanced High-Performance Communications/Control card in the first left-most card file slot. The cards and the module are described in the following table.

Table 2.1 EHPM Card/Module Types

Card/Module Type	Function
Enhanced High-Performance Comm/Control Card	Consists of: • a Communications (Comm) processor, • Control processor (Control) • separate and shared RAM for the processors, interface to the HPMM Global bus on the backpanel • FTE interface to the EHPM FTE Interface module • redundancy interface to another HPMM • front panel LEDs and a four character alphanumeric diagnostic display.
High-Performance I/O Link Card	Consists of: • an I/O Link processor • SRAM through which the processor communicates with the Communications/Control card • an I/O Link driver/receiver interface • a +24 Vdc to +5 Vdc power converter that provides +5 Vdc for both HPMM cards and the EHPM FTE Interface module.

Card/Module Type	Function
EHPM FTE Interface Module	The EHPM FTE Interface module has 3 ethernet ports with RJ45 connectors and LEDs. The backplane interfaces between the EHPM and FTE Interface. The EHPM FTE interface module does not use the Global Bus. The EHPM FTE interface supports operation at 100 MHz.

ESD HAZARD

It is important that you wear a properly connected Electrostatic Discharge (ESD) wriststrap while touching or handling the EHPM components.

Card/module illustrations

These cards and interface module are shown in more detail in the following figures:

- Figure 5.2 EHPM FTE Interface Module (Front Panel)
- Figure 5.4 Enhanced High-Performance Comm/Control Card (Front Panel)
- Figure 5 High-Performance I/O Link Card (Front Panel)

Refer to these figures for the discussion of EHPM indicators, diagnostic switch, and power margin jumper that follows.

Power indicators

When the EHPM is turned on, the **Power** indicator on each EHPM card and the EHPM FTE Interface module lights. The **Power** indicator is illuminated whenever 24 Vdc from the cabinet Power System is present.

Status indicators

The **Status** indicator on the Enhanced High-Performance Communications/Control card illuminates momentarily after applying power. Internal test routines are executed upon applying power, and the **Status** indicator remains on if the tests are successfully completed. The steady illumination of the **Status** indicator signifies that no test failures were detected.

The High-Performance I/O Link **Status** indicator is not lit when the EHPM is in the Alive state. It is lit (not blinking) after the EHPM is loaded with the operating personality software, and enters the **OK** state.

When the EUCN FTE cables are in use, it is displayed by the indicators at the front of the EHPM FTE Interface Module and under the front cover of the Enhanced High-Performance Comm/Control card.

The Transmit (**Tx**) indicator at the front of the EHPM FTE Interface module is an indication of EUCN cable transmit activity.

The **Link** indicator at the front of the EHPM FTE Interface module is an indication of EUCN cable link status.

Refer to the "FTA Redundancy Indicators"subsection in the "Fault Isolation" section. for additional information on the status indicators.

Diagnostic display

The 4-digit Diagnostic display at the front of the Enhanced High-Performance Communications/Control card (below the upper extraction lever) provides additional status information as well as error code information if a failure occurs. After power is applied and the internal test routines have completed successfully, it displays a code that indicates the EHPM is in the Alive state, such as **Axxx.** In addition, for EUCN, the 4-digit diagnostic display includes the UCN Node Number, FTE Device Index and the

four octets of the IP Address of the node. The additional diagnostic codes are presented in a fixed sequence.

> **ATTENTION**
>
> If a running EHPM fails in such a way that the status indicator (front-panel LED on the EHPM Comm/Ctrl card) is shown as all black, you should recover by performing a RAM RENTENTION RESTART to maintain the error code indication for the purposes of diagnosing the potential issue. If you perform a full power recycle, you will lose the error code indication.

Diagnostic display analysis example

A diagnostic code of **AL09** is analyzed as follows:

First character = **A** = The HPMM is in the Alive state.

Possible first characters are:

A = Alive

B = Backup

I = Idle

F = Fail

L = Load

T = Test

Second character = **L** = The card file is a left 7-Slot file.

Possible characters are:

L = Left 7-slot HPMM card file

R = Right 7-slot HPMM card file

1 = First 15-slot HPMM card file

2 = Second 15-slot HPMM card file

Third and Fourth characters = **09** = The pinned UCN node number

Refer to subsection "Redundant Analog Output IOP Failure Diagnosis" in "Fault Isolation" for additional Diagnostic display codes and more detailed information.

Detailed Diagnostic display switch

A pushbutton switch (**Display**) under the front cover of the Enhanced High-Performance Comm/Control card controls additional detailed diagnostic information displays. The additional diagnostic codes are presented in a fixed sequence.

This detailed diagnostic information becomes extremely useful when troubleshooting.

The switch effects only the behavior of the display and does not effect the operational capability of the Enhanced High-Performance Comm/Control card.

Refer to the "Fault Isolation" section for troubleshooting information, failure code charts including suggested corrective actions, and additional information on detailed diagnostic displays and the sequences of presentation.

Debug connector

The Enhanced High-Performance Comm/Control card has a debug connector (**Debug**) under the front cover. The connector is used by Honeywell engineering with specialized equipment and design level knowledge.

EHPM +5 volt power margins

EHPM +5 volt power margining can be accomplished by using the jumper positions under the front cover of the High-Performance I/O Link card. The possible settings are **Normal**, **High**, and **Low** margins. Power margining is used by manufacturing test and can also be used for troubleshooting intermittent hardware problems as a last resort. Power margining is effective as soon as the jumper is moved.

> **ATTENTION**
>
> Honeywell does not recommend the use of power margins on any device that is on-process. Figure 5 High-Performance I/O Link Card (Front Panel) identifies the pinning selections on the High Performance I/O Link card with a single jumper.

It is important that the jumper be placed in the **Normal** position when a nominal voltage level is required (rather than removing the jumper completely). The jumper in the **Normal** position is required to internally set the correct values for error detection (error trip points) at the nominal voltage level.

EHPM FTE Interface module

The following figure illustrates the front panel of the EHPM FTE Interface module. Each FTE cable (yellow and green) is connected to a CF9 Ethernet Switch (yellow and green).

Redundant EHPMs connected to an Experion network have a crossover cable connecting the redundancy ports (bottom port) of the two EHPM FTE Interface modules. This is not required for a standalone EUCN node that is not connected to an Experion network.

Figure 5.2 EHPM FTE Interface Module (Front Panel)
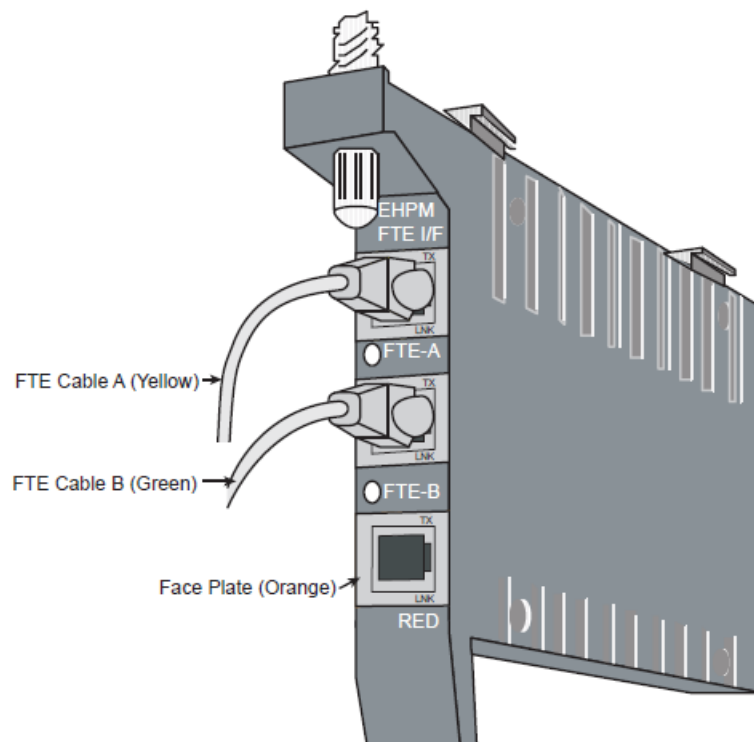
CF9 Ethernet Switch

The following figure illustrates a yellow CF9 Ethernet Switch. There are eight ports to connect to EHPM FTE Interface Modules, and one port to connect to a Level 2 port on the FTE Switch.

The CF9 Ethernet Switch has upgradable firmware. If the EUCN is connected to an Experion network, the firmware can be upgraded from the Experion system. If the EUCN is not connected to an Experion network, the firmware can be upgraded from a standalone PC loaded with EUCN Tools. Firmware and instructions to update the firmware are provided with the Utilities & Load Modules media.

The eight-port, Control Firewall (CF9) serves as the Fault Tolerant Ethernet (FTE) communication center for a given EHPM network. It consists of a CF9 Ethernet Switch module that plugs into its associated CF9 input/output termination assembly (IOTA) as shown in the following figure.

Figure 5.3 CF9 Ethernet Switch and IOTA
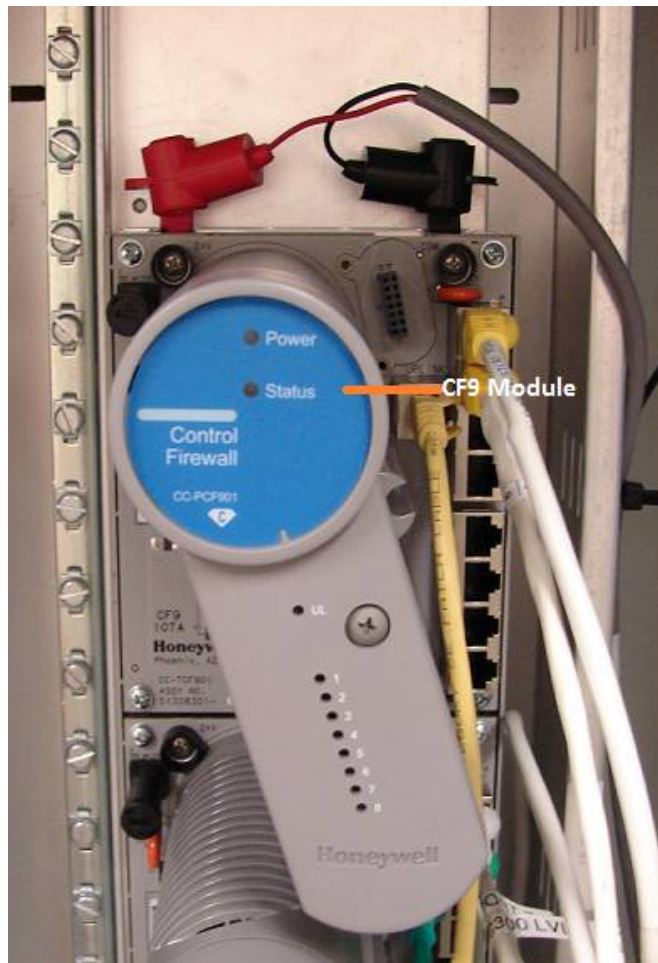
Enhanced High-Performance Comm/Control card

The following figure illustrates the front of the Enhanced High-Performance Comm/Control card as well as the indicators, Diagnostic display, Detailed Diagnostic switch, and Debug connector that are located under the front cover. Pressing the Display pushbutton switch under the cover enables the display to indicate the UCN Node Number, the FTE Device Index, and the four octets of the IP address. Pressing the pushbutton switch again disables the additional information from being displayed.

The EHPM Comm/Control card has upgradable firmware. If the EUCN is connected to an Experion network, the firmware can be upgraded from the Experion system. If the EUCN is not connected to an

Experion network, the firmware can be upgraded from a standalone PC loaded with EUCN Tools. Firmware and instructions to update the firmware are provided with the Utilities & Load Modules media.

Figure 5.4 Enhanced High-Performance Comm/Control Card (Front Panel)
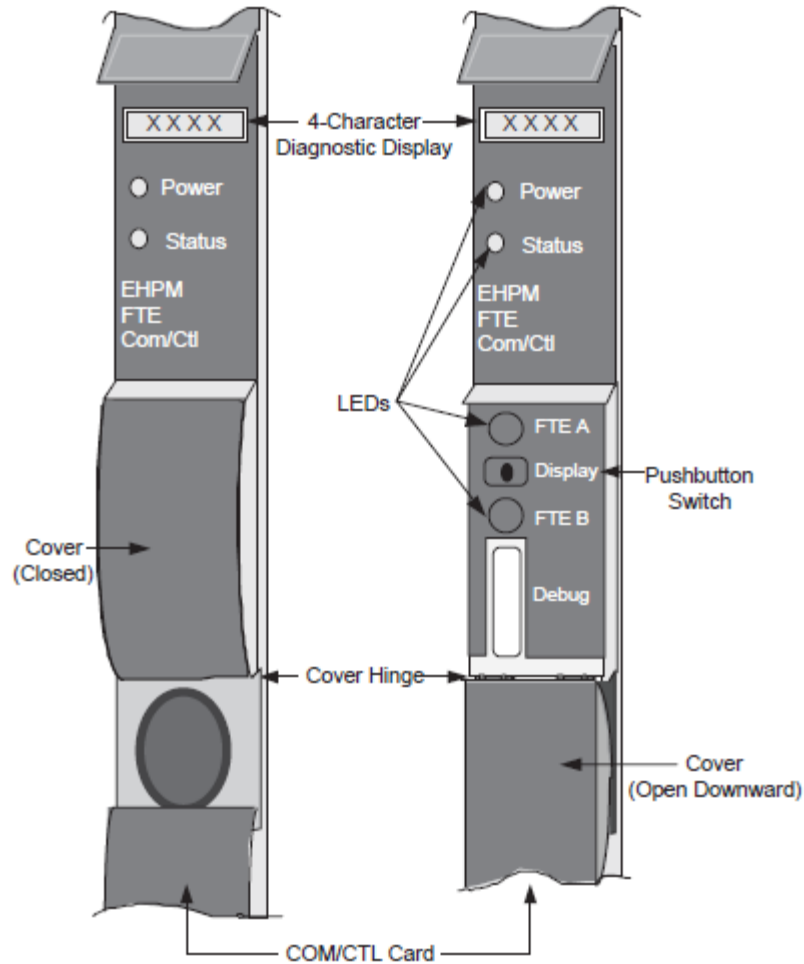
EHPM Front Panel LED display information

Table 2.2 EHPM Front Panel display indications

EHPM Front Panel LED display	Indicates…	Recovery action
AUTH	ENIM failed to authenticate EHPM.	Check $FTESTS2 schematic details for the AUTH GROUP. There might be a duplicate BOOTP server on the network. Manual failover to backup ENIM may be necessary.
BRN	Firmware load in progress.	Wait for firmware load to complete.
DUP	EHPM either has a duplicate FTE Device Index, or duplicate PdTag, or both duplicate FTE Device Index and	Identify the duplicate problem in the FTE Community (using $FTESTS2 schematic or PC's FTE Status

EHPM Front Panel LED display	Indicates…	Recovery action
	PdTag of another device in the FTE Community.	Display) and remedy duplicate.
TS	EHPM Controller is attempting connection to a configured time source or the time server is not available (Transient state).	Set the correct time source on the Experion Server (that is, SNTP or PTP).

2.7   Service failed EHPM cards flashed with Experion-integrated firmware

Overview

If the EHPM Comm/Ctrl card which is FAILED happens to be in FILE_1 card file position or the LEFT card file position (in a redundant configuration), and the card is flashed with the Experion-integrated firmware (Experion BOOT and APP firmware), then DO NOT attempt to replace this card in this file position with a replacement EHPM Comm/Ctrl card with factory default firmware (that is, standalone firmware or BOOT-only firmware).

Because of the "Floating IP address" functionality of Experion-integrated EHPMs, this will result in a duplicate IP address in the network, and may result in placing the running primary EHPM (which is in the FILE_2 card file position or RIGHT card file position) in the OFFNET state creating a Loss of View.

EHPM Comm/Ctrl card replacement procedure

To avoid duplication of IP address in the network, consider one of the following options:

- **OPTION 1 (most desirable option):** Consider having at least one spare EHPM Comm/Control Card flashed with Experion-integrated firmware (BOOT and APP). Mark this card in some manner as having the Experion-integrated firmware flashed.

    Or

- **OPTION 2:** If you only have a spare card with the Standalone (BOOT-only) firmware, you could temporarily change the device index of the EHPM FTE Interface Card in the FILE_1 position or LEFT card file position to an unused ODD-numbered device index. This would allow a Standalone (BOOT-only) firmware EHPM Comm/Ctrl card to get an unused ODD IP address to allow proper flashing of the Experion-integrated firmware. After the firmware is updated, you can change back to the correct device index. Perform the following steps:

    1.   Power-off the failed EHPM Comm/Ctrl card in the FILE_1 or LEFT card file position by temporarily pulling out the High-Performance I/O Link card about 2 inches (but leave the I/O Link card in the card file chassis) from the HPM card file chassis.

    2.   Remove the 3rd port redundancy cable (crossover cable attached to the orange port) between the redundant EHPMs.

    3.   Remove the FTE Interface card from the FILE_1 or LEFT chassis.

    4.   Change the device index (rotary switches) to an unused ODD-numbered device index (from 1 to 509). Use the FTE Status display to find an unused ODD-numbered device index.

    5.   Re-insert the FTE Interface card to the FILE_1 or LEFT chassis.

    6.   **Make sure** the FTE Cables are attached, but that the 3rd port redundancy cable (orange port) remains **disconnected**.

    7.   Insert the spare EHPM Comm/Ctrl (controlling power from the I/O Link card).

8. When the IP Address is shown, use the Stand-Alone EPA Tool to flash the EHPM Comm/Ctrl card to the desired version of Experion-integrated firmware (BOOT and APP). Refer to the section "Migration from standalone firmware (BOOT-only) to Experion-integrated (BOOT and APP) firmware" in the *Customer Release Guide*.

9. After the firmware is flashed successfully, power-off the EHPM Comm/Ctrl card by temporarily pulling out the High-Performance I/O Link card about 2 inches (but leave the I/O Link card in the card file chassis) from the HPM card file chassis.

10. Remove the FTE Interface card from the FILE_1 or LEFT chassis and change the index back to the original device index.

11. Re-insert the FTE Interface card to the FILE_1 or LEFT chassis.

12. Reconnect the 3rd port redundancy cable (orange port) to the FTE Interface card.

13. Re-insert the High-Performance I/O Link card to power-on the EHPM Comm/Ctrl card.

14. The newly flashed Experion-integrated EHPM Comm/Ctrl card in the FILE_1 or LEFT card file position will go to the ALIVE state and is ready to be loaded.

15. Load the EHPM Comm/Ctrl card from the ALIVE state to the BACKUP state.

    Or

- **OPTION 3:** Use a *different* EHPM chassis (either a FILE_2 or a RIGHT card file position) to flash the Experion-integrated firmware into the spare EHPM Comm/Control Card.

> **TIP -** Ideally, instead of a production EHPM chassis, a hot spare or lab system could be used to properly flash the replacement EHPM Comm/Control card to the correct version of Experion-integrated firmware.

1. Ensure that for the different EHPM chassis in the FILE_2 or RIGHT card file position, that the EHPM is indeed running as BACKUP. If not, you will need to perform a SWAP PRIMARY operation to obtain this node order.

> **ATTENTION -** This will require temporarily shutting down a BACKUP EHPM running in a FILE_2 or RIGHT card file position and using its EVEN device index (which will give an EVEN IP address in the FILE_2 or RIGHT card file position) to flash the replacement EHPM Comm/Control card.

2. From the Native Window's UCN Detail Status display for the EHPM, chose the right side EHPM, then select "RUN STATES" followed by the "SHUTDOWN" target. The Backup EHPM transitions to the ALIVE state.

3. Power-off the EHPM Comm/Ctrl card in the FILE_2 or RIGHT card file position by temporarily pulling out the High-Performance I/O Link card about 2 inches (but leave the I/O Link card in the card file chassis) from the HPM card file chassis.

4. Remove the existing EHPM card, and place it on a static-free surface.

5. Temporarily, remove the 3rd port redundancy cable (crossover cable attached to the orange port) between the redundant EHPMs.

6. Insert the new EHPM card into the empty slot in the FILE_2 or RIGHT card file position, and re-insert the High-Performance I/O Link card to power-on the EHPM Comm/Ctrl card.

7. Use the Stand-Alone EPA Tool to flash the replacement EHPM Comm/Ctrl card to the desired version of Experion-integrated firmware (BOOT and APP). Refer to the section "Migration from standalone firmware (BOOT-only) to Experion-integrated (BOOT and APP) firmware" in the *Customer Release Guide*.

8. Power-off the new EHPM Comm/Ctrl card in the FILE_2 or RIGHT card file position by temporarily pulling out the High-Performance I/O Link card about 2 inches (but leave the I/O Link card in the card file chassis) from the HPM card file chassis.

9. Remove the newly flashed EHPM card, and place it back into its static-free bag. It is ready now for use in another EHPM chassis.

10. To recover the existing backup EHPM, take the existing EHPM card from the static-free surface, and insert it into the empty slot in the FILE_2 or RIGHT card file position.

11. Reconnect the 3rd port redundancy cable (orange port) to the FTE Interface card.

12. Re-insert the High-Performance I/O Link card to power-on the EHPM Comm/Ctrl card.

13. The existing, original Experion-integrated replacement EHPM Comm/Ctrl card in the FILE_2 or RIGHT card file position will go to the ALIVE state and is ready to be loaded.

14. Load the EHPM Comm/Ctrl card from the ALIVE state to the BACKUP state.

2.8   C300PM Card Files

Introduction

A Common embedded platform (CEP) - based C300 Process Manager (C300PM) card file is a 7-Slot or 15-Slot card file that is populated with the C300PM card set. The C300PM card set consists of following assemblies.

- FTE-based C300 Process Manager Comm/Control card
- FTE Interface module
- Power Backup Module

C300PM card file configurations

There are 3 C300PM card file configurations. They are as follows:

- Left 7-Slot C300PM card file
- Right 7-Slot C300PM card file
- 15-Slot C300PM card file

15-Slot C300PM card file

The following figure is an illustration of a 15-Slot C300PM card file.

Figure 5.1 15-Slot C300PM Card File
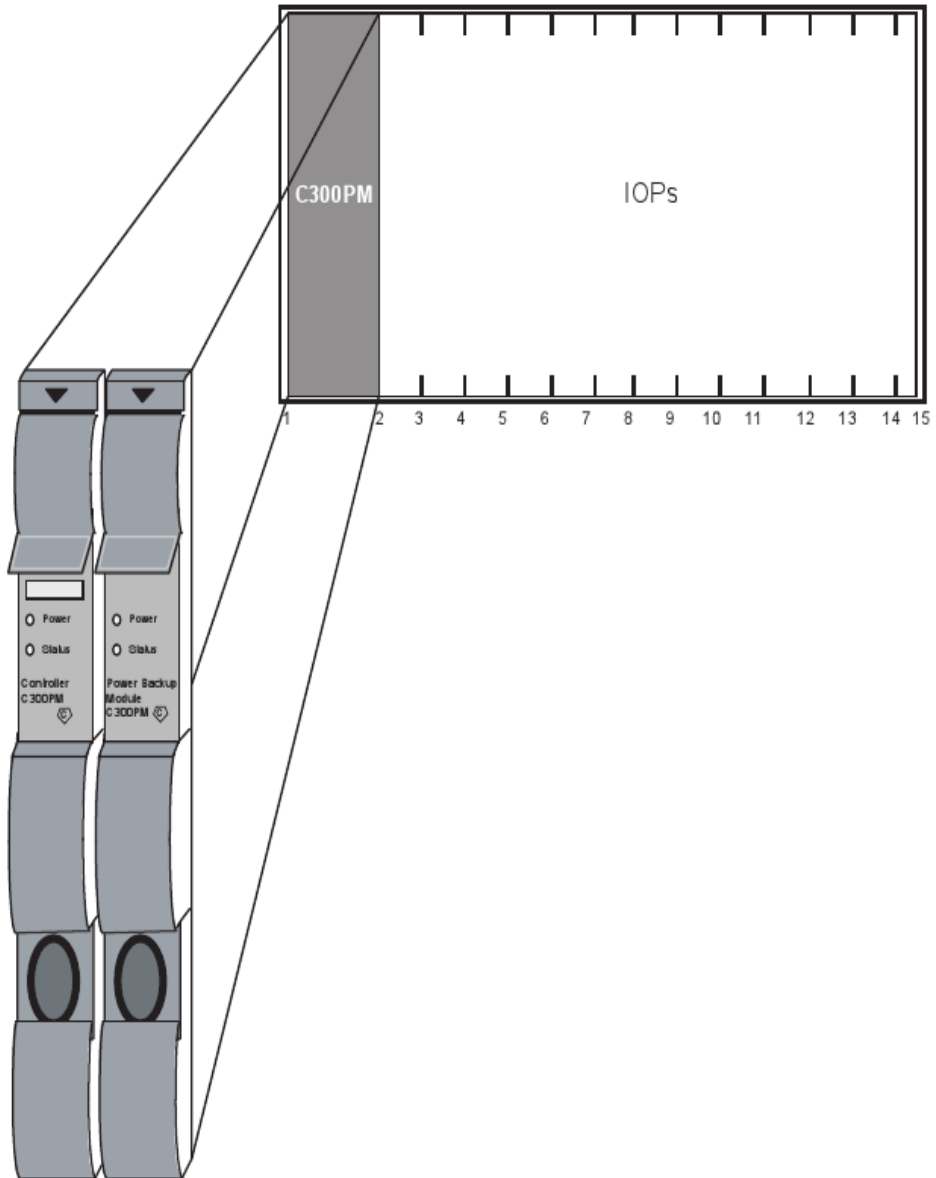
C300PM functionality

The C300PM Module provides:

- HPM Control functions

- Communications with the Local Control Network (LCN) Enhanced Network Interface Module (ENIM), ELCN ENIM variants of UEA/UVA ENIM, and Enhanced Network Bridge (ENB) through the Enhanced Universal Control Network (EUCN)

- HPM Communication processor functions

- Communications through the I/O Link Interface with Input/Output Processors (IOPs) and I/O Link Extenders

- A power backup module (PBM)

- Redundancy control for both HPM

C300PM card/module types

The C300PM board set consists of the C300PM PWA, Power Backup Module PWA and FTE Interface Module. The FTE interface module is mounted in the 50-pin connector below the C300PM PWA in the first left-most card file slot. The cards and the module are described in the following table.

Table 2.1 C300PM Card/Module Types

Card/Module Type	Function
CEP-based C300 Process Manager Comm/Control card	Consists of: • Dual core ARM processor, • IOLink communication processor • FTE interface to the C300 PM FTE Interface module • redundancy interface to another C300PM • front panel LEDs and a four-character alphanumeric diagnostic display.
Power Backup Module	Consists of: • Supercapacitor based power backup circuit
FTE Interface Module	The FTE Interface module has 3 ethernet ports (1 yellow FTE, 1 green FTE, and 1 orange redundancy port) with RJ45 connectors and LEDs. The backplane interfaces between the C300PM and FTE Interface. The FTE interface module does not use the Global Bus. The FTE interface supports operation at 100 MHz.

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ESD HAZARD

It is important that you wear a properly connected Electrostatic Discharge (ESD) wriststrap while touching or handling the C300PM components.

Card/module illustrations

These cards and interface module are shown in more detail in the following figures:

- Figure 5.2 FTE Interface Module (Front Panel)
- Figure 5.3 Power Backup Module (Front Panel)
- Figure 5.4 C300PM Comm/Control Card (Front Panel)

Refer to these figures for the discussion of C300PM indicators that follows.

Power indicators

When the C300PM is turned on, the **Power** indicator on each C300PM card and the FTE Interface module lights. The **Power** indicator is illuminated whenever 24 Vdc from the cabinet Power System is present.

Status indicators

The **Status** indicator on the C300PM Communications/Control card illuminates momentarily after applying power. Internal test routines are executed upon applying power, and the **Status** indicator remains on if the tests are successfully completed. The steady illumination of the **Status** indicator signifies that no test failures were detected.

When the EUCN FTE cables are in use, it is displayed by the indicators at the front of the FTE Interface Module and under the front cover of the C300PM Comm/Control card.

The Transmit (**Tx**) indicator at the front of the FTE Interface module is an indication of EUCN cable transmit activity.

The **Link** indicator at the front of the FTE Interface module is an indication of EUCN cable link status.

Refer to the "FTA Redundancy Indicators"subsection in the "Fault Isolation" section. for additional information on the status indicators.

Diagnostic display

The 4-digit Diagnostic display at the front of the C300PM Communications/Control card (below the upper extraction lever) provides additional status information as well as error code information if a failure occurs. After power is applied and the internal test routines have completed successfully, it displays a code that indicates the C300PM is in the IDLE state, such as **IDLE**, then change the state from **IDLE** to **NODB** and it shows this **NODB** state until the controller checkpoint or Control Builder platform block is loaded. Once the platform block is loaded, it shows **IDLE**. In addition, for EUCN, the 4-digit diagnostic display includes the UCN Node Number, FTE Device Index and the four octets of the IP Address of the node. The additional diagnostic codes are presented in a fixed sequence.

Diagnostic display analysis example

Possible first characters are:

- RUN
- BKUP
- IDLE
- FAIL
- NODB = No Database
- T = Test

L = Left 7-slot HPMM card file

R = Right 7-slot HPMM card file

1 = First 15-slot HPMM card file

2 = Second 15-slot HPMM card file

Third and Fourth characters = **XX** (1-64) = The pinned UCN node number

Refer to subsection "Redundant Analog Output IOP Failure Diagnosis" in "Fault Isolation" for additional Diagnostic display codes and more detailed information.

FTE Interface module

The following figure illustrates the front panel of the FTE Interface module. Each FTE cable (yellow and green) is connected to a CF9 or L2 Ethernet Switch (yellow and green).

Redundant C300PMs connected to an Experion network have a crossover cable connecting the redundancy ports (bottom port) of the two FTE Interface modules.

Figure 5.2 FTE Interface Module (Front Panel)
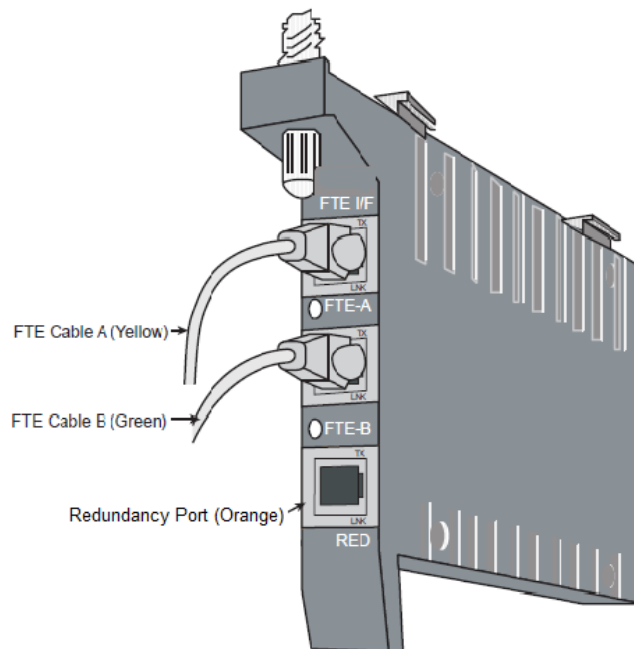
Power Backup Module

C300PM controller supports RAM Retention Restart feature. This feature allows retention of user configuration data in the event of loss of main 24V DC power supply.

When main 24V DC power is lost, C300PM controller receives power for approximately 5 seconds from Power Backup Module. During this period, C300PM controller backs up user configuration data in an on-board non-volatile memory.

Figure 5.3 Power Backup Module (Front Panel)
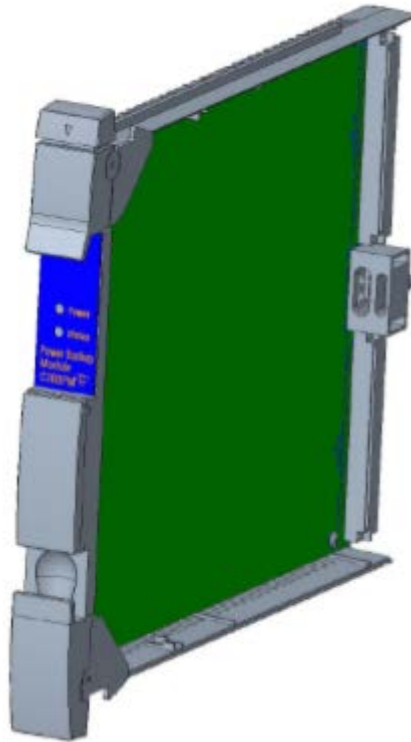
C300PM Comm/Control card

The following figure illustrates the front of the C300PM Comm/Control card as well as the indicators and Diagnostic display.

The C300PM Comm/Control card has an upgradable firmware. Firmware for C300PM is upgraded through the Firmware Manager Tool. For more information on Firmware Manager, see the *Firmware Manager User Guide (X470-en-130B).*

Figure 5.4 C300PM Comm/Control Card (Front Panel)
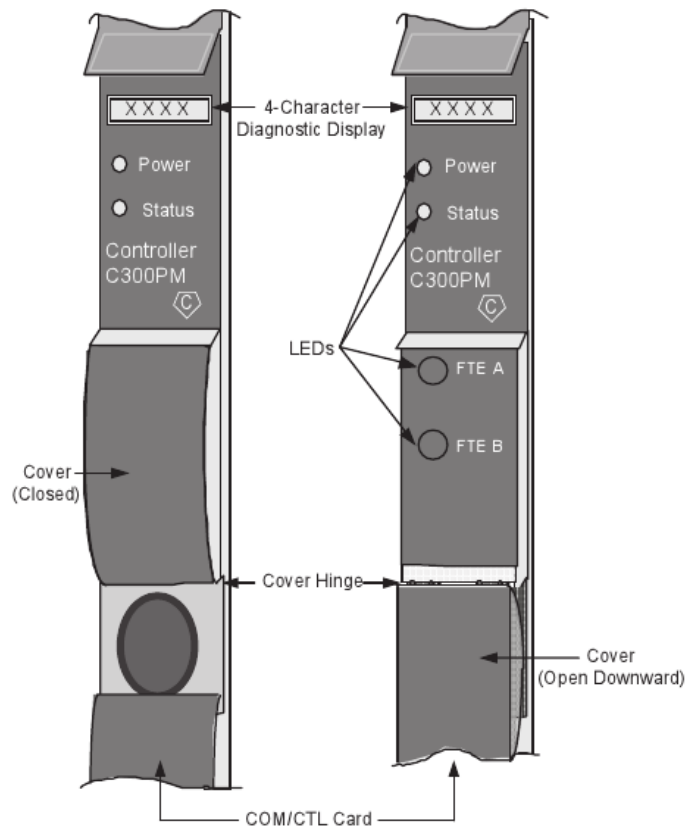
C300PM Front Panel LED display information

Table 2.2 C300PM Front Panel display indications

C300PM Front Panel LED display	Indicates…	Recovery action
AUTH	ENIM failed to authenticate C300PM.	Check $FTESTS2 schematic details for the AUTH GROUP. There might be a duplicate BOOTP server on the network. Manual failover to backup ENIM may be necessary.
BRN	Firmware load in progress.	Wait for firmware load to complete.
DUP	C300PM either has a duplicate FTE Device Index, or duplicate PdTag, or both duplicate FTE Device Index and PdTag of another device in the FTE Community.	Identify the duplicate problem in the FTE Community (using $FTESTS2 schematic or PC's FTE Status Display) and remedy duplicate.
TS	C300PM Controller is attempting connection to a configured time source or the time server is not available (Time sync).	Set the correct time source on the Experion Server (that is, SNTP or PTP).

C300PM Front Panel LED display	Indicates…	Recovery action
NODB	For example, when you try to restore the C300PM Controller from the previous point, the HPM points get restored to C300PM. If the database is empty, then it shows NODB. **Note:** Before loading/reloading C300PM platform block in Control Builder, the C300PM undergoes reboot operation. The NODB status is displayed after the reboot operation.	
SF	If Soft Fail is detected on the hardware,the details of the failure gets displayed in the UCN Detailed Status Display. For example, In the Control Config, if IO link is not connected to either of the A, B cables, then an IOLINK failure status gets displayed in the UCN Detailed Status Display.	Depending on the failure scenario, the recovery action can be performed.
IDLE	C300PM controller when inserted on the chasis, it displays IDLE mode.	
RUN	Once the Database is restored, it is fed into the C300PM controller. On Startup, the C300PM controller shows RUN.	
BKUP	For a redundant C300PM Controller in the running condition, the Primary node shows RUN and the Backup node shows BKUP. When you try to swap the controller by using Primary swap, the current primary node restarts and then shows BKUP while the secondary node shows RUN.	

2.9   IOP Card Files

Introduction

Additional Input/Output Processor (IOP) card file slots can be added to any High-Performance Process Manager by the addition of one or more 7-Slot (Left or Right) or 15-Slot card files. CE Compliant 7-Slot or 15-Slot card files that accommodate only IOPs are designated IOP card files. The IOP card files are electrically the same card files as the card files that HPMM cards occupy. They have the same backpanel but differ mechanically. Each IOP card file accommodates either 7 or 15 IOPs. A 15-Slot IOP card file is illustrated in Figure 6 15-Slot IOP Card File

In cabinets that are upgraded from a PM or APM configuration to an HPM configuration, IOP Only card files may exist. These 15-Slot IOP Only card files are restricted to IOP and optional I/O Link Extender cards.

> **ATTENTION**
>
> Ensure that the IOP card is in IDLE state before it is removed/replaced from the card file.

Total number of card files

The number of card files that can exist in a single High-Performance Process Manager subsystem is dependent upon the mix of 7-Slot and 15-Slot card files. This includes card files that are designated HPMM or IOP card files. Eight I/O Link Interface addresses are available for use in the HPM subsystem. Each card file must be assigned an I/O Link Interface address. Two 7-Slot card files can share the same I/O Link Interface address if one is a Left card file (slots 1-7) and the other a Right card file (slots 9-15). The 15-Slot card file (HPMM or IOP type) cannot share its I/O Link Interface address with another card file. It is conceivable that sixteen 7-Slot card files can exist in a HPM subsystem (eight Left 7-Slot and eight Right 7-Slot card files).

Remote card file installation

IOP card files can be installed at remote locations by the use of I/O Link Extenders as well as locally in the HPM cabinet or cabinet complex.

Total number of IOPs

Depending upon the configuration of IOP types, up to 40 primary IOPs, 40 secondary (redundant) IOPs, and 3 I/O Link Extenders (a maximum of 8 I/O Link Extender cards) can exist in a single HPM subsystem.

15-Slot IOP card file

The following figure illustrates a 15-slot IOP card file.

Figure 6 15-Slot IOP Card File
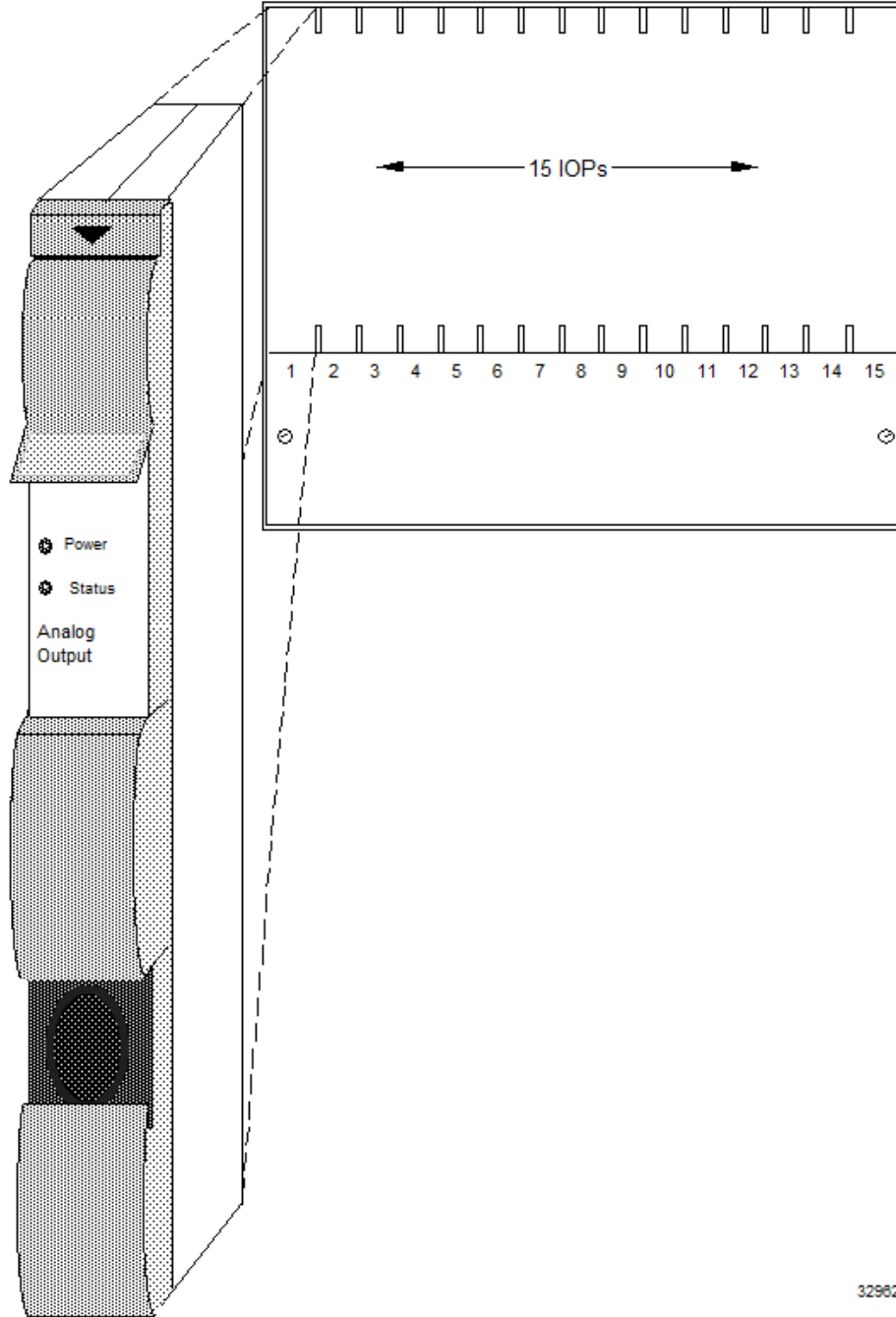
Types of Input/Output Processors (IOPs)

There are thirteen types of Input/Output Processor (IOP) card assemblies. Some IOP card types interface with more than one type of Field Termination Assembly (FTA). The functional types of IOPs are:

- High Level Analog Input (HLAI)
- Low Level Analog Input (LLAI)
- Low Level Analog Multiplexer (LLMux)
- Remote Hardened Low Level Analog Multiplexer (RHMUX)
- Digital Input (DI)
- Analog Output (AO)
- Digital Output (DO)
- Smart Transmitter Interface (STI)
- Smart Transmitter Interface Multivariable (STIM)
- Pulse Input (PI)
- Digital Input Sequence of Events (DISOE)
- Serial Device Interface (SDI)
- Serial Interface (SI)

> **ATTENTION**
> Fieldbus is not supported by the TPS Network.

AO and DO IOPs

Some of the functional types of IOPs support only certain associated Field Termination Assemblies (FTAs) models because the number of channels (Points) differ. Examples are the Analog Output (8 and 16 channels) and Digital Output (16 and 32 channels) IOPs.

Redundant IOPs

IOPs can be connected in a redundant configuration with both IOPs connected by separate cables to the same FTA. Some models of the following types of IOPs support redundancy.

- Smart Transmitter Interface (STI)
- High Level Analog Input (HLAI)
- Digital Input (DI)
- Digital Output (DO)

Redundant HLAI IOPs

The following figure illustrates an HLAI FTA that interfaces with a pair of HLAI IOPs that are installed in separate 7-Slot card files.

Figure 7HLAI FTA with Redundant HLAI IOPs
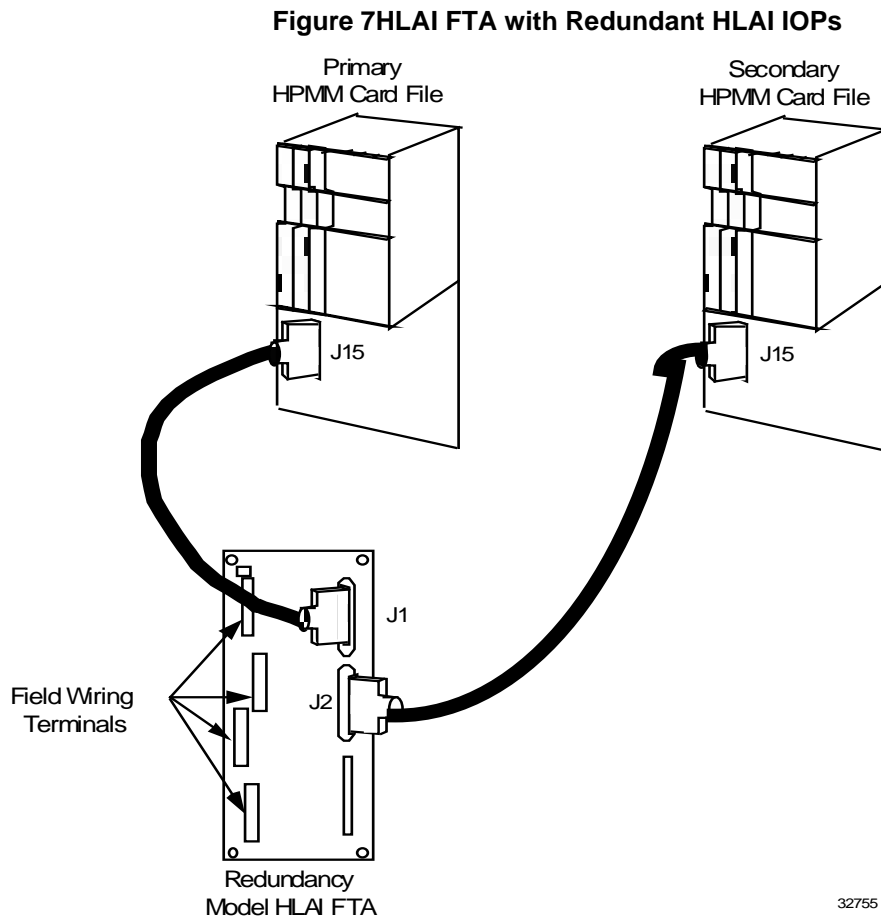
Redundant AO IOPs

When an Analog Output FTA interfaces with two IOPs through separate cables, and an automatic selector switch on the FTA selects which IOP's output drives the field wiring terminal connectors on the FTA. The following figure is an illustration of an Analog Output FTA interface with two Analog Output IOPs.

Figure 8 Analog Output FTA with Redundant Analog Output IOPs
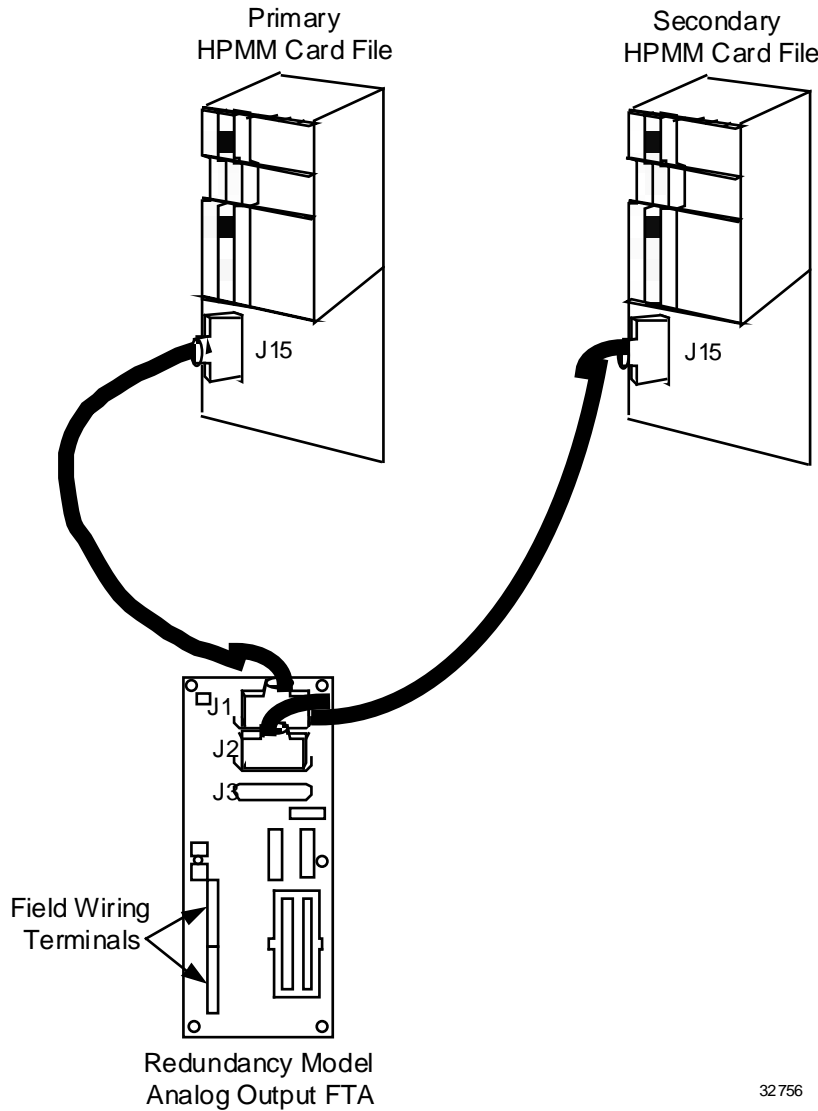
Low Level Multiplexer IOP (LLMux)

A Low Level Analog Input Multiplexer (LLMux) IOP processes up to 32 inputs from two 16 input FTAs.

The following figure illustrates LLMux FTA interconnections for non-CE Compliant FTA models. CE Compliant FTA models are similar. See the *Process Manager I/O Installation* manual for detailed information.

Figure 9 Low Level Multiplexer Interconnections
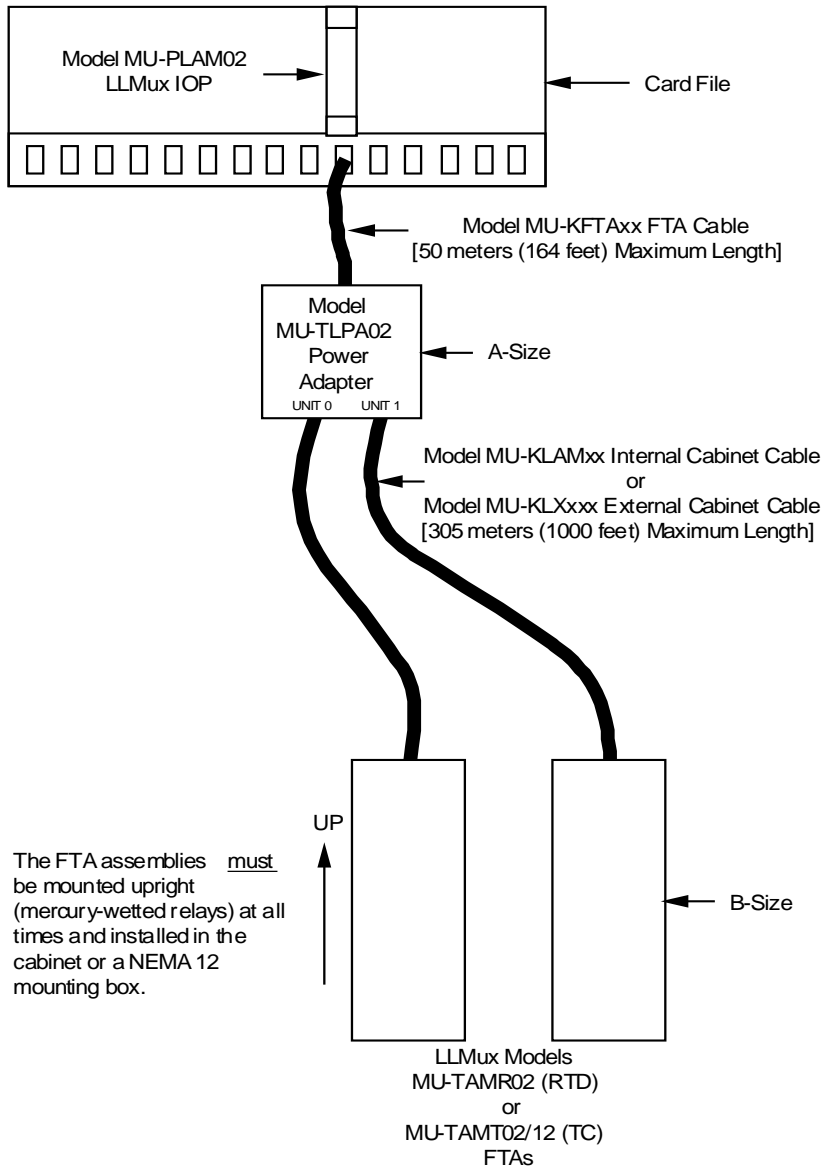
2.10 Field Termination Assemblies for IOP

Two types of FTAs

There are two types of FTAs, Thermocouple (TC) and Resistive Temperature Device (RTD) that are connected to the IOP through a Power Adapter assembly. One TC and one RTD FTA, or two of the same type FTAs can be connected to one IOP through the Power Adapter.

Power Adapter

Installation

The Power Adapter provides power to the FTA(s) from the IOP and can be installed on an FTA Mounting Channel.

IOP to Power Adapter connection

The IOP to Power Adapter connection is made using the standard model MU-KFTAxx (the suffix "xx" represents the length of the cable in meters) IOP to FTA cable. The maximum allowable length is 50 meters (164 feet).

For CE Compliance applications, the model MU-KFTSxx IOP to FTA cable must be used. See the *Process Manager I/O Installation* manual for detailed information.

Power Adapter to FTA connection

The Power Adapter connects to either FTA type with a model MU-KLAMxx (internal cabinet use) or model MU-KLXxxx (external cabinet use) cable (one per FTA). The cable is limited to a maximum length of 305 meters (1000 feet).

The model MU-KLAMxx cable has two individually shielded, twisted pair wires. The shield must be connected to ground at the Power Adapter end of the cable only.

The model MU-KLXxxx external cabinet cable has four wires with a single braided shield. The braided shield must be connected to ground at both the Power Adapter and FTA ends of the cable.

For CE Compliance applications, Belden model 83654 braided shield cable must be used. See the *Process Manager I/O Installation* manual for detailed information.

Power Adapter indicators

The Power Adapter assembly has two LEDs, one for each cable, that indicate a grounded or shorted cable. Each FTA has an LED that indicates the FTA is receiving power.

Cabling information

For more detailed information on cable selection, see the *Process Manager I/O Installation* manual or the *High-Performance Process Manager Planning* manual.

Remote Hardened Low Level Multiplexer IOP (RHMUX)

The Remote Hardened Low Level Analog Input Multiplexer (RHMUX) IOP can process up to 32 inputs from two 16-input FTAs.

The following figure illustrates the RHMUX IOP, Power Adapter, and Thermocouple FTA interconnections for a CE Compliant application. See the *Process Manager I/O Installation* manual for detailed information.

Figure 10 Remote Hardened Low Level Multiplexer Interconnections
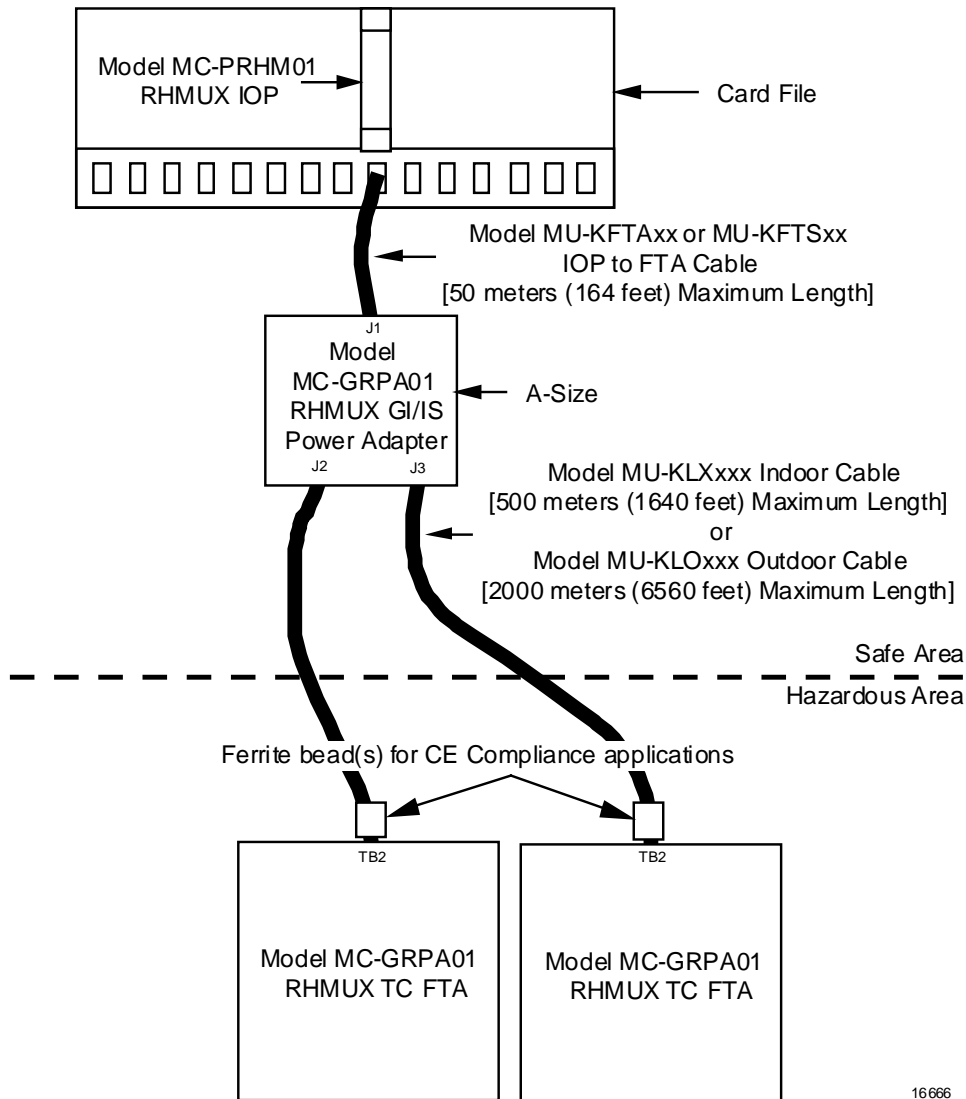
RHMUX Thermocouple FTA

One or two Thermocouple (TC) type RHMUX FTAs can be connected to a RHMUX IOP through either an Intrinsically Safe (IS) or Non-Incendive (NI) Power Adapter assembly.

FTA and Power Adapter installation

The Power Adapter provides power to the FTA(s) from the IOP. Both types of Power Adapters can be installed on an FTA Mounting Channel. The FTA's dimensions (size) are non-standard and prevent installing the FTA on a standard FTA Mounting Channel.

IOP to Power Adapter connection

The IOP to Power Adapter connection is made using the standard model MU-KFTAxx (the suffix "xx" represents the length of the cable in meters) IOP to FTA cable. The maximum allowable length is 50 meters (164 feet).

For CE Compliance applications, the model MU-KFTSxx IOP to FTA cable must be used. See the *Process Manager I/O Installation* manual for detailed information.

Power Adapter to FTA connection

The Power Adapter connects to the FTA through a model MU-KLXxxx (internal cabinet use) or model MU-KLO305 (external cabinet use) cable (one per FTA). The model MU-KLXxxx cable is limited to a maximum length of 305 meters (1000 feet), while the model MU-KLO305 cable is 305 meters in length, the cable type (Belden YC41926) can be used in lengths of up to 2000 meters (6560 feet).

Both types of cables have four conductors in a single-twist with a single braided shield. The shield must be connected to ground at both the Power Adapter and FTA ends of the cable. See the *Process Manager I/O Installation* manual for detailed information.

Power Adapter indicators

The Power Adapter assembly has two LEDs, one for each cable, that indicate a grounded or shorted cable. Each FTA has an LED that indicates the FTA is receiving power.

Cabling information

For more detailed information on cable selection, see the *Process Manager I/O Installation* manual or the *High-Performance Process Manager Planning* manual.

2.11 Serial Device Interface IOP (SDI)

Introduction

Figure 11 illustrates a typical Serial Device Interface configuration. One or two Serial Device Interface FTAs can be connected to a single Serial Device Interface IOP through the Power Adapter.

The FTA is assigned a unique FTA model number identified by the FTA's assembly tab number on the FTA. The firmware resident in the FTA plug-in module, M1, has been preprogrammed at the factory to accommodate the associated IOP and the selected serial communications interface type (EIA-232 or EIA-422/485).

The Serial Device Interface FTA has both EIA-232 (RS-232) and EIA-422/485 (RS-422/485) asynchronous serial communications interfaces, one of which is active, using either a DB-25 or a 5-terminal compression connector, respectively.

SDI interface configuration

The following figure illustrates a typical Serial Device Interface configuration.

Figure 11 Serial Device Interface Interconnections
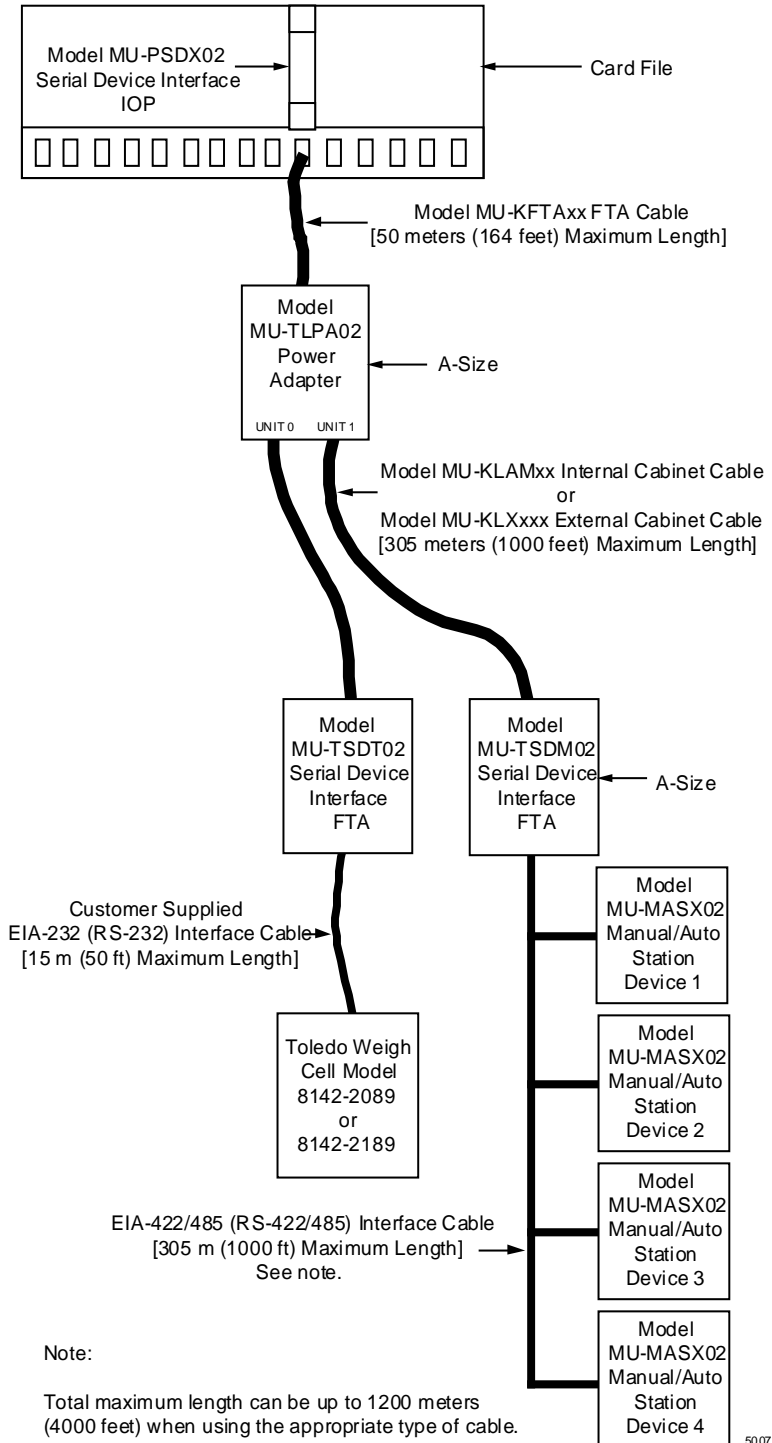
EIA-232 and EIA--422/485 interfaces

The EIA-232 interface is a point-to-point interface to which only one serial device can be connected. The EIA-422/485 interface can be configured as a multidrop interface to which several serial devices can be connected.

EIA-232 interface cable length

The EIA-232 cable is limited to a distance of 15 meters (50 feet). The cable must be supplied by the user and terminate in a DB-25 connector.

EIA-422/485 cable length limitation

EIA-422/485 cable is limited to a distance of 305 meters (1000 feet). However, the total length can be 1200 meters (4000 feet) with the appropriate interface cable.

Power Adapter installation

The Power Adapter can be installed on any available FTA Mounting Channel that is within the 50-meter (164-foot) maximum cable length requirement between the IOP and the Power Adapter. The Power Adapter has the same dimensions as an A size (6 inches) FTA. Model MU-KFTAxx interface cable is used.

SDI FTA installation

The Serial Device Interface FTA can be installed in the same cabinet as the Serial Device Interface IOP, or externally, up to 305 meters (1000 feet) from the Power Adapter. The FTA is an A-size (6 inches) FTA and installs on a standard FTA Mounting Channel.

FTA to Power Adapter interface

The Serial Device Interface FTA to Power Adapter connection is made using either model MU-KLAMxx cable for internal cabinet installation or model MU-KLXxxx cable for external cabinet installation. The suffix "xx" or "xxx" represents the length of the cable in meters.

The model MU-KLAMxx cable has two individually shielded, twisted pair wires. The shield must be connected to ground at the Power Adapter end of the cable only.

The model MU-KLXxxx external cabinet cable has four wires with a single braided shield. The braided shield must be connected at both the Power Adapter and FTA ends of the cable.

Model MU-TSDT02 FTA

The model MU-TSDT02 Serial Device Interface FTA accommodates the model 8142-2084 or 8142-2184 Toledo Weigh Cell device, manufactured by Toledo Scale Inc., through its EIA-232 (RS-232) interface.

Model MU-TSDM02 FTA

The model MU-TSDM02, assembly number 51303932-202, Serial Device Interface FTA accommodates up to four model MU-MASX02 Manual/Auto Station devices, manufactured by Honeywell Inc., through its EIA-422/485 (RS-422/485) interface.

Model MU-TSDU02 FTA

The model MU-TSDU02 Serial Device Interface FTA accommodates up to four model MU-MASX02 UDC 6000 devices, manufactured by Honeywell Inc., through its EIA-422/485 (RS-422/485) interface.

Cabling information

For more detailed information on cable selection, see the *Process Manager I/O Installation* manual or the *High-Performance Process Manager Planning* manual.

2.12 Serial Interface IOP (SI)

Introduction

Figure 11 illustrates typical Serial Interface interconnections. One or two model MU-TSIM12 or MU-TSIA12 Serial Interface FTAs interface to a model MU-PSIM02 Serial Interface IOP through the model MU-TLPA02 Power Adapter. This illustrates the model MU-TSIM12 FTA interconnections.

The FTA is assigned a unique FTA model number that is identified by the FTA's assembly tab number on the FTA. The firmware resident in the FTA plug-in module, M1, is preprogrammed at the factory to accommodate the associated IOP and the configured serial communications interface types (EIA-232 and EIA-422/485).

EIA-232 and EIA-422/485 interfaces

The Serial Interface FTA has both EIA-232 (RS-232) and EIA-422/485 (RS-422/485) asynchronous serial communications interfaces, one of which is active, using either a DB-25 or a 5-terminal compression connector, respectively.

Point-to-point or multidrop interfaces

The EIA-232 interface is a point-to-point interface to which only one serial device can be connected. The EIA-422/485 interface can be configured as a multidrop interface to which several serial devices can be connected. System performance is dependent upon the number of devices, their baud rate, the number of transactions, and the FTA Device Driver firmware.

EIA interface limitations

The EIA-232 interface is limited to a distance of 15 meters (50 feet) maximum, and the EIA-422/485 interface is limited to a distance of 305 meters (1000 feet). However, the total length of the EIA-422/485 interface can be 1200 meters (4000 feet) with the appropriate interface cable.

Power Adapter installation

The Power Adapter can be installed on any available FTA Mounting Channel that is within the 50-meter (164-foot) maximum cable length requirement using a model MU-KFTAxx cable (the suffix "xx" represents the length of the cable in meters).

For CE Compliant installations, if the Power Adapter is remotely mounted in a cabinet that is separate from the cabinet in which its associated IOP is mounted, it is mandatory that a model MU-KFTSxx shielded IOP to FTA cable be used between the assemblies.

Power Adapter size

The Power Adapter has the same dimensions as an A-size (6 inches) FTA.

New SI IOP Slot Summary display to view Array points built on the SI FTA

Beginning with TPN R686, a new SI IOP Slot Summary display has been introduced that enables you to directly view the list of array points built against the SI FTA. The display consists of 2 pages: the first 16 points connected to FTA 1 on page 1, and the remaining 16 points connected to FTA 2 on page 2. Use the Page Up and Page Down buttons to navigate between the 2 pages of the display.

The configured array points are displayed in the ascending order of the array slot numbers. In addition to all the features of the existing IOP slot summary display, the following key differences must be noted:

- The slot number will follow the slot number of the array point type in the ascending order per FTA.

- The value field is not supported since this is an array point type with varying configurations like flag, numeric or string.

SLOT SELECT target has been removed as the slot numbers listed in this display are that of array points that can range from 1 – 511, spread across the new 2-page display.

Model MU-TSIM12 interconnections

The following figure illustrates the Serial Interface configuration.

Figure 12 Model MU-TSIM12 Serial Interface FTA Interconnections
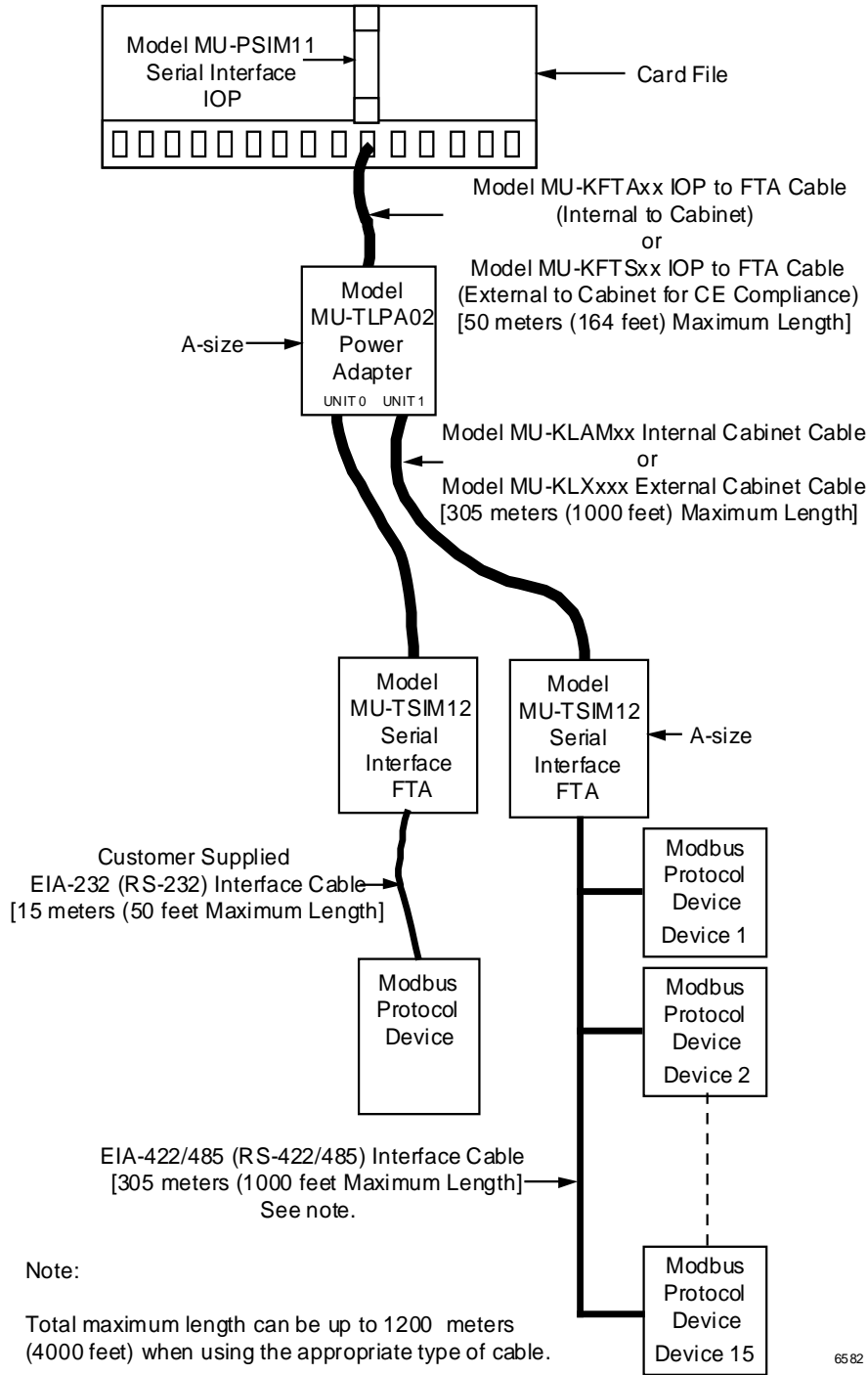
SI FTA installation

The Serial Interface FTA can be installed in the same cabinet as the Serial Interface IOP using model MU-KLAMxx cable (the suffix "xx" designates the length of the cable in meters), or remotely, up to 305 meters (1000 feet) from the Power Adapter. The FTA is an A-size (6 inches) FTA and installs on a standard FTA Mounting Channel.

FTA to Power Adapter interface

The Serial Interface FTA to Power Adapter connection is made using either model MU-KLAMxx cable for internal cabinet installation or model MU-KLXxxx cable for external cabinet installation. The suffix "xx" or "xxx" represents the length of the cable in meters.

The model MU-KLAMxx cable has two individually shielded, twisted pair wires. The shield must be connected to ground at the Power Adapter end of the cable only.

The model MU-KLXxxx external cabinet cable has four wires with a single braided shield. The braided shield must be connected at both the Power Adapter and FTA ends of the cable.

Cabling information

For more detailed information on cable selection, see the *Process Manager I/O Installation* manual or the *High-Performance Process Manager Planning* manual.

Model MU-TSIA12 EIA-232 interface

The model MU-TSIA12 Serial Interface FTA, in combination with the model MU-PSIM11 IOP and the model MU-TLPA02 Power Adapter, provides an EIA-232 (RS-232) communications interface for the Allen-Bradley PLC-2, PLC-3, or PLC-5 devices with its EIA-232 interface.

Model MU-TSIM12 EIA-232 interface

The model MU-TSIM12 Serial Interface FTA, in combination with the model MU-PSIM11 IOP and the model MU-TLPA02 Power Adapter, provides a Modbus RTU EIA-232 (RS-232) communications interface for a peripheral with its EIA-232 interface.

Model MU-TSIM22 EIA-422/485 interface

The model MU-TSIM22 Serial Interface FTA, in combination with the model MU-PSIM11 IOP and the Power Adapter, provides an EIA-422/485 (RS-422/485) communications interface for peripherals that have an EIA-422/485 interface.

2.13 I/O Link Extender (Fiber Optic Link)

Introduction

The I/O Link Extender provides the ability to locate 7-Slot and 15-Slot IOP card files and associated FTAs up to 8 kilometers (5 miles) from the HPMM(s). Two types of I/O Link Extenders and their associated fiber Optical Coupler Modules are available, the "Standard" I/O Link Extender which provides up to a 1.3 kilometers (4000 feet) link, and the "Long Distance" I/O Link Extender which provides up to an 8 kilometers (5 miles) link. The connection is made using a pair of fiber optic transmission cables, driven and terminated by a fiber Optical Coupler Module that mates with the connector located directly below the card file slot in which the I/O Link Extender card is installed.

See the following figures

- Figure 13 Standard I/O Link Extender Interconnections with Nonredundant HPMM
- Figure 14 Standard I/O Link Extender Interconnections with Redundant HPMMs
- Figure 15 Long Distance I/O Link Extender Interconnections with Nonredundant HPMM
- Figure 19 Long Distance I/O Link Extender Interconnections with Redundant HPMMs

Features and guidelines

- Each I/O Link Extender consists of two I/O Link Extender cards, one for Link A and one for Link B, which occupy two slots in the HPMM or IOP card file.

- Each Standard I/O Link Extender card has an associated fiber Optical Coupler Module that can drive up to three pair of fiber optic cables. Each cable pair is terminated by a fiber Optical Coupler Module that terminates one fiber optic pair.

- Each Long Distance I/O Link Extender card has an associated Fiber Coupler that drives a single pair of fiber optic cables. Each cable pair is terminated by a fiber Optical Coupler Module that terminates one fiber optic pair.

- Every remote card file, or complex of IOP card files, requires two I/O Link Extender cards and two fiber Optical Coupler Modules, one for Link A and one for Link B. The Standard I/O Link Extender card will drive and terminate Link A or Link B, depending upon the card file number and card file slot number. If the card file number and card file's slot number are both odd or both even, the card will drive Link A. If the card file number and card file's slot number are not both odd or both even, the card will drive Link B. The Link A or Link B selection for the Long Distance I/O Link Extender is determined by a jumper on the card.

- Two Standard I/O Link Extender cards, connecting up to six remote card files, can be installed in a HPMM card file, but the maximum number of other primary IOPs is still 40 (plus 40 redundant IOPs).

- The maximum fiber optic cable length is dependent upon the number of splices and quality of the cable (dB loss per meter of cable). This maximum can be between 0.98 and 1.3 kilometers for the Standard I/O Link Extender and 8 kilometers for the Long Distance I/O Link Extender. See the *High-Performance Process Manager Planning* manual for the Loss Budget calculation.

Front panel indicators

Two visual front panel indicators are provided on the I/O Link Extender card that are consistent with the display of IOP card indicators. The upper indicator is illuminated if the fused +24 Vdc is present on the card (the input voltage is acceptable). The lower indicator denotes status.

Status indicator operation

In normal operation, the lower indicator is illuminated when messages are being transmitted from the fiber optic cable. The indicator should be fully lit or slightly flickering, depending on system loading. Abnormal operation will result in the anti-jabber circuit locking up the transmitter circuit when the transmission period has been too long. The indicator will then be extinguished. If the fiber Optical Coupler Module is improperly installed, the indicator will blink at a 50% duty cycle. The anti-jabber circuit can be reset by cycling the upper extractor/insertion lever power switch on the I/O Link Extender card. For the Long Distance I/O Link Extender, cycling power resets both ends of the link. The Standard I/O Link Extender must be manually reset at both ends of the link. The Long Distance I/O Link Extender can be reset by cycling power at one end of the link.

Standard I/O Link Extender connections nonredundant HPMM

The following figure illustrates the interconnections for a Standard I/O Link Extender in an High-Performance Process Manager that contains a nonredundant HPMM.

Figure 13 Standard I/O Link Extender Interconnections with Nonredundant HPMM
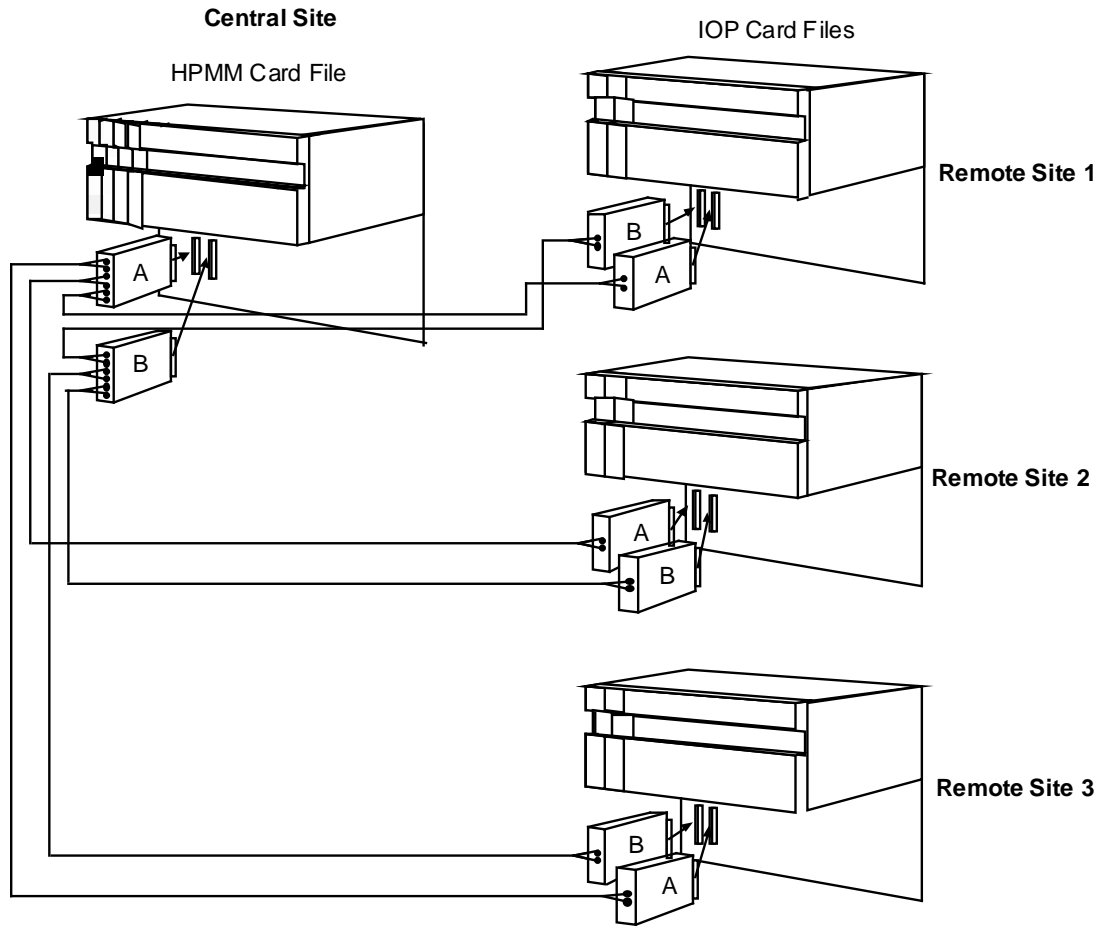
NOTE

The following High-Performance Process Manager subsystem configuration is assumed.
1. The HPMM card file is configured as card file #1 (I/O Link address of 0).
2. Remote Site #1's IOP card file is configured as card file #2 (I/O Link address of 1).
3. Remote Site #2's IOP card file is configured as card file #3 (I/O Link address of 2).
4. Remote Site #3's IOP card file is configured as card file #4 (I/O Link address of 3).

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Standard I/O Link Extender connections redundant HPMMs

The following figure illustrates the interconnections for a Standard I/O Link Extender in an High-Performance Process Manager that contains redundant HPMMs.

Figure 14 Standard I/O Link Extender Interconnections with Redundant HPMMs
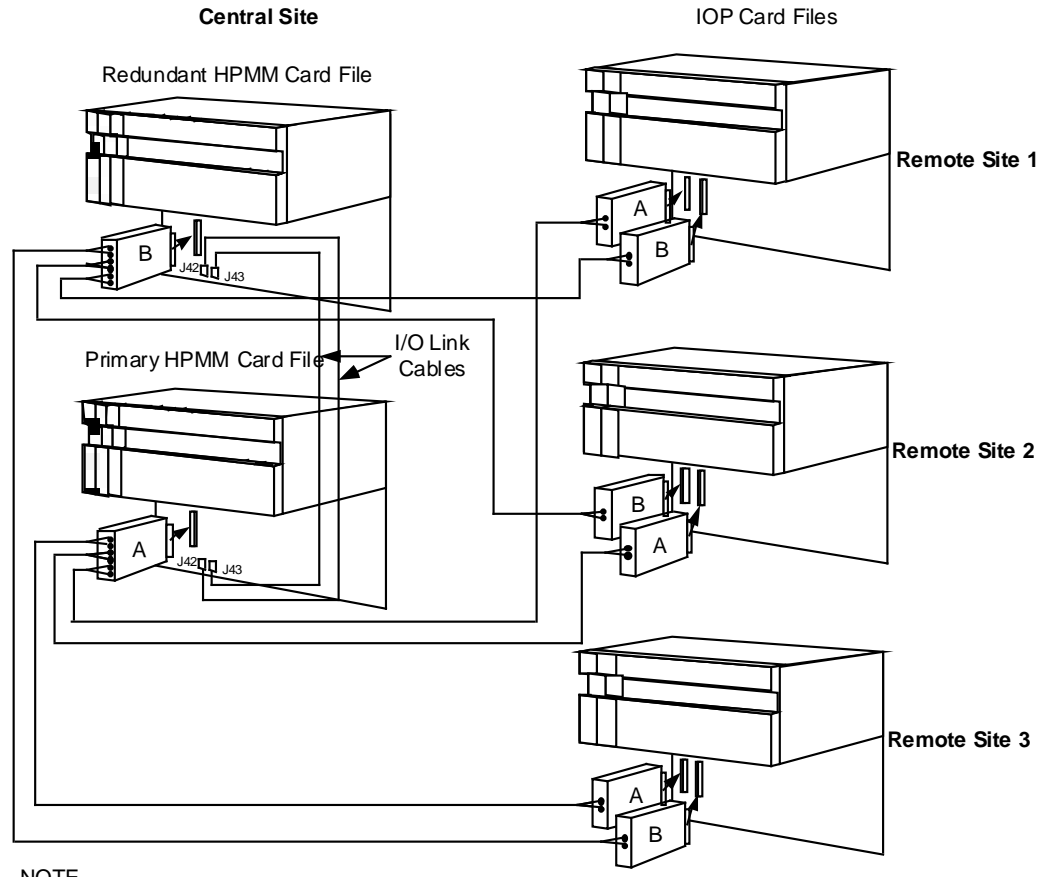
NOTE

The following High-Performance Process Manager subsystem configuration is assumed.
1. The lower HPMM card file is configured as card file #1 (I/O Link Address of 0).
2. The upper HPMM card file is configured as card file #2 (I/O Link Address of 1).
3. Remote Site #1's IOP card file is configured as card file #3 (I/O Link Address of 2).
4. Remote Site #2's IOP card file is configured as card file #4 (I/O Link Address of 3).
5. Remote Site #3's IOP card file is configured as card file #5 (I/O Link Address of 4).

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Long Distance I/O Link Extender connections nonredundant HPMM

The following figure illustrates the interconnections for a in an High-Performance Process Manager that has a nonredundant HPMM.

Figure 15 Long Distance I/O Link Extender Interconnections with Nonredundant HPMM
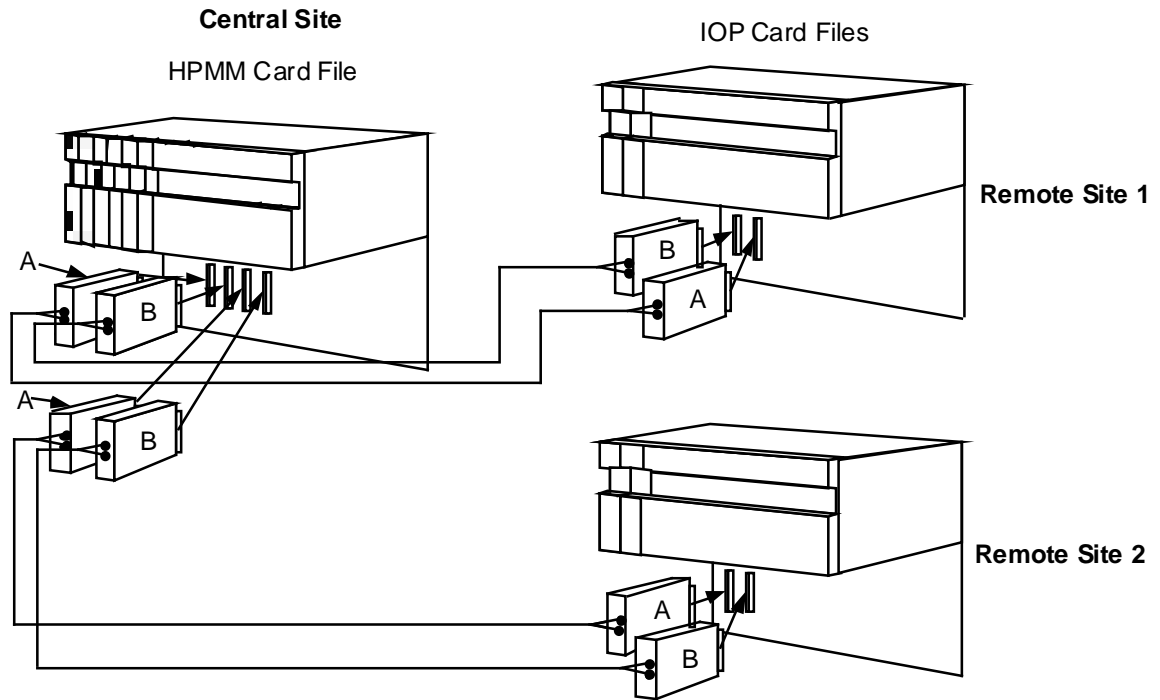
NOTE

The following High-Performance Process Manager subsystem is assumed.
1. The HPMM card file is configured as card file #1 (I/O Link Address of 0).
2. Remote Site #1's IOP card file is configured as card file #2 (I/O Link Address of 1).
3. Remote Site #2's IOP card file is configured as card file #3 (I/O Link Address of 2).

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Long Distance I/O Link Extender connections redundant HPMMs

The following figure illustrates the interconnections for a Long Distance I/O Link Extender in an High-Performance Process Manager that has redundant HPMMs.

Figure 16 Long Distance I/O Link Extender Interconnections with Redundant HPMMs
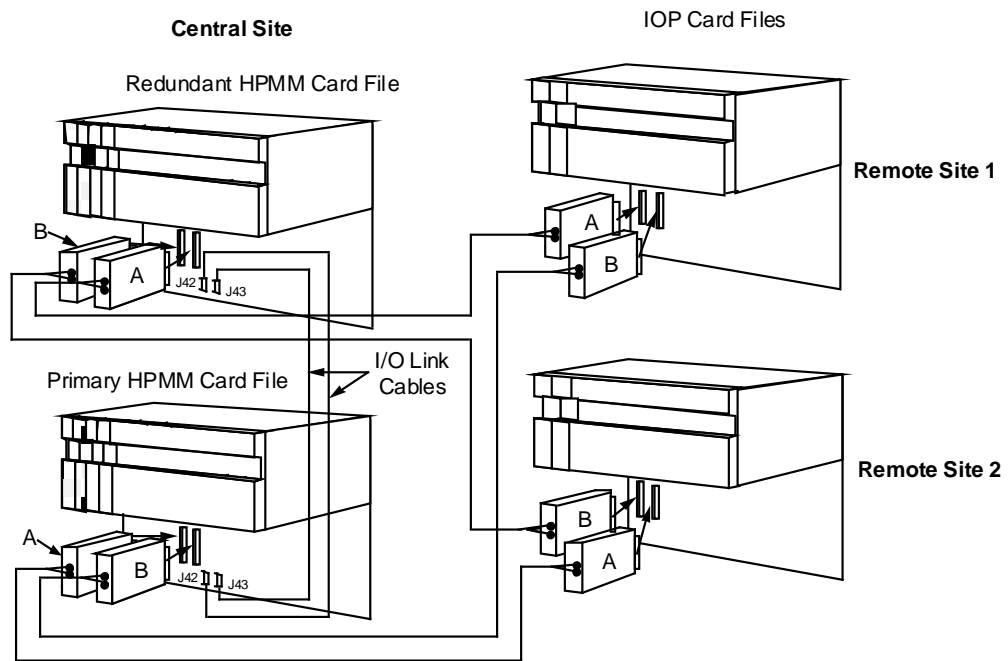
NOTE

The following High-Performance Process Manager subsystem configuration is assumed.
1. The lower HPMM card file is configured as card file #1)I/O Link address of 0).
2. The upper HPMM card file is configured as card file #2 (I/O Link address of 1).
3. Remote Site #1's IOP card file is configured as card file #3 (I/O Link address of 2).
4. Remote Site #2's IOP card file is configured as card file #4 (I/O Link address of 3).

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2.14 Field Termination Assembly

Terminal Connectors

Terminal connectors on the (FTA) provide the connection points for the process control wiring to sense, condition, or operate the connected device. Depending upon the type of FTA, fuses, relays, and resistors protect the FTA circuitry. The FTA communicates with an associated IOP, which in turn communicates with the HPMM(s).

FTAs types

Standard types of FTAs, as described in Table 3 Standard Field Termination Assembly Types, interface the field wiring and provide communication with an associated IOP. They are categorized as "standard" because types of Galvanically Isolated FTAs are also available as described in Table 4 Galvanically Isolated Field Termination Assembly Types.

Model and part numbers

The model and part numbers for available individual FTAs of each type can be found in the "Spare Parts" section.

Detailed descriptions

Refer to the Process Manager I/O Installation manual for a detailed description of each FTA.

Standard FTAs

Standard type FTAs are listed in the following table.

Table 3 Standard Field Termination Assembly Types

FTA Type	Description
High Level Analog Input/ Smart Transmitter Interface (HLAI/STI)	Accepts high level analog inputs. The inputs are configurable as single-ended or differential in relation to logic common. This FTA is also used to interface a Smart Transmitter device.
High Level Analog Input (HLAI)	Accepts high level analog inputs. The inputs are configurable as single-ended or differential in relation to logic common.
Smart Transmitter Interface (STI)	Interfaces with Smart Transmitter devices. The interface is referenced to logic ground. The Smart Transmitter provides field isolation.
Low Level Analog Input (LLAI)	Can be configured to accept low-level or high-level analog inputs. Low-level analog inputs include Thermocouples (TC), Resistance Temperature Detectors (RTDs), or millivolt sources. High-level inputs such as voltage sources (0-5 V) and 4-20 milliamp current loop devices are acceptable.The inputs are isolated from each other and the HPM, but share a common bus for field wire shields.
Low Level Analog Input Multiplexer (LLMux or RHMUX)	The FTA accepts one set of low-level analog inputs, such as thermocouples (TC) or Resistance Temperature Detectors (RTDs). The set of inputs must be either thermocouples or RTDs. The inputs are sequentially multiplexed. One or two FTAs of either type can be connected to one Power Adapter assembly and its IOP.
Analog Output (AO)	Provides 4-20 mA analog outputs to proportioning loads such as valves.
Analog Output (AO) HART	Provides 4-20 mA outputs, and incorporates circuitry to allow HART field devices to be connected to the FTA without using external filters. These FTAs also provide a connector for an external HART multiplexer.
120 Vac Digital Input (DI)	Accepts ac digital inputs. All inputs are isolated from each other. Two versions of the FTA are available, with and without pluggable input modules.

FTA Type	Description
240 Vac Digital Input (DI)	Similar to the 120 Vac DI FTA, except it has a higher operating voltage and a lower sense current. The inputs are in four groups of eight circuits with a common return for each group. Groups are isolated from each other.
24 Vdc Digital Input (DI)	Accepts contacts grouped with an isolated common return. Two versions of the FTA are available, with and without pluggable input modules.
120/240 Vac Solid-State Digital Output (DO)	Provides solid-state ac digital outputs that are isolated from each other and the HPM.
3-30 Vdc Solid-State Digital Output (DO)	Provides dc power digital outputs that are isolated from each other and the HPM.
31-200 Vdc Solid-State Digital Output (DO)	Provides dc power digital outputs that are isolated from each other and the HPM.
24 Vdc Nonisolated Digital Output (DO)	Provides nonisolated digital outputs to loads such as lamps and relays. The signals are referenced to logic common.
24 Vdc Isolated Digital Output (DO)	Provides isolated digital outputs to loads such as lamps and relays. The signals are not referenced to logic common.
120 Vac/125 Vdc Relay Digital Output (DO)	Provides independent electromechanical relays for ac or dc digital outputs.
240 Vac/125 Vdc Relay Digital Output (DO)	Provides independent electromechanical relays for ac or dc digital outputs.
Pulse Input (PI)	Accepts eight inputs, each with a 32-bit counter, and have a frequency range of dc to 20 kHz. The inputs are referenced to logic ground.
Serial Device Interface (SDI Toledo)	The SDI FTA provides an EIA-232 (RS-232) asynchronous serial communications interface for a model 8142-2084 or 8142-2184 Toledo Weigh Cell peripheral manufactured by Toledo Scale Inc.
Serial Device interface (SDI M/A Station)	The SDI FTA provides an EIA-422/485 (RS-422/485) asynchronous serial communications interface for up to four model MU-MASX02 Manual/Auto Station peripherals manufactured by Honeywell Inc.
Serial Device interface (SDI UDC 6000)	The SDI FTA provides an EIA-422/485 (RS-422/485) asynchronous serial communications interface for up to four UDC 6000 Modbus peripherals manufactured by Honeywell Inc.
Serial Interface (SI Modbus RTU)	The SI FTA provides either an EIA-232 (RS-232) asynchronous serial communications interface for one Modbus compatible device or an EIA-422/485 (RS-422/485) asynchronous serial communications interface for up to 15 Modbus RTU compatible devices.
Serial Interface (Allen-Bradley)	The SI FTA accommodates a single EIA-232 compatible Allen-Bradley device through its EIA-232 interface.

Galvanically isolated FTAs

Galvanically Isolated type FTAs are listed in the following table.

Table 4 Galvanically Isolated Field Termination Assembly Types

FTA Type	Description
High Level Analog Input (HLAI/STI)	The HLAI/STI FTA accepts high level analog inputs. Some FTA models also interface with Smart Transmitter devices. All inputs are isolated from ground and each other.
24 Vdc Digital Input (DI)	The 24 Vdc DI FTA accepts contact inputs. All inputs are isolated from each other.
Analog Output (AO)	The AO FTA provides isolated 4-20 mA outputs to proportioning loads such as valves.
Analog Output (AO) HART	Provides 4-20 mA outputs, and incorporates circuitry to allow HART field devices to be connected to the FTA without using external filters. These FTAs also provide a connector for an external HART multiplexer.
24 Vdc Digital Output (DO)	The 24 Vdc DO FTA provides isolated digital outputs to loads such as solenoid valves or lamps.

Three physical sizes

The standard FTAs have three physical sizes as illustrated in the following figure. The Galvanically Isolated FTAs are one size only, B-size.

Figure 17 Field Termination Assembly (FTA) Sizes
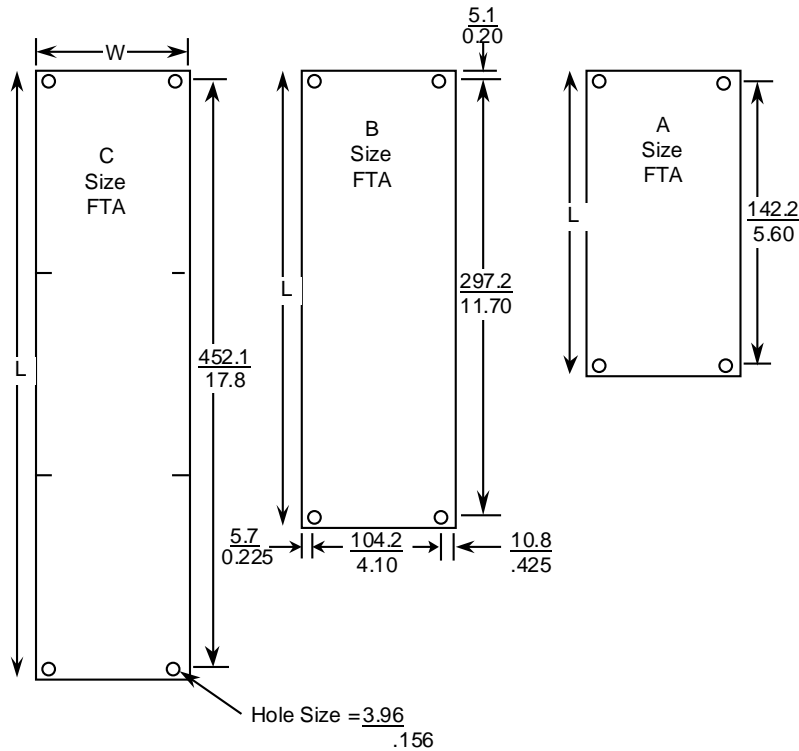
Size	Length L	Width W
A	152.4/6.00	120.7/4.75
B	307.3/12.10	120.7/4.75
C	462.3/18.20	120.7/4.75

All measurements are in: $\dfrac{\text{millimeters}}{\text{inches}}$

Note:

The center of the mounting holes is a constant distance from the edge of the assembly board for all three FTA sizes as shown for size B.

Sizes B and C, depending on the type of FTA, can have additional mounting holes along the length (sides) of the FTA. The additional mounting holes all fall on a grid established for mounting adjacent A-size FTAs.

FTA Mounting Channels

The FTAs are installed at the rear or front of a dual access cabinet on one or more FTA Mounting Channels. In a single access cabinet, the FTAs are mounted on FTA Mounting Channels at the front of the cabinet. The FTA Mounting Channels also function as cable and wiring channels, or troughs. The standard and Galvanically Isolated FTAs must not be mounted on the same FTA Mounting Channel. Mounting both types of FTAs on the same FTA Mounting Channel is an intrinsic safety violation because their field wiring will be routed together.

Vertical orientation

Standard and Galvanically Isolated FTAs are mounted on vertically oriented 3-foot long FTA Mounting Channel segments; however, Standard and Galvanically Isolated FTAs must not be mounted on the same FTA Mounting Channels.

Galvanically Isolated FTAs can be mounted on an FTA Mounting Channel that is above or below an FTA Mounting Channel that has standard FTAs mounted on it, but the field wiring must never be routed in the standard FTA's channel.

Horizontal orientation

Optionally, Galvanically Isolated FTAs can be mounted on horizontally oriented 2-foot long FTA Mounting Channels.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Typical cabinet layout

A typical cabinet layout of FTA Mounting Channels that demonstrates the installation of standard FTAs in a dual access High-Performance Process Manager cabinet is shown in the following figure.

Figure 18 Typical Vertical FTA Mounting Channel Layout
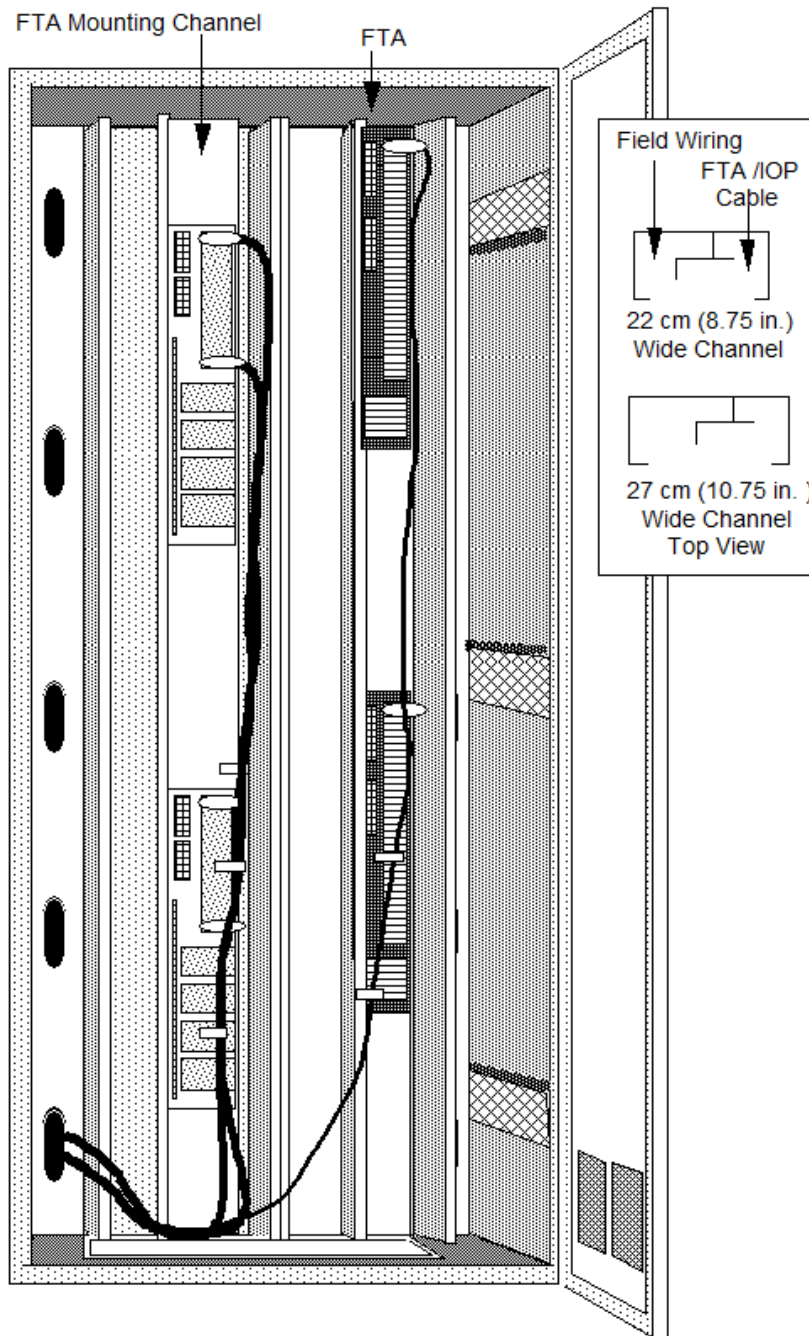
Compression or screw terminals available

Most standard FTA types are available with either compression-type or screw-type terminal connectors. Some exceptions are the 6-inch Analog Output (AO), 6-inch High Level Analog Input (HLAI), 6-inch Low Level Analog Input Multiplexer (LLMux), and the 6-inch Digital Input Power Distribution Assembly, which are available with compression-type terminal connectors only. The Remote Hardened Low Level Analog Input Multiplexer (RHMUX) is available only with screw-type terminal connectors. The number of terminals for both the compression-type and screw-type terminal connector can vary depending on the type of standard FTA.

All Galvanically Isolated FTAs are available with both crimp pin-type and compression-type terminal connectors. The Marshalling Panel and Combiner Panel are available only with screw-type terminals.

FTA compression-type terminal connector

The following figure is an illustration of a typical compression-type terminal connector connection to a standard FTA.

Figure 19 Typical FTA Compression Terminal Connector
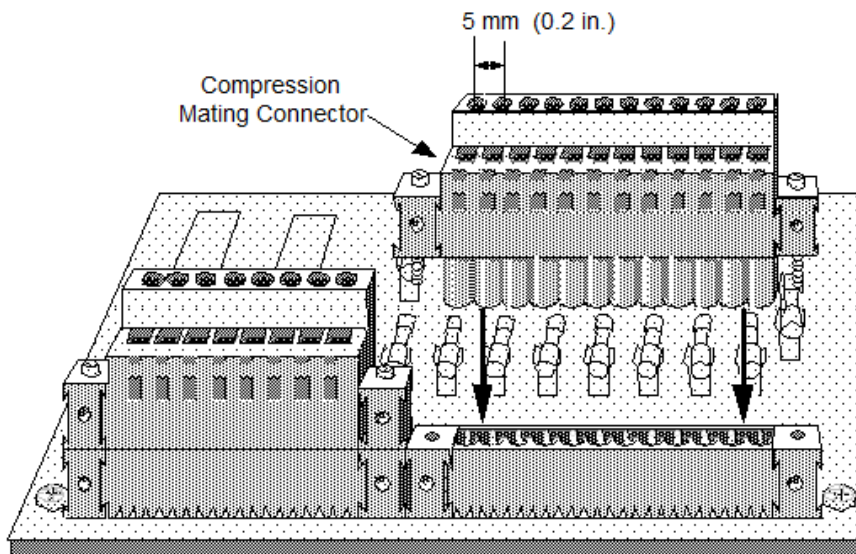
Compression Mating Connector

Number of Connections	Honeywell Part Number
8	511190694 - 108, - 208, - 408
11	- 111, - 411
12	- 112, - 412

FTA fixed screw terminal connector

The following figure illustrates a typical fixed screw-type terminal connector as it would appear on a standard FTA.

Figure 20 Typical FTA Fixed Screw Terminal Connector
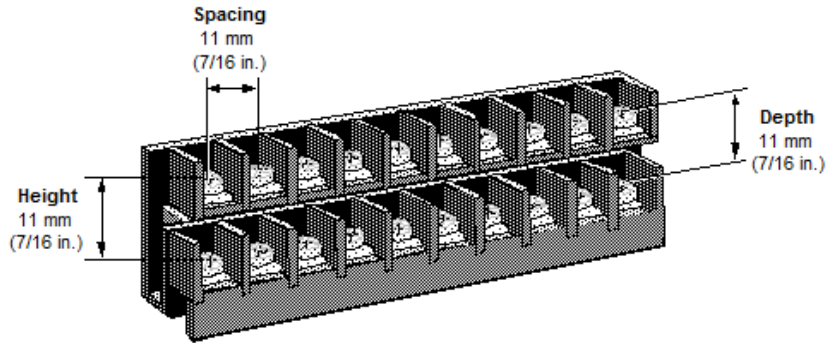
Screw Terminal Strip Sizes

Number of Terminals	Connector Length
8	52 mm (2.0 in.)
12	74 mm (2.9 in.)
24	140 mm (5.5 in.)

FTA removable screw-type connector

The following figure illustrates a typical removable screw-type terminal connector.

Figure 21 Typical FTA Removable Screw Terminal Connector
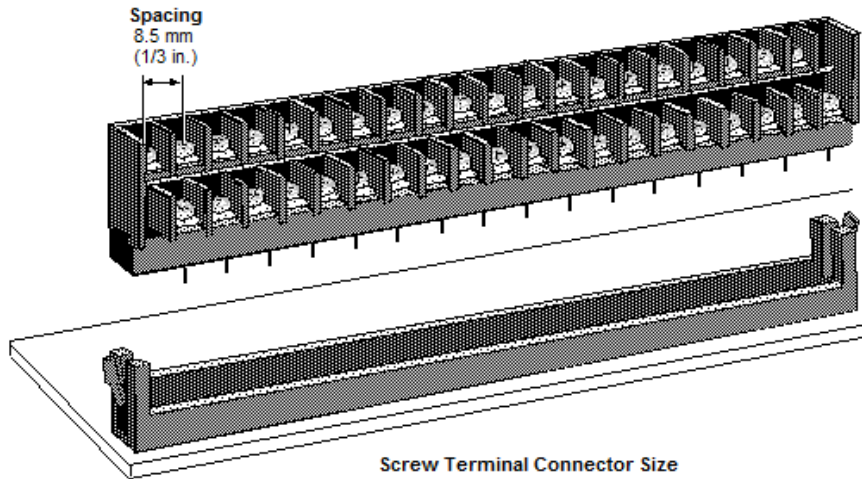
Screw Terminal Connector Size

Number of Terminals	Connector Length
40	176 mm (6.9 in.)

Galvanic Isolation Module connectors

Figure 22 and Figure 23 illustrate the crimp pin-type and compression-type terminal connectors for the Galvanically Isolated FTAs, respectively. Galvanically isolated FTA terminal connectors on the Galvanic Isolation Modules have six terminals. Depending on the type of terminal connector, the terminals accept size 0.3 to 3.5 mm^2 (12 to 22 AWG) wiring.

Crimp pin-type terminal connector

The following figure illustrates the crimp pin-type Galvanic Isolation Module terminal connector.

Figure 22 Crimp-Type Galvanic Isolation Module Terminal Connector

Compression-type terminal connector

The following figure illustrates the compression-type Galvanic Isolation Module terminal connector.

Figure 23 Compression-Type Galvanic Isolation Module Terminal Connector

Wire Size
12-22 AWG

8.0 mm $\pm$ 0.5

Connector Part Number
51191738-100

11 376
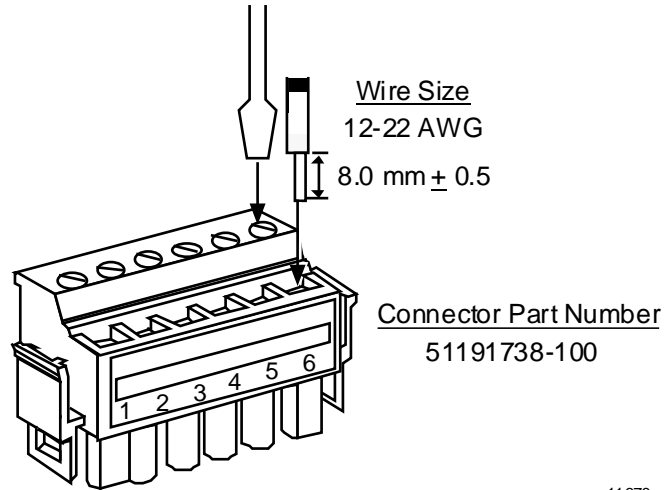
2.15 FTA Mounting Channels

Introduction

FTA Mounting Channels are used to mount the Field Termination Assemblies (FTAs) and to organize and separate the field wiring and IOP to FTA cables.

Location

The FTAs are installed on FTA Mounting Channels that are located in the front of a single access High-Performance Process Manager cabinet, and in the rear or front of a dual access cabinet.

Number of FTA Mounting Channels

The number of FTA Mounting Channels that can be accommodated in an High-Performance Process Manager cabinet is dependent upon whether the cabinet is single access or dual access, and whether standard or wide vertically orientated FTA Mounting Channels are installed.

Optionally, horizontally oriented FTA Mounting Channels can be installed when Galvanically Isolated FTAs are mounted in the cabinet.

Vertical FTA Mounting Channels

Vertical FTA Mounting Channels are available in two sizes, standard and wide, to better accommodate the amount of process control wiring that connects to the FTAs. The FTA Mounting Channels provide both a mounting surface for the FTAs and dual channels (troughs) to route the IOP to FTA cabling, and the process control wiring.

When standard FTAs are mounted on the FTA Mounting Channel, the IOP to FTA or Power Distribution Assembly cabling is routed in the right channel and the process control wiring is routed in the left channel. The opposite is true when Galvanically Isolated FTAs are mounted on the FTA Mounting Channel because the vertical orientation of the FTA Mounting Channel is reversed.

> **TIP**
>
> For EUCN, if you want to install the CF9 switch in an HPM cabinet, the top 24 inch of FTA tray must be cleared. The top six inches is left empty and the carrier adapter assembly, which is used for mounting the CF9, occupies the remaining 18 inches.

Horizontal FTA Mounting Channels

Horizontal FTA Mounting Channels can be installed when Galvanically Isolated FTAs are mounted in the cabinet. Only Galvanically Isolated FTAs are mounted on the horizontal FTA Mounting Channels. They are approximately 61 centimeters (24 inches) long and up to eight horizontal FTA Mounting Channels can be accommodated on one side of the cabinet.

The IOP to FTA, Power Distribution Assembly, or Marshalling Panel cabling is routed in the upper channel to the left side of the cabinet, and the process control wiring is routed in the lower channel to the right side of the cabinet.

Dual access cabinet installation

The following figure illustrates the installation of vertical FTA Mounting Channels in the rear of a dual access cabinet.

⚠️ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Figure 24 Vertical FTA Mounting Channel Installation – Dual Access Cabinet
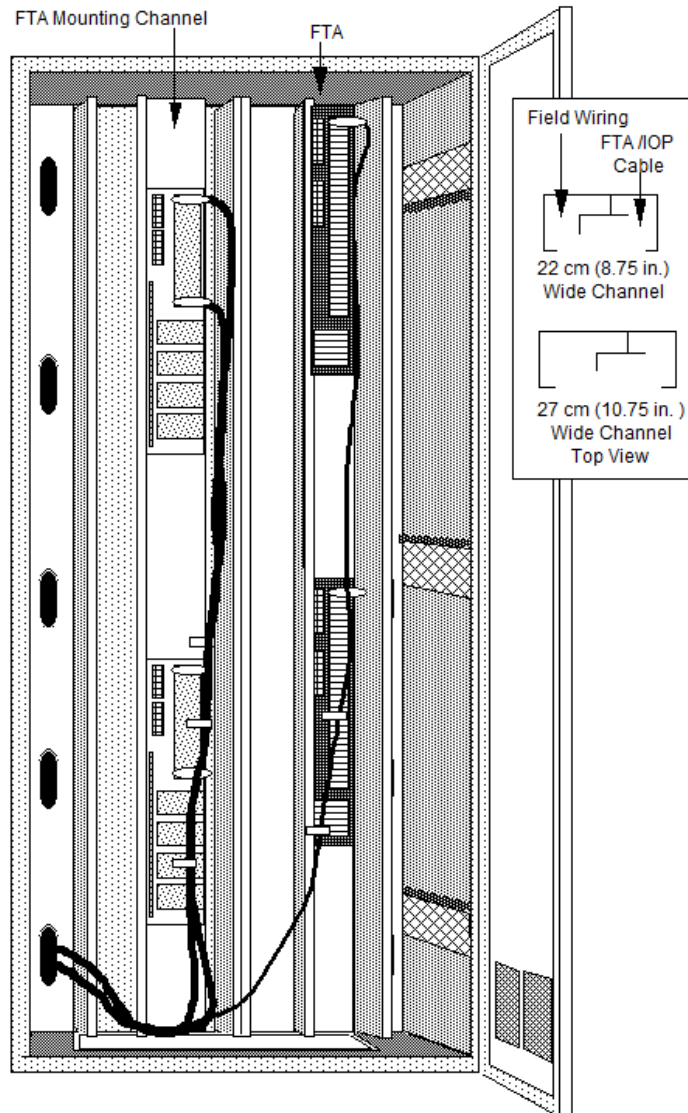
Figure 25 Vertical FTA Mounting Channel Installation – CF9 Mounting
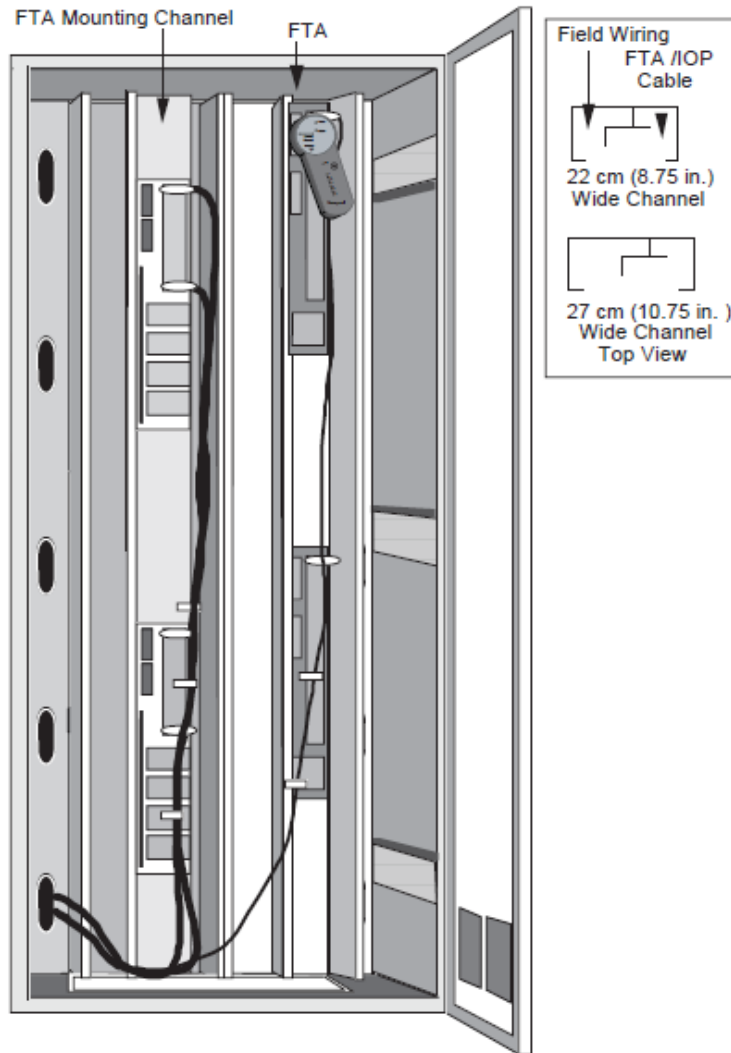
Single access cabinet installation

Single vertical FTA Mounting Channels, mounted adjacently, can be used to accept FTAs installed in the front lower area of a single access cabinet below an HPMM card file and Power System as shown in the following figure.

⚠️ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Figure 26 Vertical FTA Mounting Channel Installation – Single Access Cabinet
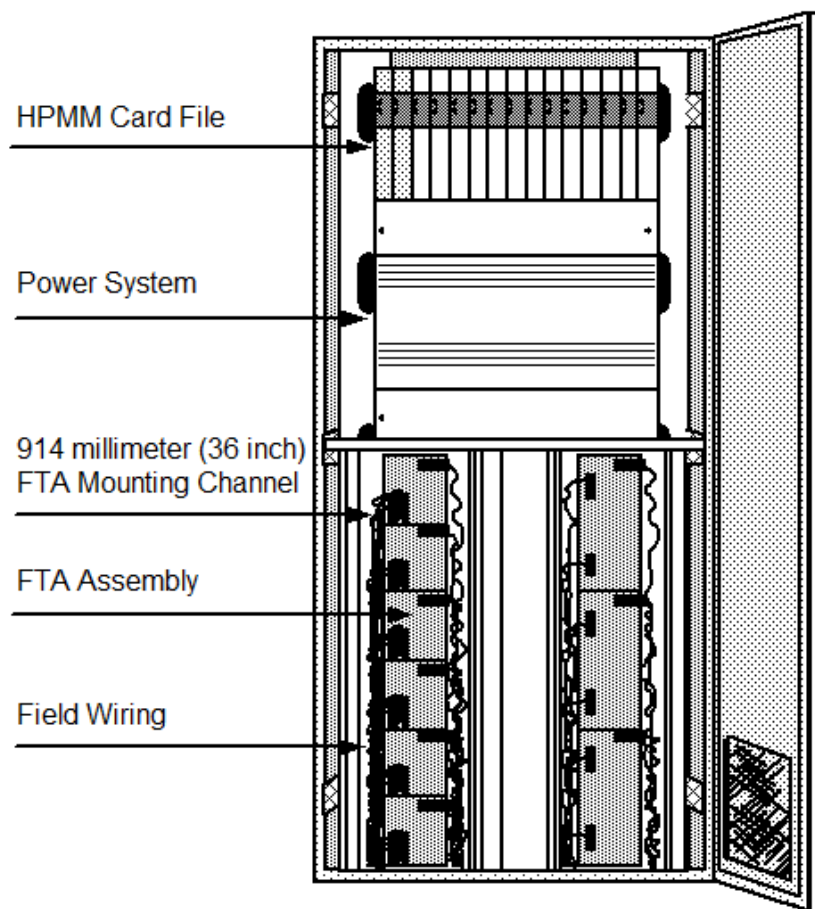
2.16 Power Systems

Power System features

⚡ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

The High-Performance Process Manager Power System provides 24 Vdc power for operation of all HPMM cards, IOP cards, FTAs, a nominal 3.6 Vdc battery output for backup of the HPMM and IOP memory circuits, and a nominal 0.25 ampere, 6 Vac output for operation of a LLAI line frequency noise cancellation clock circuit. There are three types of Power Systems. They are listed below.

Power System Type	Description
Early production Standard Power System (Model MU/MC-PSSX03) (Model MU/MC-PSRX03) (Model MU/MC-PSRB03)	This power system appears in early production HPM cabinets as well as HPM cabinets that were upgraded from PM or APM configurations.
HPM Standard Power System (Model MU/MC-PSSX04) (Model MU/MC-PSRX04) (Model MU/MC-PSRB04)	An enhanced version of power system that will be incorporated some time after initial HPM cabinets are shipped. An upgrade kit for upgrading PM and APM Power Systems will be available.
AC Only Power System (optional)	This Power System is intended for use with an uninterruptible ac power source. It does **not** provide a battery backup option for continuous operation in the event of a primary power loss.

Standard Power System

The Standard Power System has many versatile attributes that include:

- An optional redundant Power Supply Module (model MU-PSRX04)
- Either 120 Vac or 240 Vac input power. A single or dual source of input power can be connected when the optional redundant Power Supply Module option is implemented
- Single and redundant Power Supply Module failure detection
- CMOS memory NiCad battery backup (3.6 Vdc) with failure detection
- An optional 48 Vdc Battery Backup Module (model MU-PSRB04) with a disconnect connector that provides continuous equipment in the event of a primary power loss
- Provides fused ac power for 4 cabinet fan assemblies

48 volt battery backup time duration

The 48 volt battery backup time duration for a redundant HPM cabinet containing redundant HPMMs and a total of 40 IOPs (40 nonredundant or 20 redundant pairs) is approximately 20 minutes for a fully charged battery.

CMOS backup time duration

The following CMOS backup durations are defined for a HPM cabinet containing redundant HPMMs and a total of 40 IOPs (40 nonredundant or 20 redundant pairs). The time duration depends on which type of power system exists in the specific HPM cabinet.

- Early production Standard Power System versions = 12 hours
  (uses three AA size NiCad batteries). This version of power system also exists in the currently installed PM/APM cabinets.

- Enhanced HPM Standard Power System = 45 hours
  (uses three C size NiCad batteries)

Nearly all of the CMOS backup power is consumed by the HPMMs. A cabinet with a nonredundant HPMM will have a battery backup time of approximately double the values listed above. Adding/deleting IOPs does not affect the times to any great extent. The current draw of each IOP is almost negligible.

Honeywell does not specify that upgrading an existent PM/APM cabinet to HPM functionality must include a new power system. The user must decide if the current power system in their upgrade PM/APM cabinet provides sufficient CMOS backup time. The newer enhanced Standard Power System provides a longer CMOS backup time.

PSM redundancy requirements

Configuration rules specify that an HPM cabinet containing redundant HPMMs must have a power system with redundant Power Supply Modules.

Early production Standard Power System

Figure 27 is an illustration of the early production Standard Power System. The Power System's connectors, terminal strips, battery and fuse holders are an integral part of the Power System backpanel.

There are eight 24 Vdc power distribution output connectors, four Cabinet Fan Assembly power connectors with associated fuse holders, and a NiCad battery holder on the backpanel. Sets of terminals provide alarm signals for each Power Supply Module and the CMOS Battery Backup.

The Power Supply Module in the later production Power System adjusts automatically to the input ac voltage.

Figure 27 Standard Power System
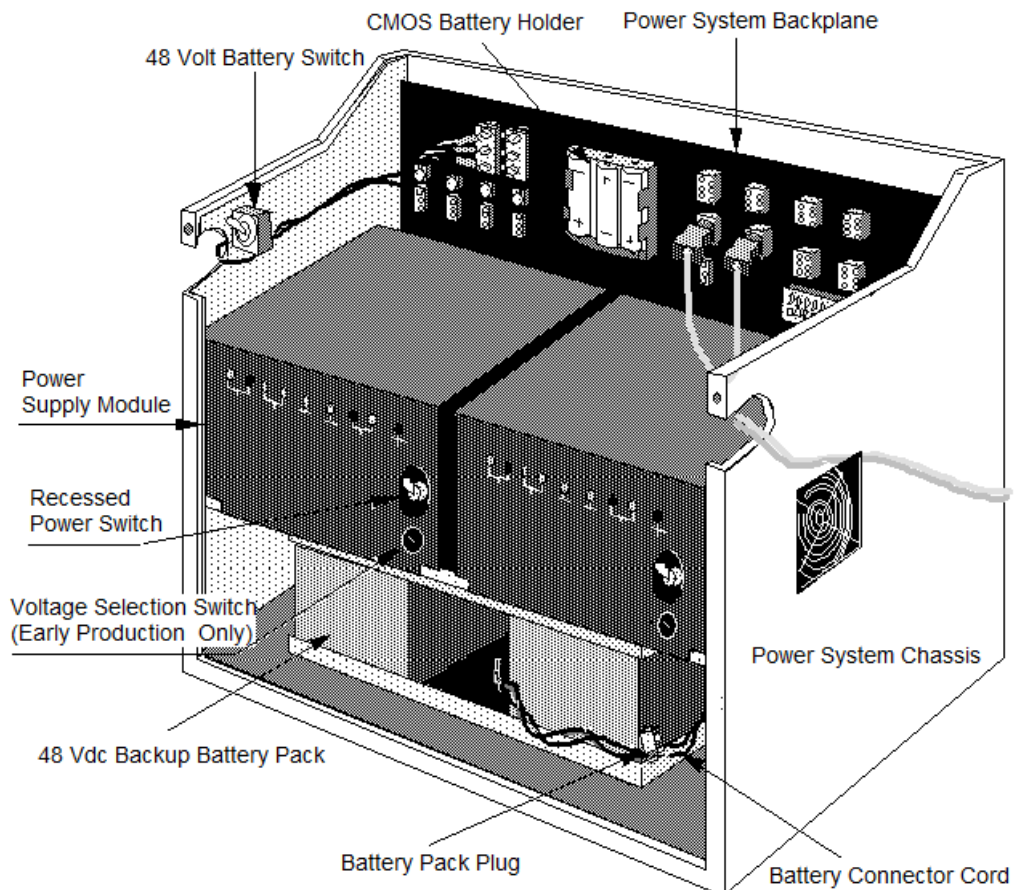
HPM Standard Power System

Figure 28 is a illustration of the enhanced HPM Standard Power System configuration that will be shipped with all new HPM cabinets in the near future. Initial HPM shipments will have an early production Standard Power System instead. The Power System's connectors, terminal strips, battery and fuse holders are an integral part of the Power System backpanel.

There are twelve 24 Vdc power distribution output connectors, four Cabinet Fan Assembly power connectors with associated fuse holders, and a NiCad battery holder on the backpanel. Sets of terminals provide alarm signals (for external alarm mechanisms) from each Power Supply Module and the CMOS Battery Backup. The alarm signals are normally wired in series to a 24 Vdc Digital Input FTA to notify the system when a Power Supply Module fails.

Figure 28 HPM Standard Power System
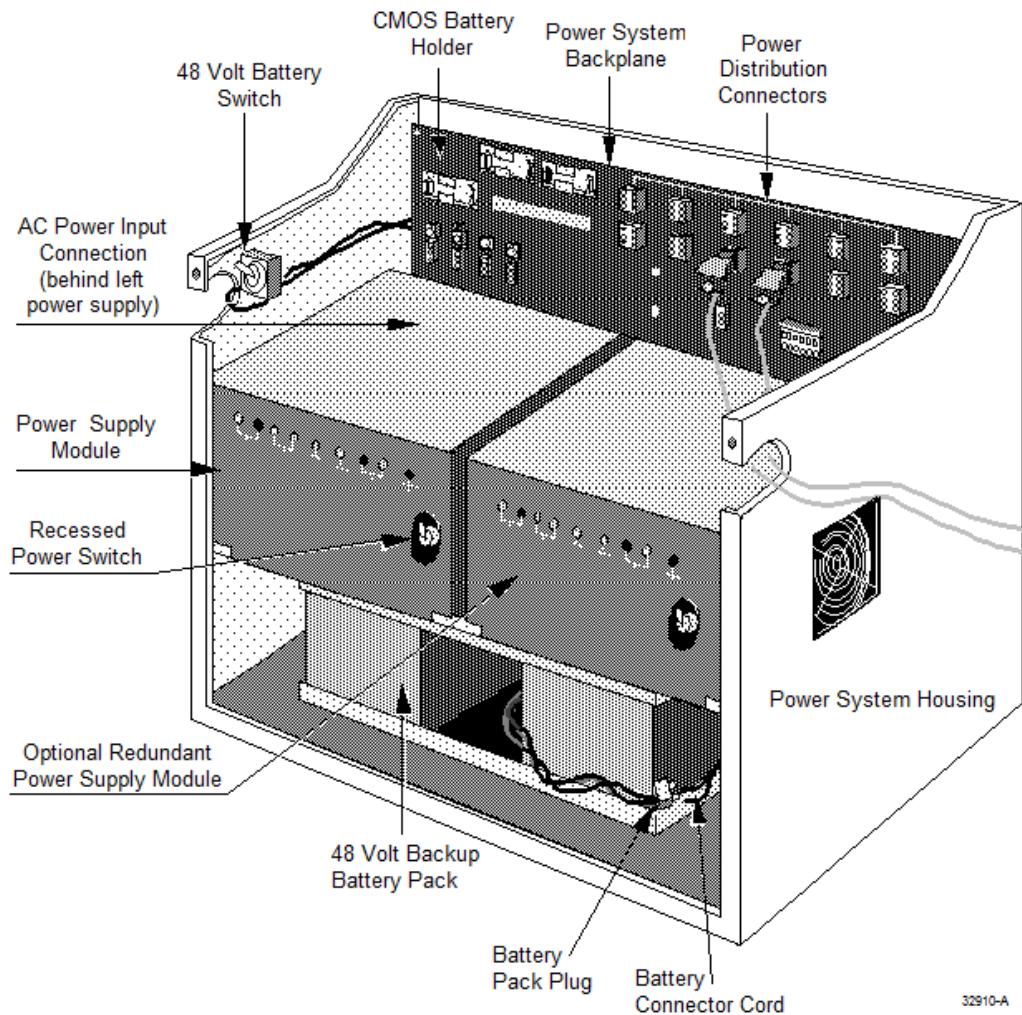
AC Only Power System

The AC Only Power System offers optional 8- or 16-ampere redundant Power Supply Modules, but does not offer the optional 48 Vdc Battery Backup module feature and rechargeable NiCad CMOS memory backup power. Nonrechargeable alkaline battery CMOS memory backup power is provided instead.

The following figure is an illustration of the AC Only Power System. Like the early production Standard Power System, the AC Only Power System has eight power distribution output connectors and four fused Cabinet Fan Assembly power connectors. There are two sets of normally open alarm contacts, each set operated by a relay, that signal a Power Supply Module failure. The alarm signals are normally wired in series to a 24 Vdc Digital Input FTA to notify the system when a Power Supply Module fails. Two LED indicators, mounted on the AC Only AC/DC Distribution Assembly, offer a visual indication of a Power Supply Module failure when the LED is extinguished.

Figure 29 AC Only Power System
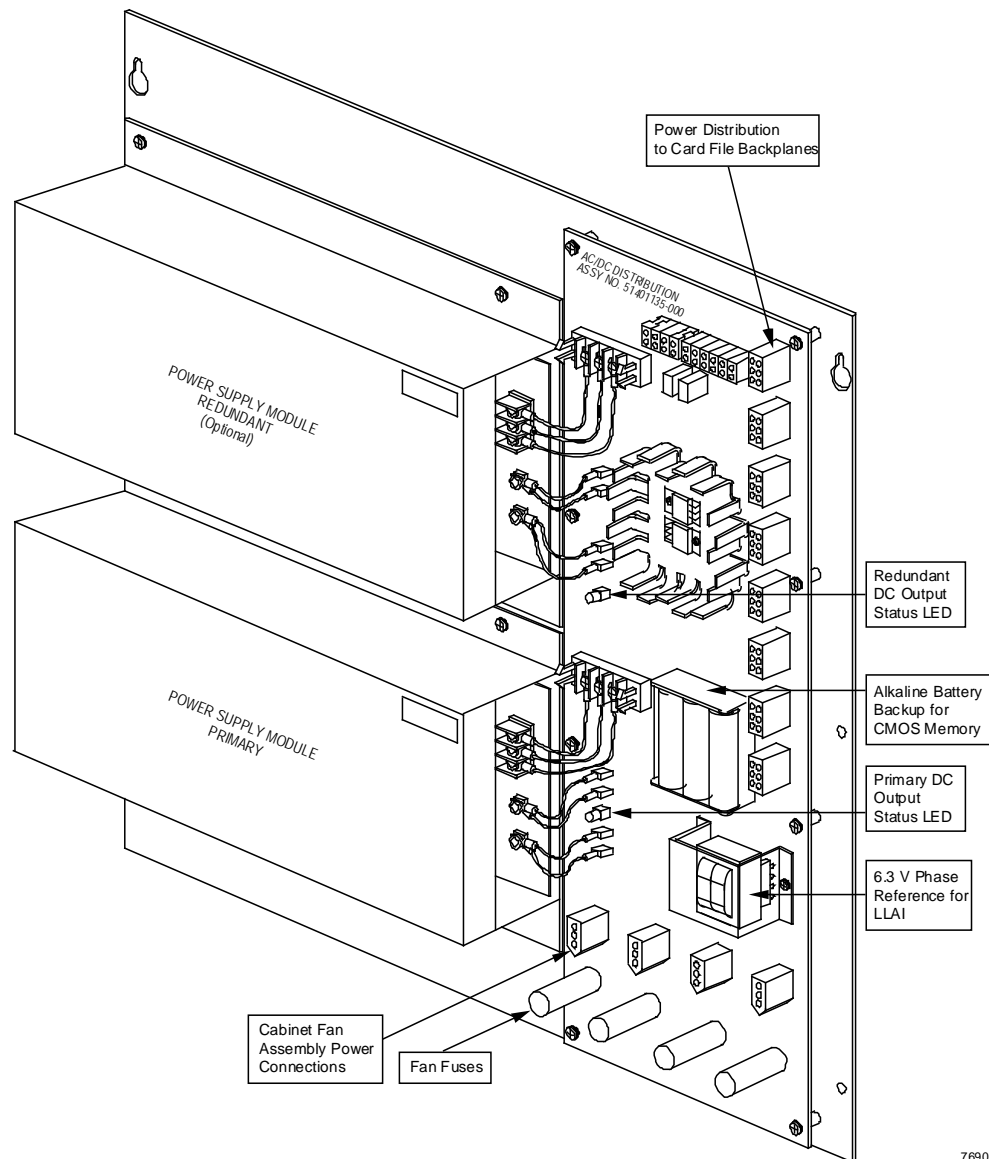
2.17 Power Distribution

Overview

AC input power connections are made to the two AC Input terminal strips at the upper left side of the backpanel in the early production Standard Power System.

The connections are located on the lower left side of the backpanel, behind the left Power Supply Module, in the HPM Standard Power System.

Primary and redundant terminals can be wired in parallel from a single power line source, or wired separately from two power line sources. See Figure 31 and Figure 32.

Power distribution is illustrated in the following figure.

Figure 30 Power Distribution
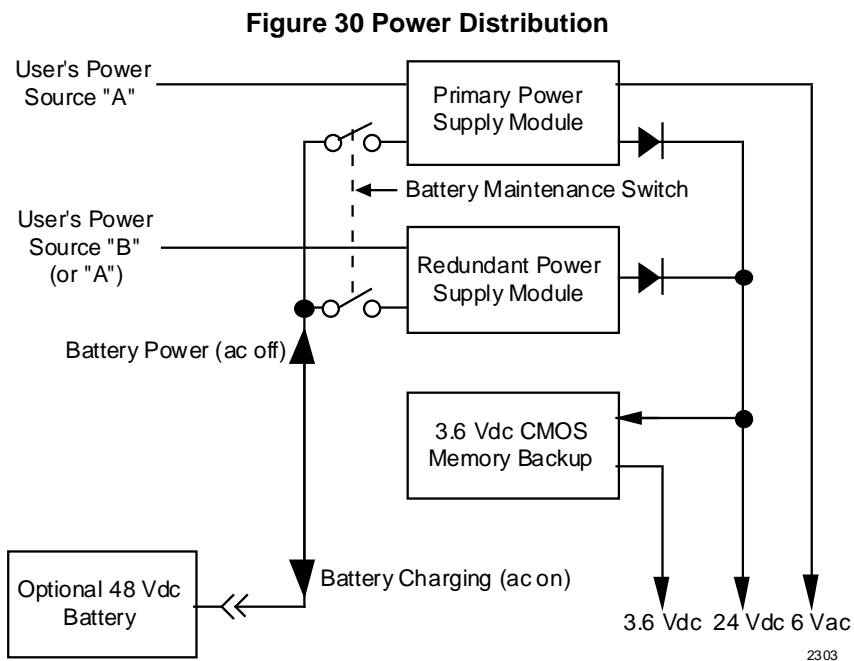
AC Only Power System ac power

AC input power connections to the AC Only Power System are made to the AC Input terminal strips at the left side of the AC/DC Distribution board as shown in Figure 29. The upper AC Input terminal strip powers the optional redundant Power Supply Module, and the lower AC Input terminal strip powers the primary Power Supply Module. Like the Standard Power System, the primary and redundant terminals can be wired in parallel from a single power line source, or wired separately from two power line sources.

Battery Backup Module

The Battery Backup Module used to power the 24 Vdc Power Supply Modules is a 48 Vdc lead acid battery that provides backup power for approximately 25 minutes with a full charge. The charging circuit is active in both Power Supply Modules whenever ac power is available to the Power Supply Module(s). At least one Power Supply Module must be present to allow the battery to supply power to the card files.

48 Volt Battery switch

A 48 Volt Battery switch that is located at the left side of the Standard Power System chassis provides a means of preventing the Power Supply Modules from discharging the Battery Backup Module when ac power is removed from one or both Power Supply Modules. Placing the switch in the off position disconnects the battery to Power Supply Module paths.

No battery backup (early production Standard Power System)

When there is no battery backup, a battery backup failure is reported unless the zero-ohm resistor jumpers, W1 and W2, located next to the Power Supply Module connectors, are cut. This is done at the factory before shipping. If a battery backup is later installed, the connections must be restored. The following figure is a view of the Standard Power System backpanel.

Figure 31 Standard Power System Backpanel (Early Production)
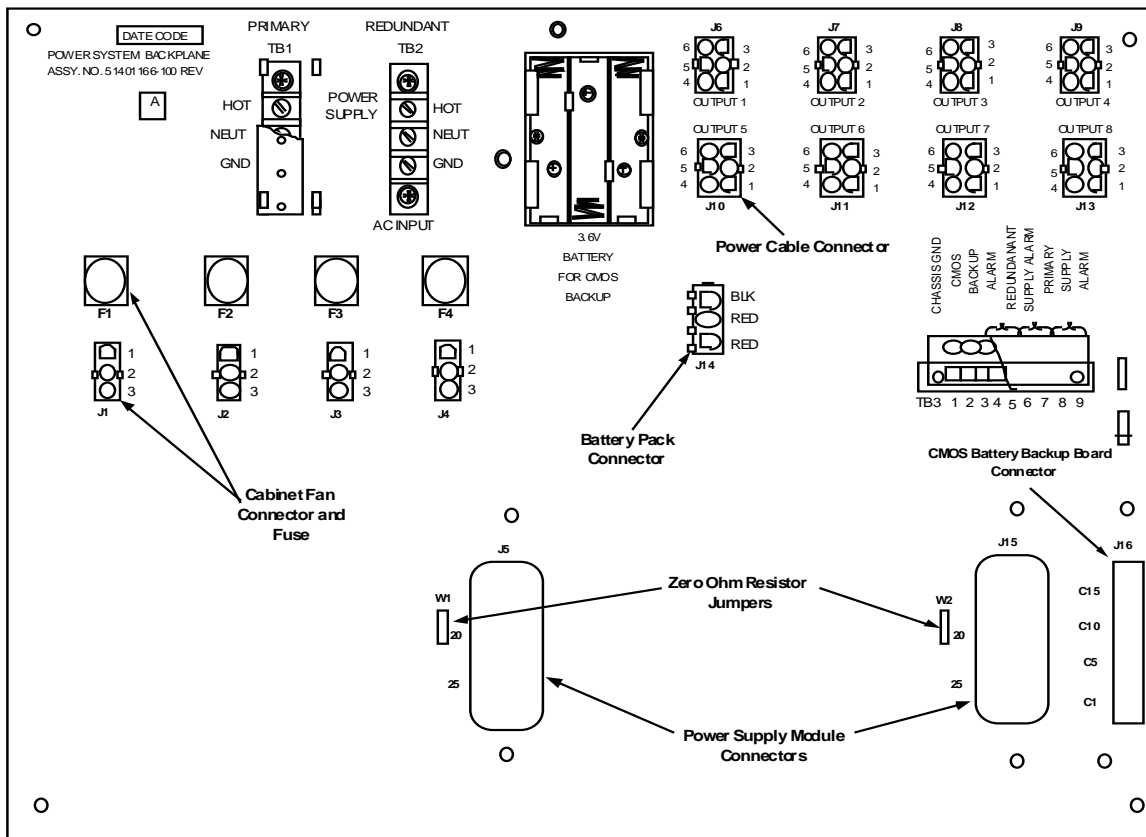
No battery backup (HPM Standard Power System)

When there is no battery backup, a battery backup failure is reported unless the zero-ohm resistor jumpers, W1 and W2, located next to the Power Supply Module connectors, are cut. This is done at the factory before shipping. If a battery backup is later installed, the connections must be restored. The following figure is a view of the HPM Standard Power System backpanel.

Figure 32 HPM Standard Power System Backpanel
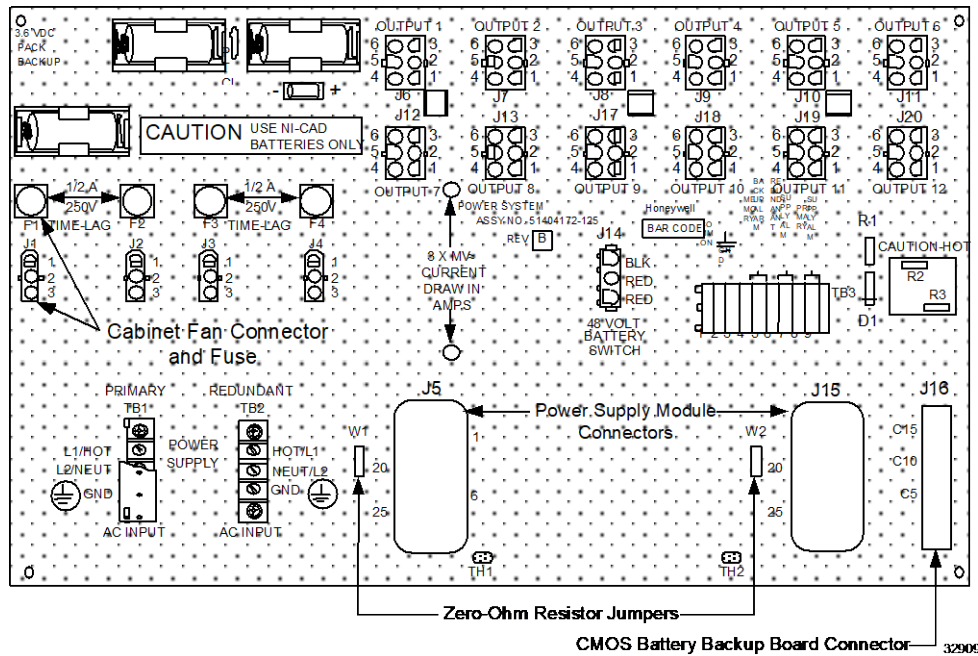
CMOS Battery Backup

Depending on the Power System configuration, three rechargeable NiCad or three nonrechargeable alkaline batteries provide a nominal 3.6 Vdc for CMOS memory backup power. The batteries support all the memory circuits in the HPMM(s) and IOPs. NiCad batteries are long-lived, and they are automatically tested periodically. Every 8 seconds the batteries' output voltage is tested for the proper level, and every 2 hours a load is applied to the batteries and the voltage level is again tested.

The early production Standard Power System uses 3 "AA" size NiCad batteries which provide approximately 12 hours of backup. The enhanced Standard HPM Power System uses 3 "C" size NiCad batteries which provide approximately 45 hours of backup.

Standard Power System (early production)

Refer to the following figure for the location of the CMOS Battery Backup Assembly mating connector on the backpanel.

The early production Standard Power System has NiCad batteries located at the upper center of the Power System chassis backpanel, and the supporting CMOS Battery Backup Assembly is inserted into a connector at the lower right-hand side of the backpanel. The right Power Supply Module must be removed to view the assembly. The assembly provides both charging circuitry and a monitoring circuitry for failure alarm reporting.

See the following figure for an illustration of the CMOS Battery Backup Assembly.

Figure 33 CMOS Battery Backup Assembly (Early Production)
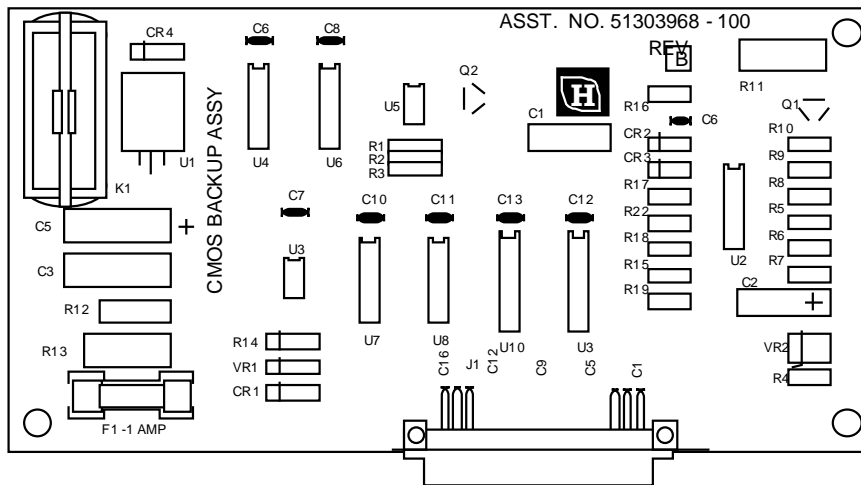
Note: F1 is a 0.5 A time-delay fuse.

HPM Standard Power System

Refer to Figure 32 for the location of the CMOS Battery Backup Assembly mating connector on the backpanel.

The Standard Power System configuration has NiCad batteries located at the upper left of the Power System chassis backpanel, and the supporting CMOS Battery Backup Assembly is inserted into a connector at the lower right-hand side of the backpanel. The right Power Supply Module must be removed to view the assembly. The assembly provides both charging circuitry and a monitoring circuitry for failure alarm reporting. The new version (CMOS Battery Backup Assembly) is backward compatible with the early production version. The older version is not forward compatible.

See the following figure for an illustration of the latest version of CMOS Battery Backup Assembly.

Figure 34 CMOS Battery Backup Assembly (HPM Standard Power System)
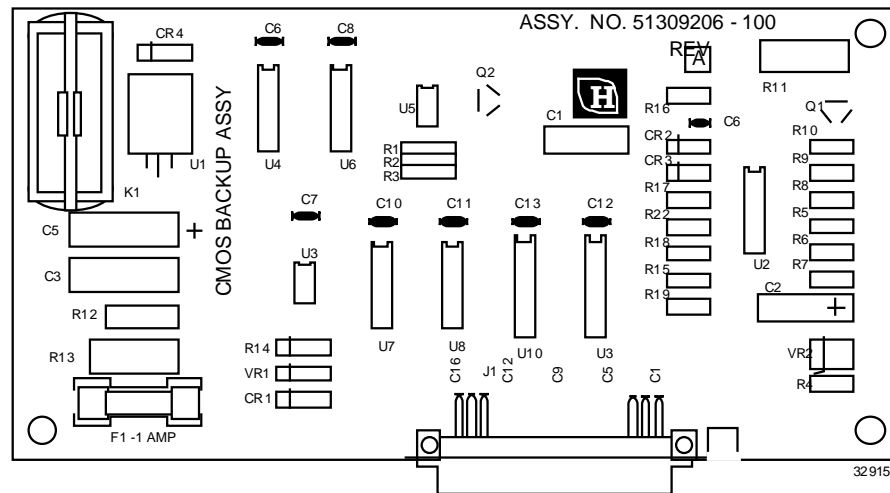
ATTENTION

A bad batteries alarm occurs when the CMOS batteries are discharged or when a High-Performance Comm/Control card is not present in an HPMM card file with or without power applied to the card file. Both the High-Performance Comm/Control and the High-Performance I/O Link cards must either be present or absent in order to charge the batteries.

AC Only Power System

The AC Only Power System uses alkaline batteries which must be replaced frequently. The three alkaline batteries are located at the center of the AC/DC Distribution Assembly as shown in Figure 29. No charging circuitry or monitoring circuitry for failure alarm reporting exists.

A new set of batteries will provide approximately 55 hours of backup time.

2.18 24 Vdc Power Distribution

Dual power distribution cables

To improve reliability, 24 Vdc distribution to the card files is always provided by two power distribution cables.

Standard Power System

The early production Standard Power System provides eight 6-pin connectors located on its backpanel. Three card files and a Digital Input Power Distribution Assembly or Galvanic Isolation Power Distribution Assembly can be redundantly powered.

The enhanced HPM Standard Power System provides twelve 6-pin connectors located on its backpanel. This allows a greater flexibility in providing power to card files and Power Distribution assemblies.

AC Only Power System

The AC Only Power System also provides eight 6-pin connectors located on the AC/DC Distribution Assembly that will redundantly power three card files and a Digital Input Power Distribution Assembly or Galvanic Isolation Power Distribution Assembly.

Typical cabinet power distribution

The following figure illustrates the typical 24 Vdc cabinet power distribution to the card files, Digital Input Power Distribution Assembly, and Galvanic Isolation Power Distribution Assembly for the various Power System configurations.

Figure 35 Typical Cabinet 24 Vdc Power Distribution
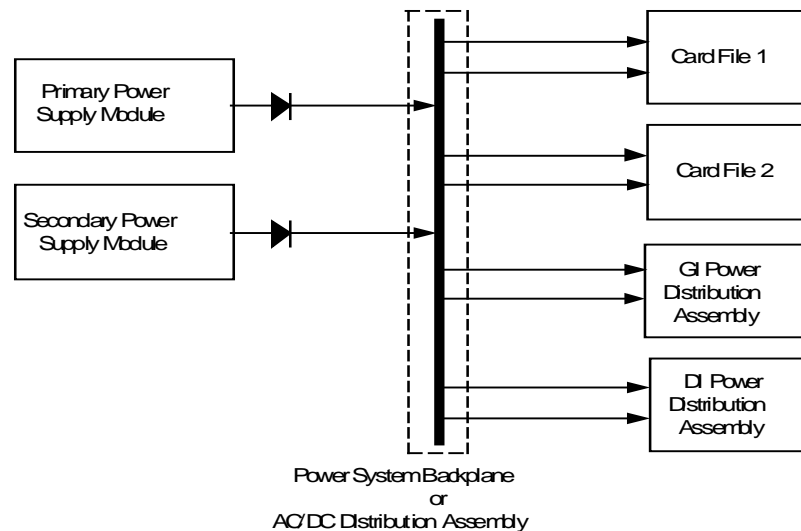
2.19 Cabinet Fan Assembly

Introduction

Fused 0.5 A 120 Vac or 240 Vac power is provided by the Power System for Cabinet Fan assembly operation.

Up to four Cabinet Fan assemblies

Up to four Cabinet Fan assemblies can be powered by the 120 Vac or 240 Vac provided by the four 3-pin connectors of the Standard or AC Only Power System configurations. The connectors and fuses are located at the left side of the Standard Power System backpanel and at the bottom of the AC Only Power System AC/DC Distribution assembly. See Figure 27, Figure 28, and Figure 29 respectively.

Optional Cabinet Fan assembly

An optional Cabinet Fan assembly has an LED indicator that indicates normal operation of both fans, and an alarm signal, represented by normally open contacts, is available at a terminal strip, TB1. The contacts are closed when the Cabinet Fan assembly is operating normally. The operation of the Cabinet Fan assembly can be monitored by a 24 Vdc Digital Input FTA, by providing the alarm 24 Vdc signal source from the FTA and returning it to the FTA through the alarm contacts.

2.20 LLAI Line Frequency Clock Voltage

Introduction

The Power System provides a nominal 6 Vac half-wave rectified phase reference signal to the High-Performance Process Manager card file assemblies through the Power Distribution cable. A pluggable solid-state optical coupler module, U1, on each type of card file backpanel generates this line frequency phase reference signal. It is located at the bottom right of a 7-slot card file backpanel and in a similar position on the 15 slot card file. Its 6 Vac output is routed to the Low Level Analog Input (LLAI) IOPs through Power Distribution cables and card file backpanels. The signal is used by the IOPs to improve the common and normal mode noise rejection ratio.

Standard Power System

In the Standard Power System configuration, the Power Supply Module located at the left side of the assembly is the source of the line frequency phase reference signal. If the left Power Supply Module is removed, the LLAI IOPs in the same cabinet will report a Soft failure and continue to operate, but at lesser degree of accuracy.

AC Only Power System

The line frequency phase reference signal in the AC Only Power System configuration is not dependent upon the presence of the left or right side Power Supply Modules, since a constant voltage is supplied by the AC/DC Distribution Assembly.

2.21 24 Vdc Fuse Protection

Card file fusing

Fuse protection is provided for the four types of card files. The following protection philosophy applies for both the 7-Slot, 15-Slot, and IOP Only card files.

- The individual IOP card and an associated standard FTA are protected by a common fast-action fuse that is located on the backpanel. The fuse has a 2 A rating.

- In addition to the 2 A protection, each individual IOP card has fast-action 0.5 A fuse protection that is located on the card. The fast-action 0.5 A fuse is soldered in place and is not field replaceable. You must replace the IOP card.

- Both HPMM cards, High-Performance Communications/Control and High-Performance I/O Link, and the HPM UCN Interface module are protected by a fast-action 3.2 A fuse that is located on the High-Performance I/O Link card. The fuse is field replaceable.

- A fast-action 2.0 A fuse protects the LLAI optical coupler module on backpanel U1. It generates the line frequency phase reference signal that is used by LLAI IOPs.

Fuse removal

A Honeywell designed fusepuller is generally needed for extracting and inserting fuses in the HPM backpanels because of the restricted space between components. The Honeywell part number is 51190586-100.

The fusepuller is comprised of three parts; an inner barrel that grasps the fuse, an end cap that is attached one end of the inner barrel, and an outer barrel in which the inner barrel moves.

The following extraction and insertion procedures should aid in the use of the fusepuller.

Fuse extraction

Use the following procedure to extract a fuse from an HPM backpanel.

Step	Action
1	Hold the outer barrel of the fusepuller with the fingers of one hand and depress the the fusepuller's end cap with your other hand.
2	Place the protruding end of the inner barrel around the fuse. The fusepuller must be perpendicular to the backpanel.
3	Release the end cap while still holding the outer barrel.
4	Move the outer barrel towards the backpanel. The greater the movement, the greater the gripping force will be on the fuse.
5	Extract the fuse from the backpanel by vertically moving the fusepuller away from the backpanel. Depress the end cap to release the fuse.

Fuse insertion

Use the following procedure to insert a fuse in an HPM backpanel.

Step	Action
1	Hold the outer barrel of the fusepuller with the fingers of one hand and depress the the fusepuller's end cap with the thumb.
2	Hold the fuse in position with the fingers of your other hand and place the protruding end of the fusepuller's inner barrel around the fuse.
3	Release the end cap while still holding the outer barrel and the fuse.
4	Move the outer barrel towards the fuse. The greater the movement, the greater the gripping force will be on the fuse.
5	Insert the fuse in its backpanel position by vertically moving the fusepuller towards from the backpanel. Depress the end cap to release the fuse.

Left 7-Slot card file

Table 5 Left 7-Slot Card File Fuse Protection lists the individual backpanel fuses and their application for the Left 7-Slot card file. The fuse rating is 2 A for fuse locations F1 through F8.

Left 7-Slot Card File Fuse Protection

When HPMM cards occupy the left two slots of a card file, fuse F2 is not in use. Fuse F1 on the backpanel is used to supply 24 Vdc to the UCN Interface Module.

Table 5 Left 7-Slot Card File Fuse Protection

Fuse	Rating	Protection Application
F1	2 A fast-action	Slot 1 IOP card and associated FTA or UCN Interface Module (24 Vdc) if HPMM exists in card file
F2	2 A fast-action	Slot 2 IOP card and associated FTA
F3	2 A fast-action	Slot 3 IOP card and associated FTA
F4	2 A fast-action	Slot 4 IOP card and associated FTA
F5	2 A fast-action	Slot 5 IOP card and associated FTA
F6	2 A fast-action	Slot 6 IOP card and associated FTA
F7	2 A fast-action	Slot 7 IOP card and associated FTA
F8	2 A fast-action	HLAI Optical Coupler Module, U1

Left 7-Slot HPMM card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the Left 7-Slot HPMM card file backpanel.

Figure 36 Left 7-Slot HPMM Card File Backpanel 24 Vdc Distribution

Left 7-Slot IOP card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the Left 7-Slot IOP card file backpanel.

Figure 37 Left 7-Slot IOP Card File Backpanel 24 Vdc Distribution

Notes:

A fast-action 2 A fuse that is located on the backplane protects each IOP/nongalvanically isolated FTA combination.

A fast-action 0.5 A fuse that is located on the IOP card protects the IOP card.

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Left 7-Slot card file backpanel fuse locations

The following figure illustrates the locations of the individual fuses on the Left 7-Slot card file backpanel.

Figure 38 Left 7-Slot Card File Backpanel Fuse Locations
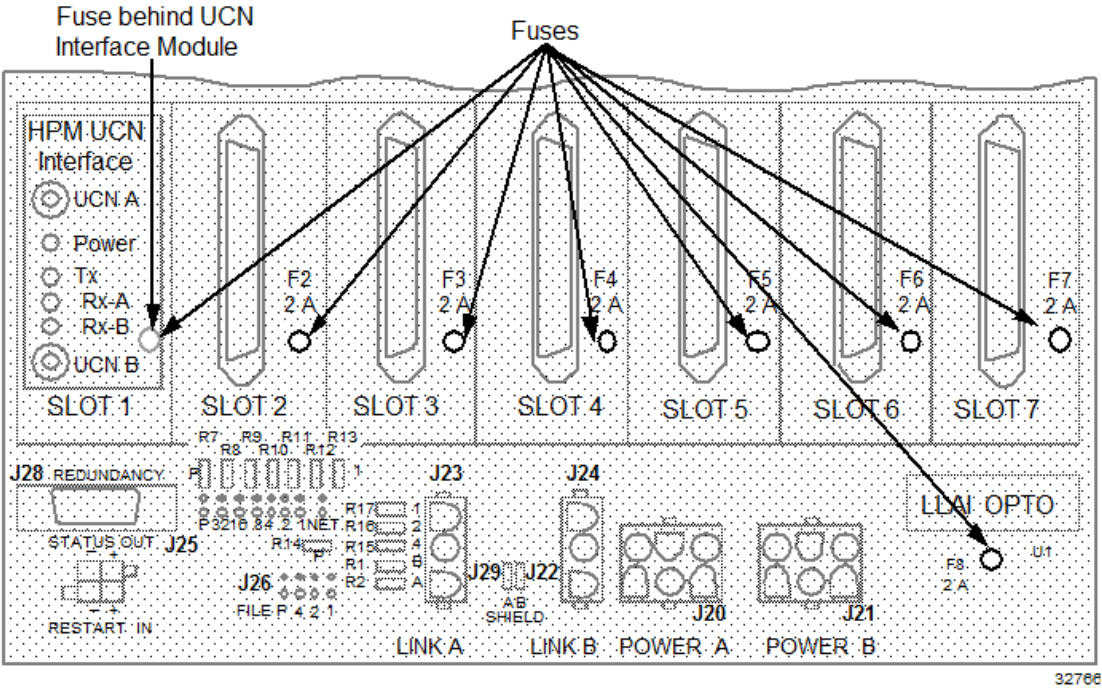
Figure 39 Left 7-Slot Card File Backpanel Fuse Locations for EHPM
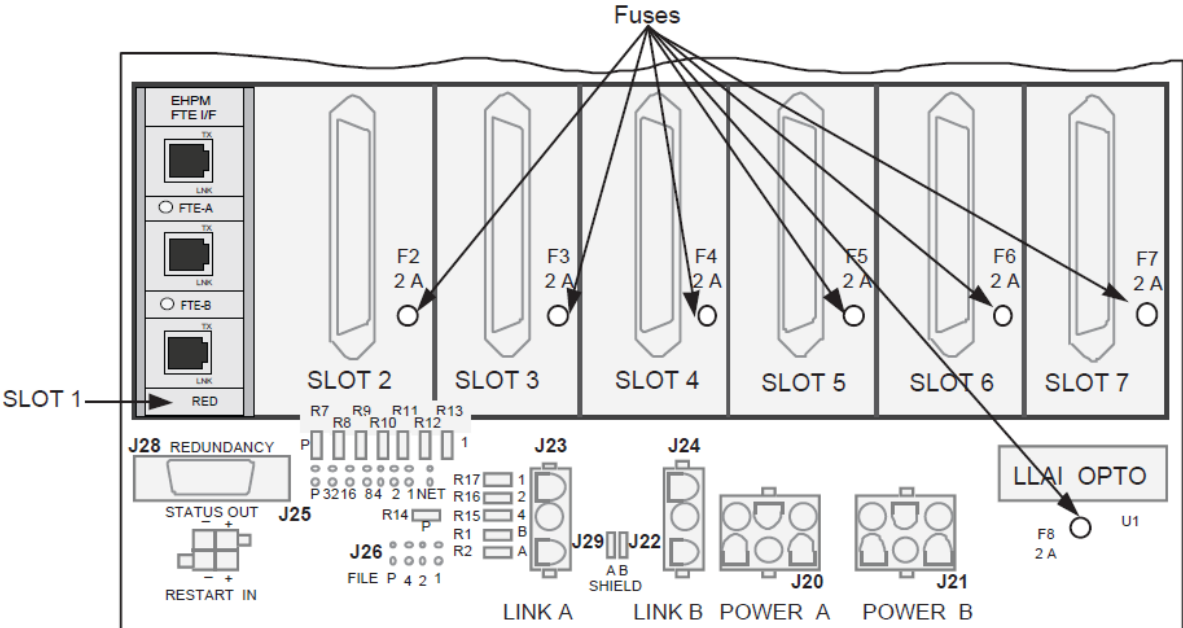
Right 7-Slot card file

Table 6 Right 7-Slot Card File Backpanel Fuse Protection lists the individual backpanel fuses and their application for the Right 7-Slot card file. The fuse rating is 2 A for fuse locations F1 through F8.

Right 7-Slot Card File Backpanel Fuse Protection

When HPMM cards occupy the left two slots of a card file, fuse F2 is not in use. Fuse F1 on the backpanel is used to supply 24 Vdc to the UCN Interface Module.

Table 6 Right 7-Slot Card File Backpanel Fuse Protection

Fuse	Rating	Protection Application
F1	2 A fast-action	Slot 9 IOP card and associated FTA or UCN Interface Module (24 Vdc) if HPMM exists in card file
F2	2 A fast-action	Slot 10 IOP card and associated FTA
F3	2 A fast-action	Slot 11 IOP card and associated FTA
F4	2 A fast-action	Slot 12 IOP card and associated FTA
F5	2 A fast-action	Slot 13 IOP card and associated FTA
F6	2 A fast-action	Slot 14 IOP card and associated FTA
F7	2 A fast-action	Slot 15 IOP card and associated FTA
F8	2 A fast-action	HLAI Optical Coupler Module, U1

Right 7-Slot HPMM card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the Right 7-Slot HPMM card file backpanel.

Figure 40 Right 7-Slot HPMM Card File Backpanel 24 Vdc Distribution

Right 7-Slot IOP card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the Right 7-Slot IOP card file backpanel.

Figure 41 Right 7-Slot IOP Card File Backpanel 24 Vdc Distribution

Notes:

A fast-action 2 A fuse that is located on the backplane protects each IOP/nongalvanically isolated FTA combination.

A fast-action 0.5 A fuse that is located on the IOP card protects the IOP card.

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Right 7-Slot card file backpanel fuse locations

The following figure illustrates the locations of the individual fuses on the Right 7-Slot card file backpanel.

Figure 42 Right 7-Slot Card File Backpanel Fuse Locations
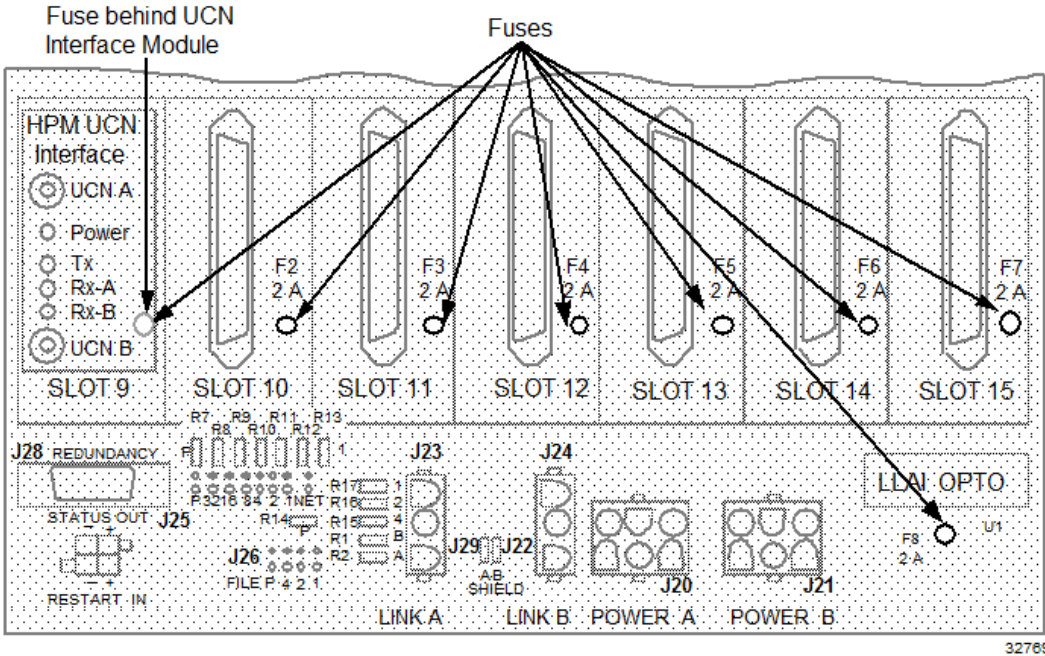
Figure 43 Right 7-Slot Card File Backpanel Fuse Locations for EHPM
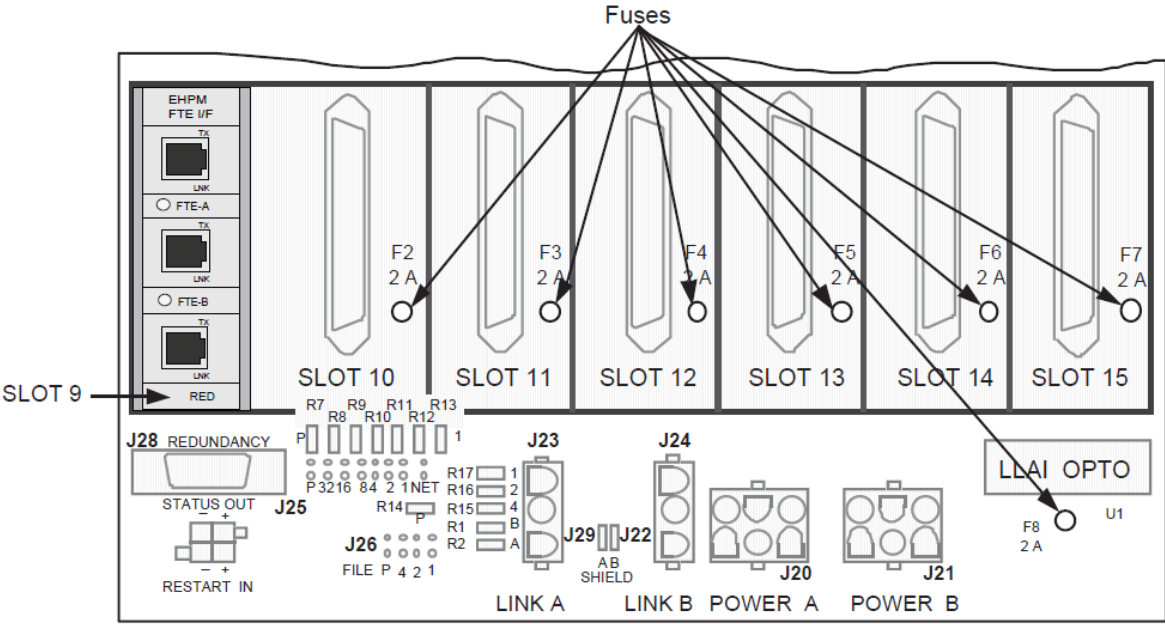
15-Slot card file

The 15-Slot card file provides 2 A fast-action fuse IOP card and associated standard FTA protection. The backpanel assembly also provides fast-action 2.0 A fuse protection for the LLAI Optical Coupler Module on the backpanel U1.

When HPMM cards occupy the left two slots of a card file, fuse F2 is not in use. Fuse F1 on the backpanel is used to supply 24 Vdc to the UCN Interface Module.

15-Slot Card File Backpanel Fuse Protection

The following table lists the individual backpanel fuses and their application for the 15-Slot card file. The fuse rating is 2 A for fuse locations F1 through F16.

Table 7 15-Slot Card File Backpanel Fuse Protection

Fuse	Rating	Protection Application
F1	2 A fast-action	Slot 1 IOP card and associated FTA or UCN Interface Module (24 Vdc) if HPMM exists in card file
F2	2 A fast-action	Slot 2 IOP card and associated FTA
F3	2 A fast-action	Slot 3 IOP card and associated FTA
F4	2 A fast-action	Slot 4 IOP card and associated FTA
F5	2 A fast-action	Slot 5 IOP card and associated FTA
F6	2 A fast-action	Slot 6 IOP card and associated FTA
F7	2 A fast-action	Slot 7 IOP card and associated FTA
F8	2 A fast-action	Slot 8 IOP card and associated FTA
F9	2 A fast-action	Slot 9 IOP card and associated FTA
F10	2 A fast-action	Slot 10 IOP card and associated FTA
F11	2 A fast-action	Slot 11 IOP card and associated FTA
F12	2 A fast-action	Slot 12 IOP card and associated FTA
F13	2 A fast-action	Slot 13 IOP card and associated FTA
F14	2 A fast-action	Slot 14 IOP card and associated FTA
F15	2 A fast-action	Slot 15 IOP card and associated FTA
F16	2 A fast-action	LLAI Optical Coupler Module, U1

15-Slot HPMM card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the 15-Slot HPMM card file backpanel.

Figure 44 15-Slot HPMM Card File Backpanel 24 Vdc Distribution
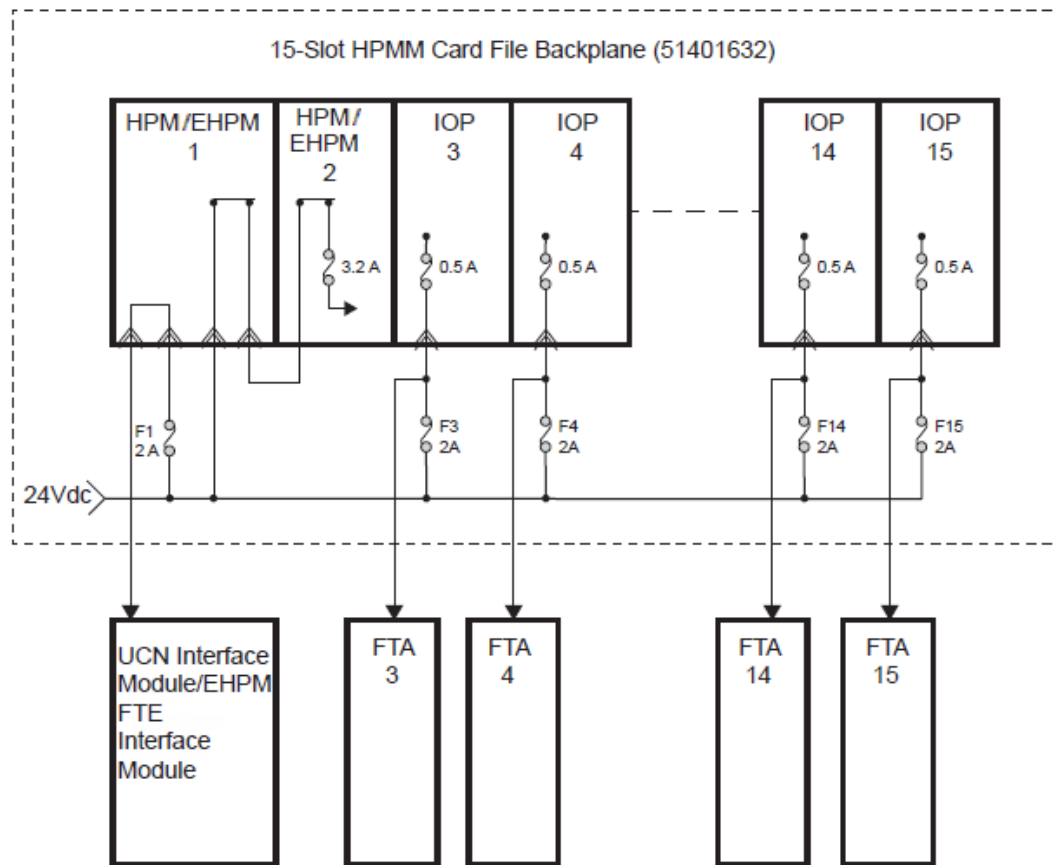
Notes:

A fast-action 2 A fuse that is located on the backplane protects each IOP/nongalvanically isolated FTA combination.

A fast-action 0.5 A fuse that is located on the IOP card protects the IOP card.

A fast-action 3.2 A fuse that is located on the High-Performance I/O Link card protects the HPMM cards and HPM UCN Interface module.

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15-Slot IOP card file 24 Vdc distribution

The following figure illustrates the 24 Vdc power distribution on the 15-Slot IOP card file backpanel.

Figure 45 15-Slot IOP Card File Backpanel 24 Vdc Distribution
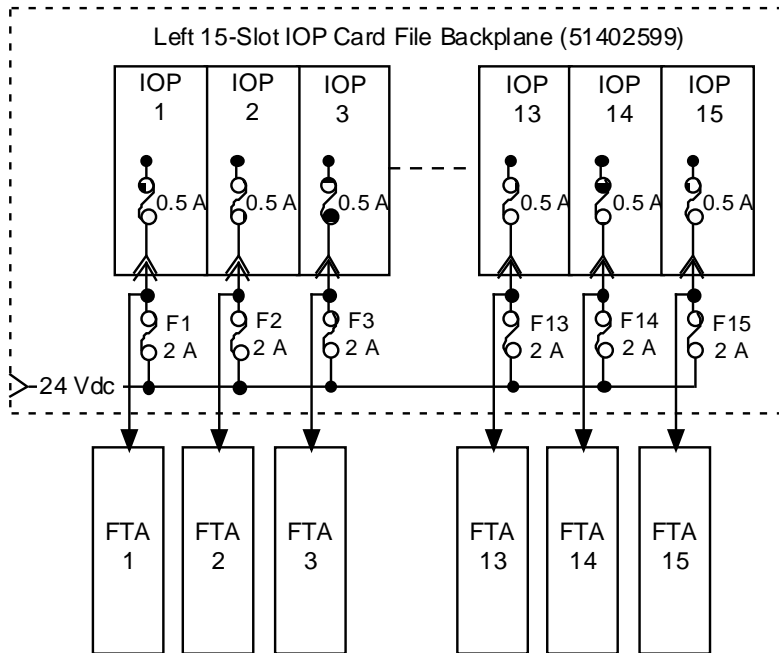
Notes:

A fast-action 2 A fuse that is located on the backplane protects each IOP/nongalvanically isolated FTA combination.

A fast-action 0.5 A fuse that is located on the IOP card protects the IOP card.

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15-Slot card file backpanel fuse locations

The following figure illustrates a portion of the locations of the individual fuses on the 15-Slot card file backpanel.

Figure 46 15-Slot Card File Backpanel Fuse Locations
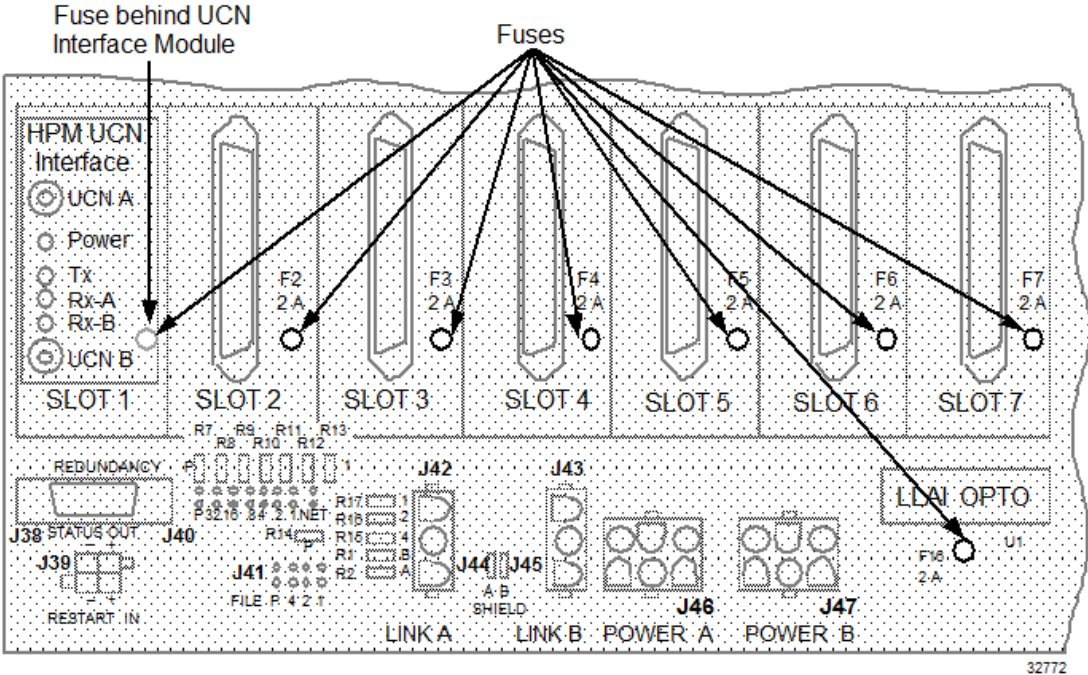
Figure 47 15-Slot Card File Backpanel Fuse Locations
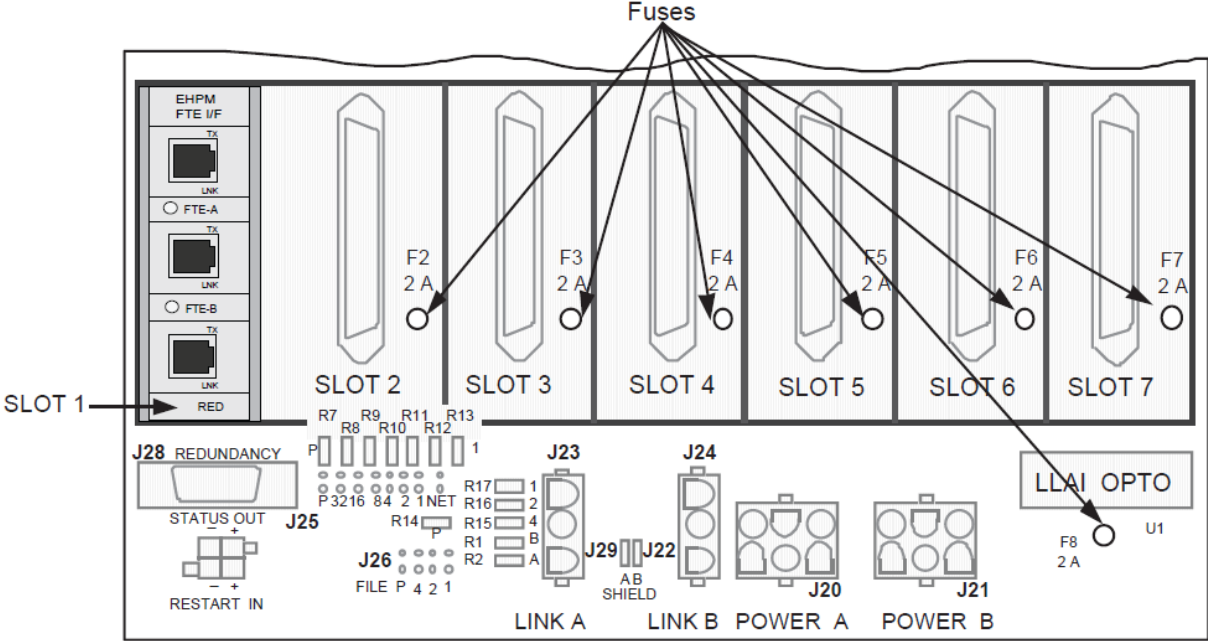
IOP Only card file

The "IOP Only" card file assembly that is used by the Process Manager and Advanced Process Manager can be used with the High-Performance Process Manager. When upgrading a PM or APM to HPM hardware, it is not necessary to also convert the IOP card file(s) to 15-Slot IOP card file(s).

IOP Only card file assemblies

An early version of the IOP Only card file did not offer card and FTA fuse protection at the backpanel. This backpanel can be identified by the assembly number 51401129, revision A. Later versions of the 51401129 backpanel have time-delay 3 A fuse protection for the IOP card and its associated standard FTA. They are identified by assembly 51401129, revision B, or later. Assembly 51401406 and 51402599 backpanels, all revisions, have fast-action 2 A fuse card and FTA protection. All card file backpanel assemblies provide a fast-action 0.5 A fuse for the LLAI optical coupler module on the backpanel, U1.

IOP Only Card File Fuse Protection

The following table lists the individual backpanel fuses and their application for the 15-Slot card file. The fuse rating is 2 A for fuse locations F1 through F15.

Table 8 IOP Only Card File Fuse Protection

Fuse	Rating	Protection Application
F1	2 A fast-action/3 A time-delay	Slot 1 IOP card and associated FTA
F2	2 A fast-action/3 A time-delay	Slot 2 IOP card and associated FTA
F3	2 A fast-action/3 A time-delay	Slot 3 IOP card and associated FTA
F4	2 A fast-action/3 A time-delay	Slot 4 IOP card and associated FTA
F5	2 A fast-action/3 A time-delay	Slot 5 IOP card and associated FTA
F6	2 A fast-action/3 A time-delay	Slot 6 IOP card and associated FTA
F7	2 A fast-action/3 A time-delay	Slot 7 IOP card and associated FTA
F8	2 A fast-action/3 A time-delay	Slot 8 IOP card and associated FTA
F9	2 A fast-action/3 A time-delay	Slot 9 IOP card and associated FTA
F10	2 A fast-action/3 A time-delay	Slot 10 IOP card and associated FTA
F11	2 A fast-action/3 A time-delay	Slot 11 IOP card and associated FTA
F12	2 A fast-action/3 A time-delay	Slot 12 IOP card and associated FTA
F13	2 A fast-action/3 A time-delay	Slot 13 IOP card and associated FTA
F14	2 A fast-action/3 A time-delay	Slot 14 IOP card and associated FTA
F15	2 A fast-action/3 A time-delay	Slot 15 IOP card and associated FTA
F16	0.5 A fast-action	LLAI Optical Coupler Module, U1

IOP Only card file 24 Vdc power distribution

The following figure illustrates the 24 Vdc power distribution on the IOP Only card file backpanel.

Figure 48 IOP Only Card File Backpanel 24 Vdc Power Distribution
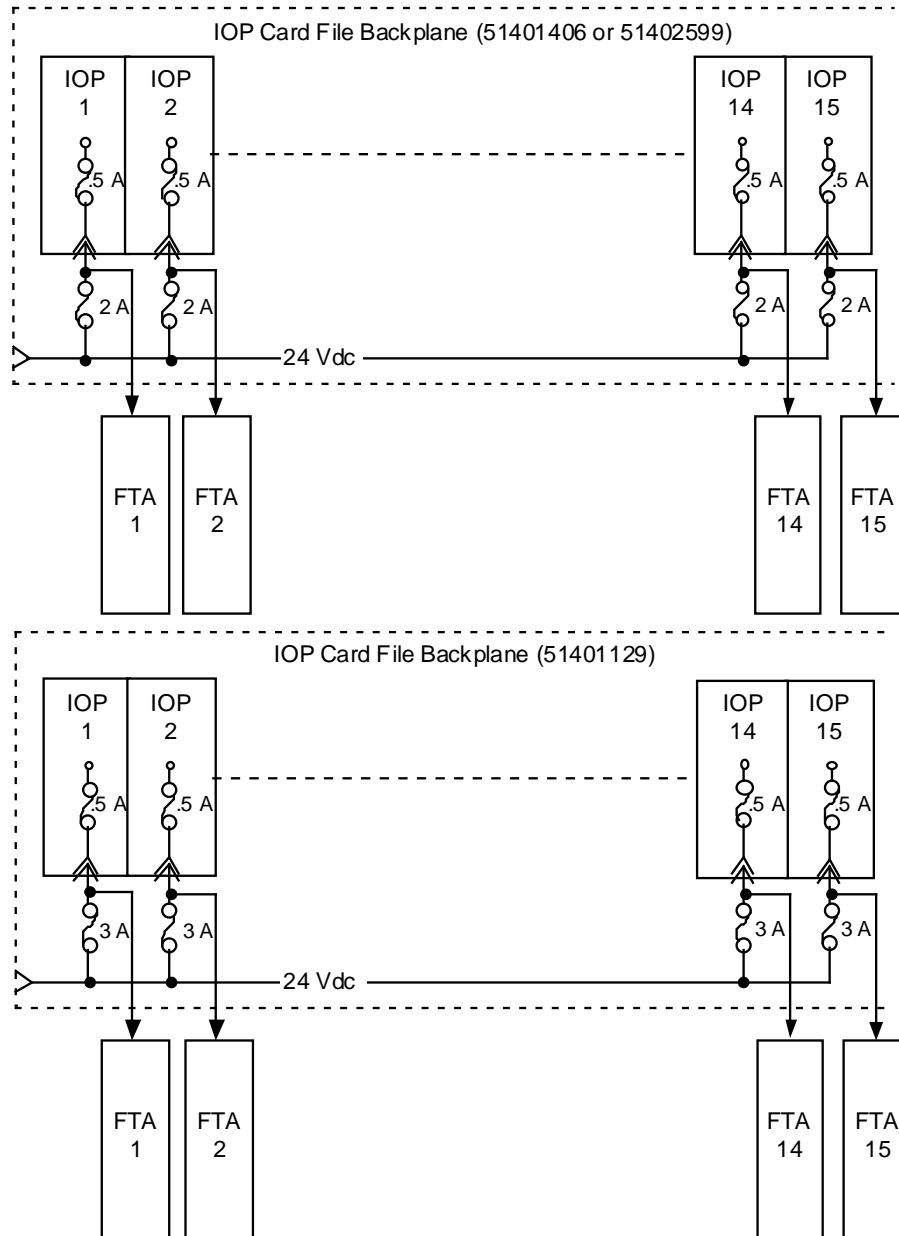
Notes:

A fast-action 2 A or time-delay 3 A fuse that is located on the backplane protects each IOP/nongalvanically isolated FTA combination.
A fast-action 0.5 A fuse that is located in the card protects each IOP card.

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IOP Only card file backpanel fuse locations

The following figure illustrates the locations of the individual fuses on the IOP Only card file backpanel.

Figure 49 IOP Only Card File Backpanel Fuse Locations

IOP Card File Backplane (51401129)

U1

F16   F15

F1   F2   F3   F4   F5   F6   F7   F14

SLOT 1   SLOT 2   SLOT 3   SLOT 4   SLOT 5   SLOT 6   SLOT 7   OT 14   SLOT 15

15 IOP BACKPLANE   ASSY NO

IOP Card File Backplane (51401406 or 51402599)

U1

F16
1/2 A

F1   F2   F3   F4   F5   F6   F7   F14   F15
2 A   2 A   2 A   2 A   2 A   2 A   2 A   2 A   2 A

SLOT 1   SLOT 2   SLOT 3   SLOT 4   SLOT 5   SLOT 6   SLOT 7   OT 14   SLOT 15

15 IOP BACKPLANE   ASSY NO

5068
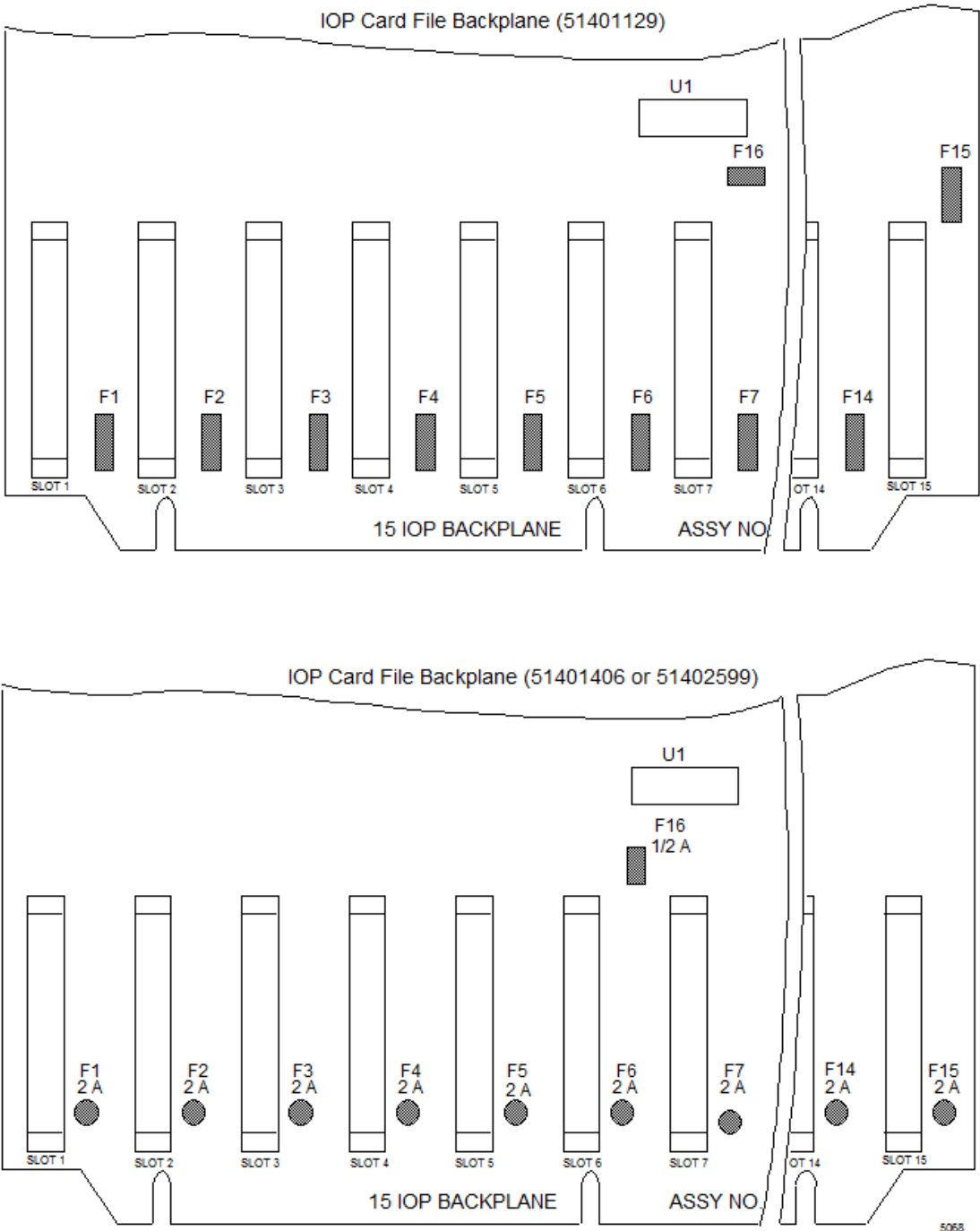
FTA fuse protection

Some individual FTAs may have fuse protection on the assembly. In general, output type FTAs are fused, but not exclusively. Fuse information for the individual FTAs can be found in the *Process Manager I/O Installation* manual.

Cabinet Fan assembly fuse protection

Each cabinet Fan Assembly is protected by fast-action 0.5 A fuse located on the Power System backpanel assembly. A High-Performance Process Manager cabinet can contain two individually fused Fan Assemblies. Both the early production Standard, HPM Standard, and AC Only Power System configurations provide fused circuits for four Fan assemblies. Refer to Figures Figure 27, Figure 28, and Figure 29 for the locations of the Fan Assembly fuses.

2.22 5 Vdc Fuse Protection

High-Performance I/O Link card

The High-Performance I/O Link card provides the 5 Vdc operating power for the High-Performance Comm/Control and the HPM UCN Interface module by converting the unfused 24 Vdc from the backpanel. The 5 Vdc power is protected at the input to the converter by a 3.2 A surface-mounted fuse on the High-Performance I/O Link card. The 5 Vdc converter output is used by the High-Performance I/O Link card itself and is also routed to the High-Performance Comm/Control card and the UCN Interface Module through the backpanel.

HPMM power routing and fuses

The HPMM components consist of the High-Performance Comm/Control card, High-Performance I/O Link card, and the HPM UCN Interface module. Figure 50 illustrates the power routing and fusing as it applies to the HPMM components.

Note the location of the of the two fuses involved

- 3.2 amp fuse on High-Performance I/O Link card (Located near the upper card lever)
- 2 amp fuse (F1) on the backpanel (Located on the backpanel, immediately to the right of the FTA cable connector for the leftmost slot in the card file).

Figure 50 HPMM Power Routing and Fuses
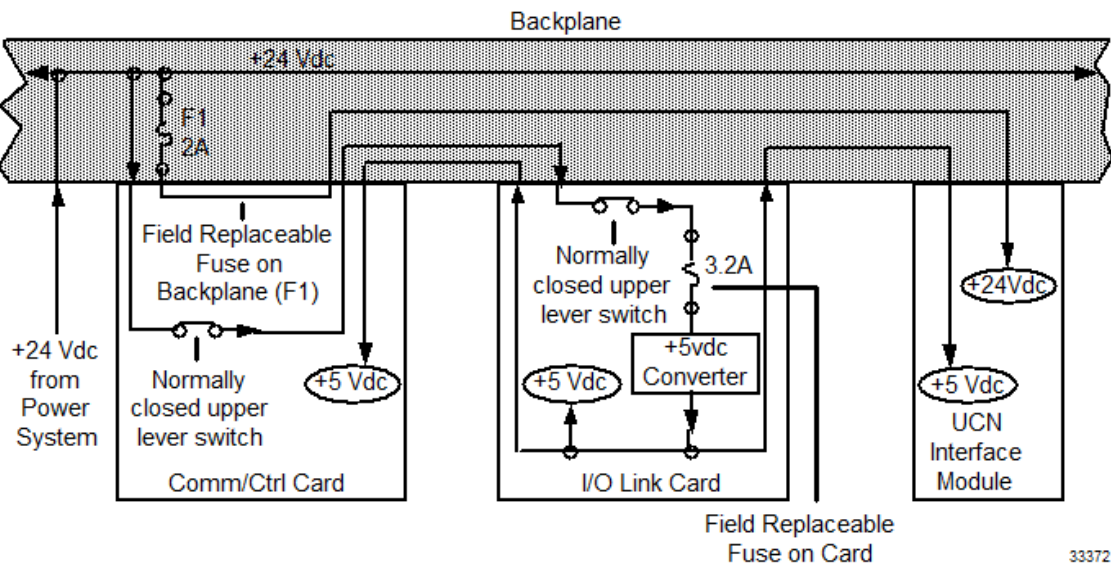
2.23 Card File Power Cabling

Card file power connectors

Each card file receives power (24 Vdc, 3.6 Vdc, and 6 Vac) from the Power System through dual cables that connect to the Power System which are listed in the following table.

Table 9 Card File Power Cabling

Card File Type	Dual Power Connectors
7-Slot	J20 and J21
15-Slot	J46 and J47
IOP Only	J33 and J37

Power Distribution assemblies

Digital Input Power Distribution assemblies and Galvanic Isolation Power Distribution assemblies require 24 Vdc power and require the same type of power cable as the card files.

Power System power connectors

The early production Standard Power System and the AC Only Power System have eight power connectors, labeled **Output 1** through **Output 8**. Connectors are not "assigned" to any particular card file or Power Distribution assembly. The connectors are located at the upper right side of the backpanel of the Standard Power System as shown in Figure 27. The AC Only Power System power connectors are located at the right side of its AC/DC Distribution assembly as shown in Figure 29.

The HPM Standard Power System has 12 power output connectors as shown in Figure 28.

Power distribution examples

Figure 46, Figure 48, Figure 49, and Figure 50 illustrate typical power cabling of various combinations of card files and Power Distribution assemblies using the Standard Power System. The AC Only Power System cabling would be similar.

Power distribution methods

The early production Standard Power System and the AC Only power system are limited to eight power output connectors. The eight connectors provide power for various combinations, depending upon power requirements of card files, Digital Input Power Distribution assemblies, and Galvanic Isolation Power Distribution assemblies. Redundant power cabling to each assembly is recommended. However, an exception must be made when three card files, a Digital Input Power Distribution assembly, and a Galvanic Isolation Power Distribution assembly are present in the cabinet, since only eight power output connectors are available. The power cables are then daisy-chained. See Figure 55.

The HPM Standard Power System provides 12 power output connectors which eliminates the need to daisy-chain power from one file to file.

15-Slot Card File with Power Distribution Assemblies

The following figure is an illustration of power cabling for a typical High-Performance Process Manager configuration of a single 15-Slot card file and Power Distribution assemblies.

Figure 51 15-Slot Card File with Power Distribution Assemblies
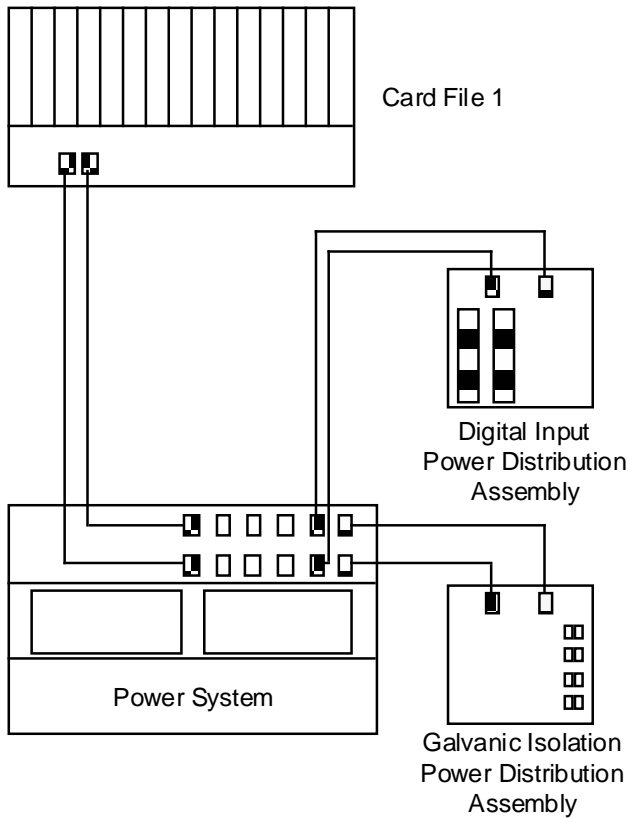
Two 15-Slot Card Files with Power Distribution Assemblies

The following figure is an illustration of power cabling for a typical High-Performance Process Manager configuration of two 15-Slot card files and two Power Distribution assemblies.

Figure 52 Two 15-Slot Card Files with Power Distribution Assemblies
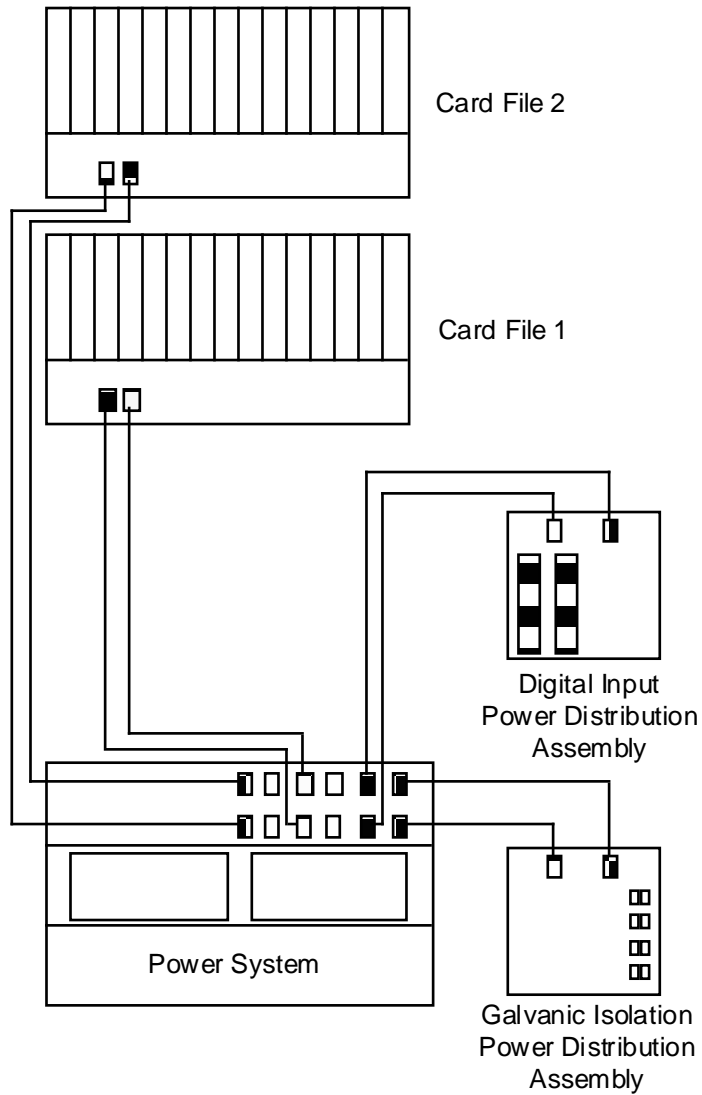
Three 15-Slot Card Files

The following figure is an illustration of power cabling for a typical High-Performance Process Manager configuration of three 15-Slot card files.

Figure 53 Three 15-Slot Card Files
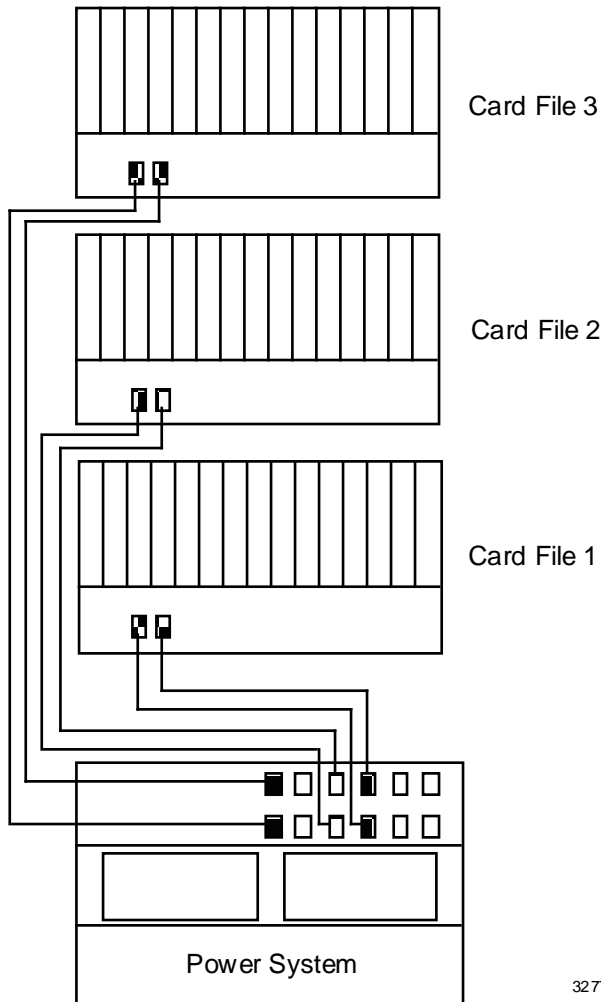
Three 15-Slot Card Files with Power Distribution Assemblies

The following figure is an illustration of power cabling for a typical High-Performance Process Manager configuration of three 15-Slot card files and two Power Distribution assemblies.

Figure 54 Three 15-Slot Card Files with Power Distribution Assemblies
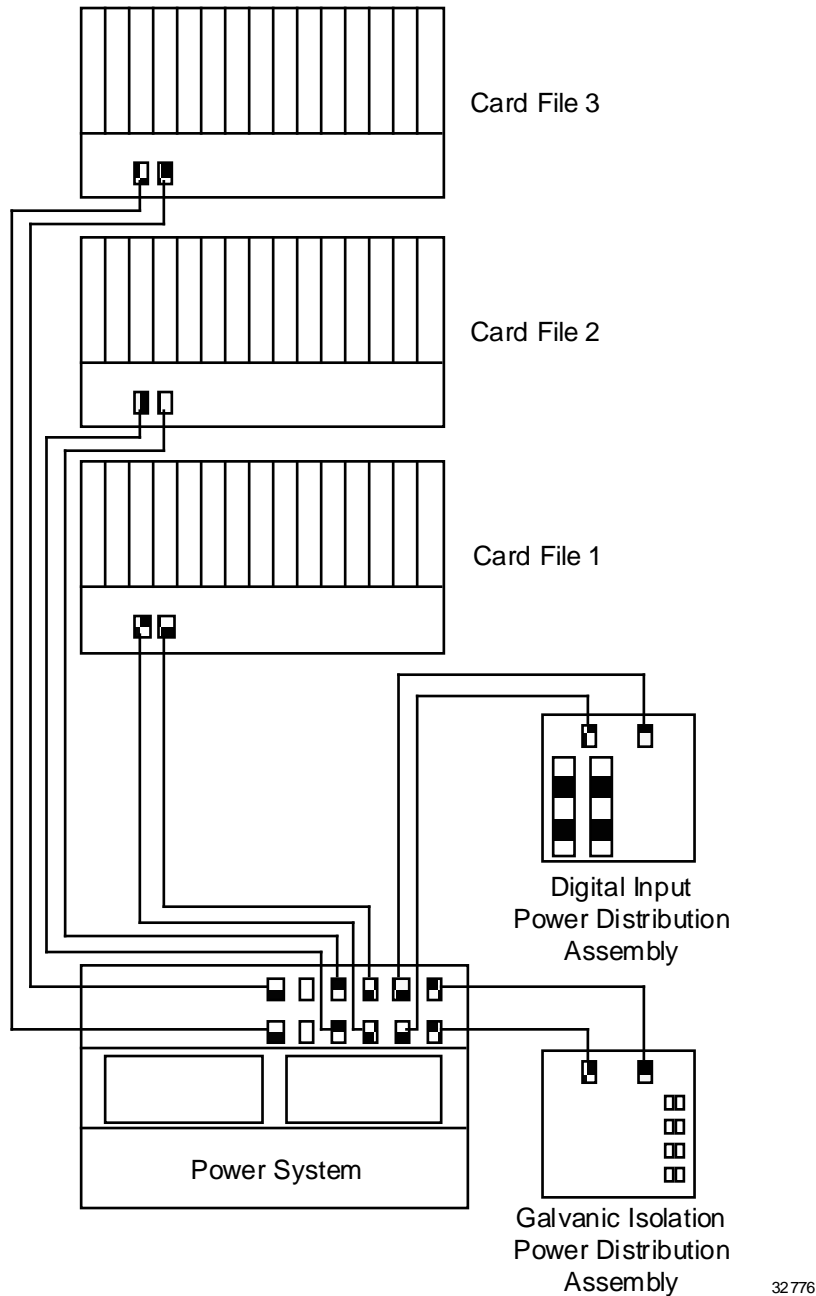
Power Distribution Assemblies for redundant cabling

Early production Standard Power Systems and AC Only Power Systems are limited to eight power output connectors. The following figure illustrates how power is distributed when the number of available connectors does not meet the total need for redundant cabling.

Figure 55 Power Distribution Assemblies for redundant cabling
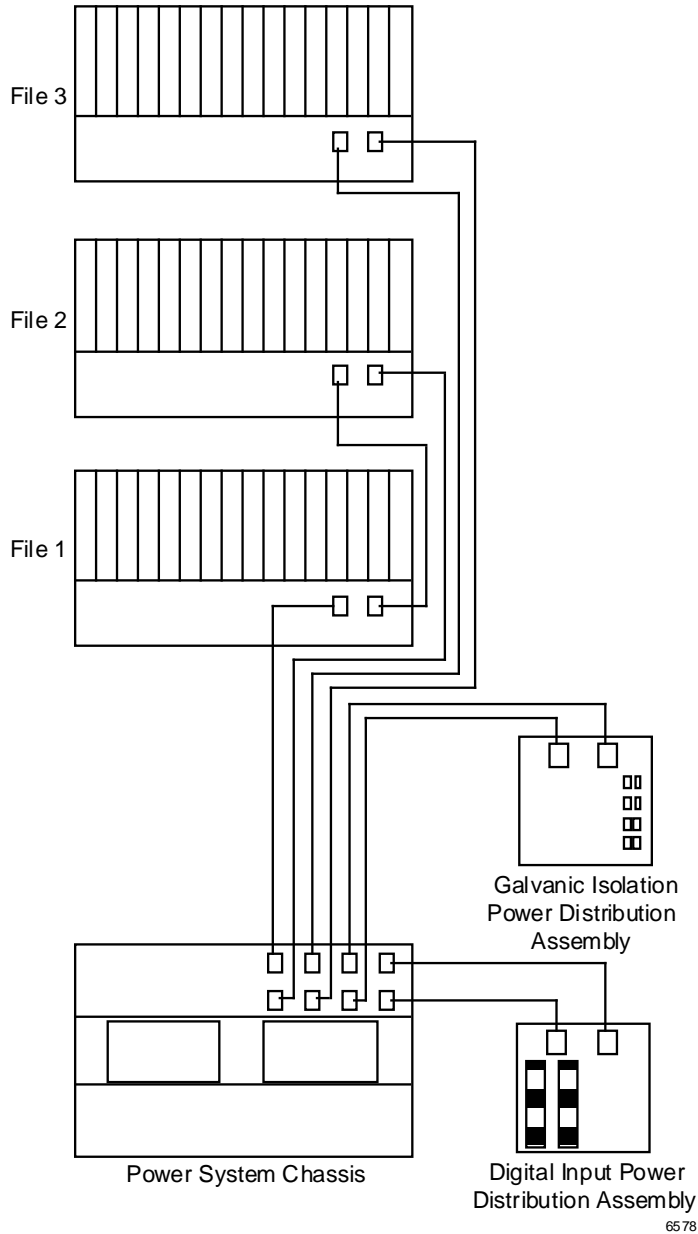
2.24 I/O Link Interface Cabling

Introduction

The I/O Link Interface is a dual serial communications link between the HPMM(s) and IOP card files. If there are more than two card files, the cables are daisy-chained. Figure 56 and Figure 57 illustrate typical I/O Link Interface cable installations. The following table identifies the I/O Link Interface connectors on the 7-Slot, 15-Slot, and IOP Only card file backpanels.

Table 10 I/O Link Interface Cabling Card File Connector Assignments

Card File Type	I/O Link A Connector	I/O Link B Connector
7-Slot	J23	J24
15-Slot	J42	J43
IOP Only	J32	J31

Cable length

I/O Link Interface cables are to be no longer than 10 m (33 feet) in total length and are not to leave the cabinet or cabinet complex.

Redundant cables

Two cables are required because the I/O Link Interface is redundant for reliability. One cable is designated Link A and the other Link B.

No cable termination

The I/O Link Interface cabling does not involve external terminators and therefore an empty I/O Link Interface connector on the backpanel is an acceptable situation.

CAUTION	The High-Performance Process Manager accommodates four types of card files. Use caution when connecting the I/O Link Interface cables because of the differences between the card files. All card files have two I/O Link Interface receptacles marked **LINKA** and **LINKB**.

I/O Link Interface cabling - Three Card Files

The following figure is an illustration of the I/O Link Interface cabling for an High-Performance Process Manager configuration that consists of two 7-Slot HPMM card files and one 15-Slot IOP card file.

Figure 56 Three Card Files
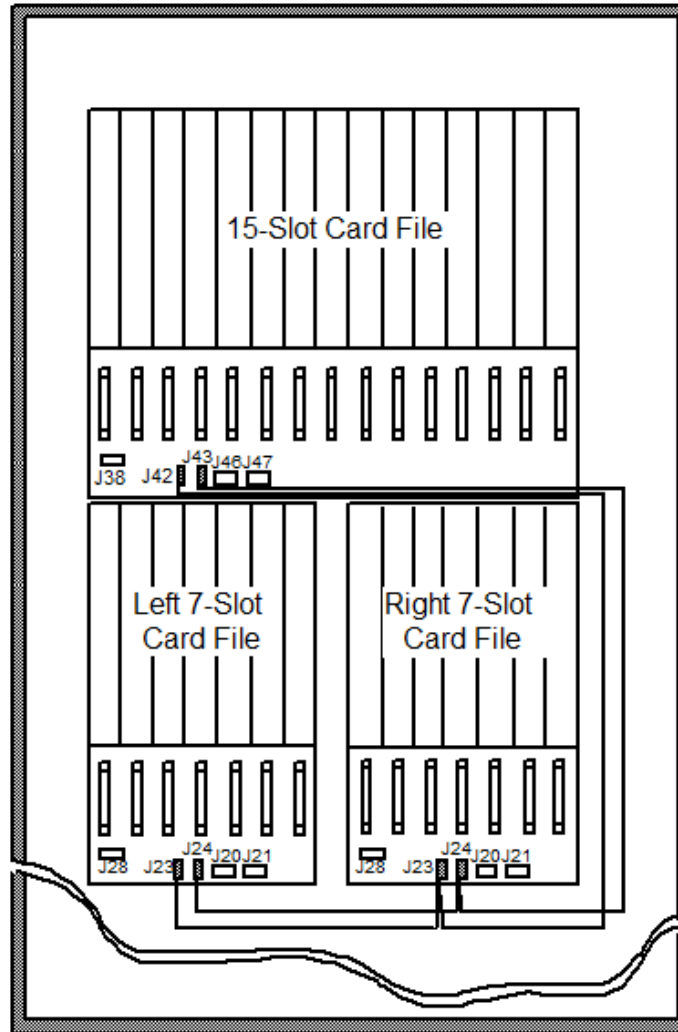
I/O Link Interface - Four Card Files

The following figure is an illustration of the I/O Link Interface cabling for an High-Performance Process Manager configuration that consists of two 7-Slot HPMM card files and two 15-Slot IOP card files.

Figure 57 Four Card Files
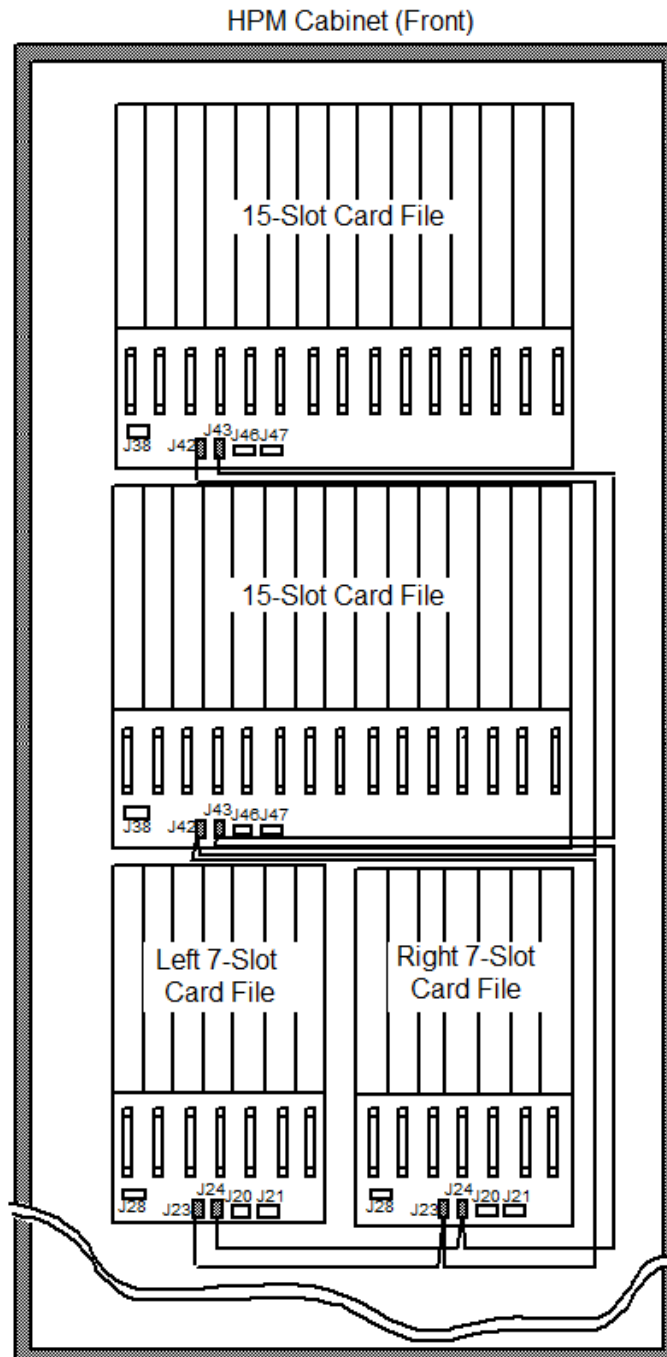
I/O Link Interface Cables in adjacent cabinets

The I/O Link Interface cable daisy chain can be extended to include additional intermediate drops. Longer daisy chain runs from card file to card file in one cabinet can also include card files in an adjacent cabinet. I/O Link Interface cables with the appropriate number of drops must be ordered to satisfy your HPM subsystem configuration (number of card files).

I/O Link Interface cable shield grounding (non-CE Compliance)

Only one point along the I/O Link Interface cable daisy chain should provide ground to the cable chain shield. This is normally done on the backpanel of the first HPMM card file (file position 1) in the first HPM cabinet (with jumpers on the backpanel).

On a 7-Slot card file, J29 and J22 are located between the I/O Link Interface cable connectors. Both the A and B I/O Link Interface cables have their own jumper for grounding the cable shield. J29 is for the A cable shield and J22 is for the B cable shield. The cable shield is grounded if the jumper is bridged across both pins.

On the 15-Slot card file, J44 and J45 are located between the I/O Link Interface cable connectors and accomplish the same function.

The above I/O Link Interface cable shield grounding must be carefully adhered to when installing or upgrading a High-Performance Process Manager subsystem. Failure to follow the above guidelines can result in unwanted ground loops and abnormal system sensitivity to RFI and ESD influence from the surrounding environment.

I/O Link Interface cable shield grounding (CE Compliance)

CE Compliance requires that the I/O Link Interface cable shield be grounded to the card file chassis (Safety Ground) at each connector. This is accomplished with shield wire that attaches to a FASTON terminal on the card file's backpanel ground plate. Only cables with a part number of 51204042-xxx can be used. See the *High-Performance Process Manager Installation* manual for additional information.

Induced power surge protection

An induced power surge of 10 amperes or greater can originate through an FTA's field connections as a result of a lighting strike and elevate the card file(s) above the common mode range of the HPM's I/O Link Interface transceivers and cause transceiver failure.

To prevent this occurrence, a power cable was developed with a surge protection network that filters the power surge on the I/O Link Interface to the power cable's ground before the I/O Link Interface connects to the card file.It illustrates a pair of surge protection network power cables, cable A and cable B.

The I/O Link Interface connects to the surge protection network that is an integral part of the power cable, passes through the filter, and then connects to the card file. The method of implementing the surge protection is illustrated in the following figures.

New and upgraded subsystems only

The surge protection network power cable is presently used in new production and newly upgraded hardware only. However, older hardware can and should be upgraded by the use of a set of power cable I/O Link protector adapters, Honeywell part number 51204127-100. Figure 58 Surge Protection Network Power Cables illustrates a set of the cables, cable A and cable B.

The power cable I/O Link protector adapters are installed between the model MU-KDPRxx (51201397-xxx) power cables and the I/O Link Interface cables and their present connections to the card file. The result is a similar method of implementing the surge protection network that is illustrated in Figure 59 I/O Link Interface Cable Connection to Power Cable.

Surge protection network power cables

The following figure is an illustration of a pair of surge protection network power cables, cable A and cable B.

Figure 58 Surge Protection Network Power Cables
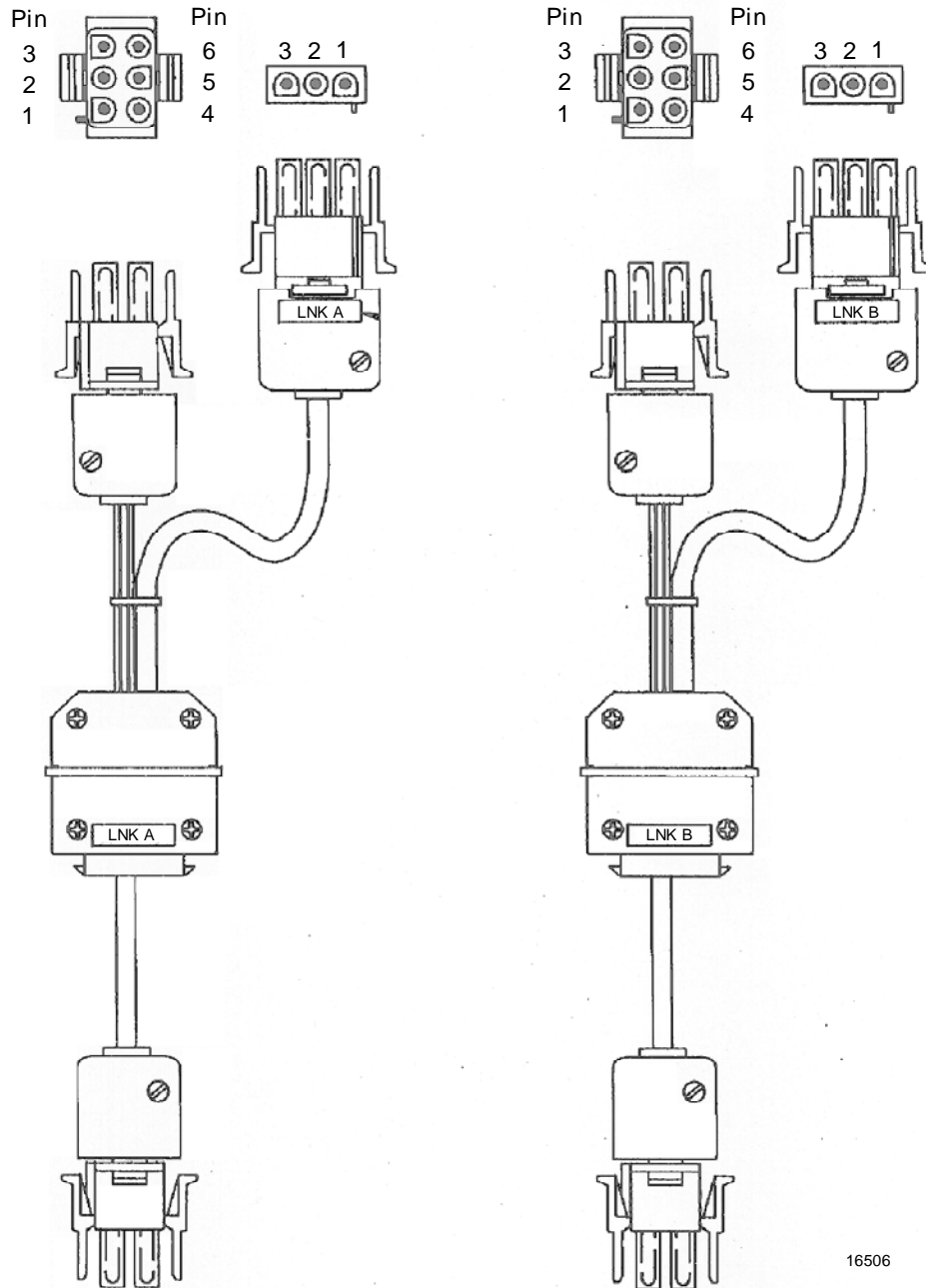
I/O Link cable connection

The following figure illustrates the I/O Link cable connection to the power cable's surge protection network connector.

Figure 59 I/O Link Interface Cable Connection to Power Cable

Backpanel Connections
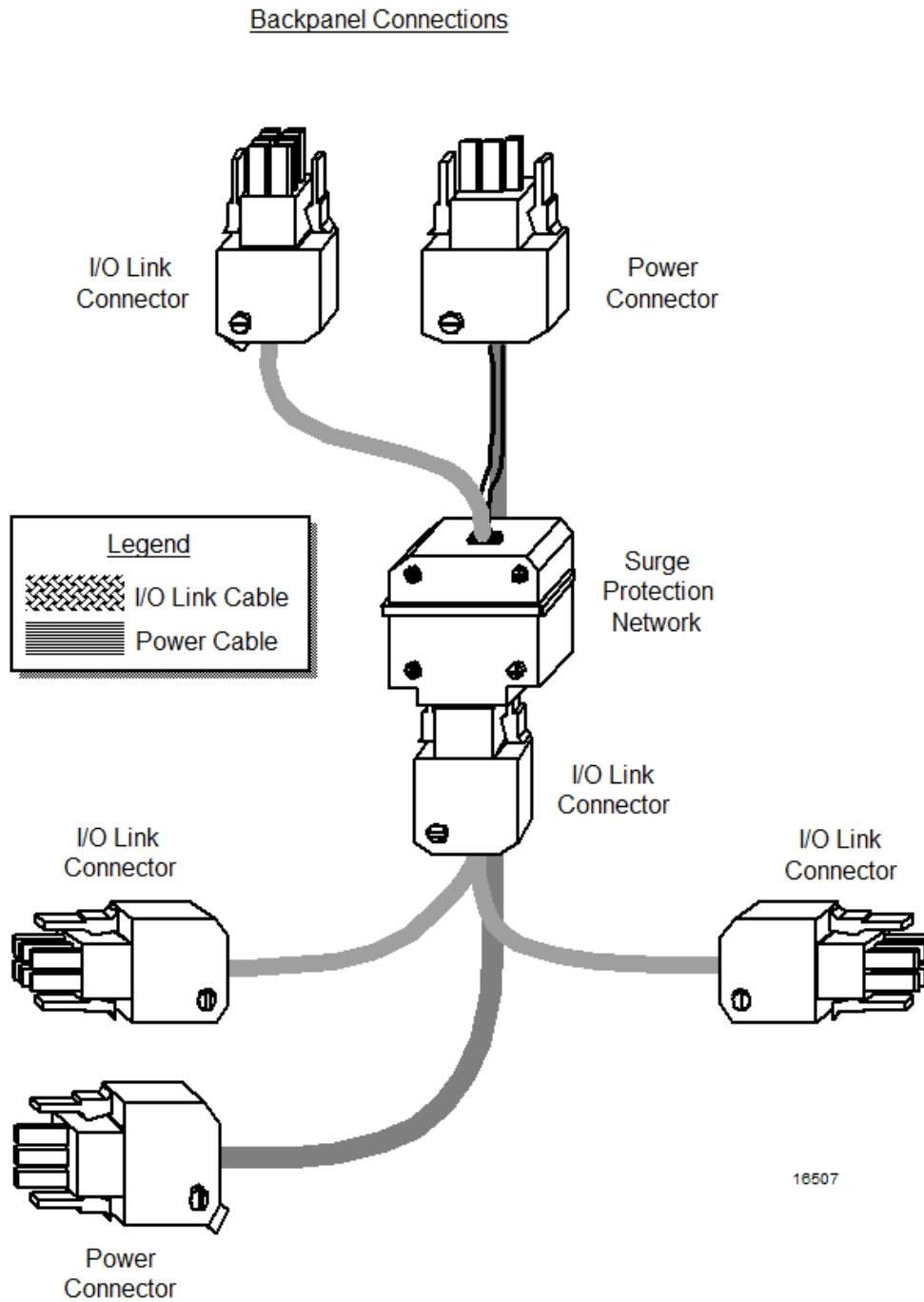
Typical I/O Link and power cable connection

> The following figure illustrates typical surge protection network power cable and I/O Link Interface cable connections to the Power System and card files in a cabinet.

Figure 60 Typical Cabinet Surge Protection Network Cable Connections

Link A Link B Pwr Pwr

I/O Link A
Cable

I/O Link B
Cable

Link A Link B Pwr Pwr

51204126-XXX
Cable Set

51204126-XXX
Cable Set

Power System
Backpanel

Power Supply
Module

Power Supply
Module

16508
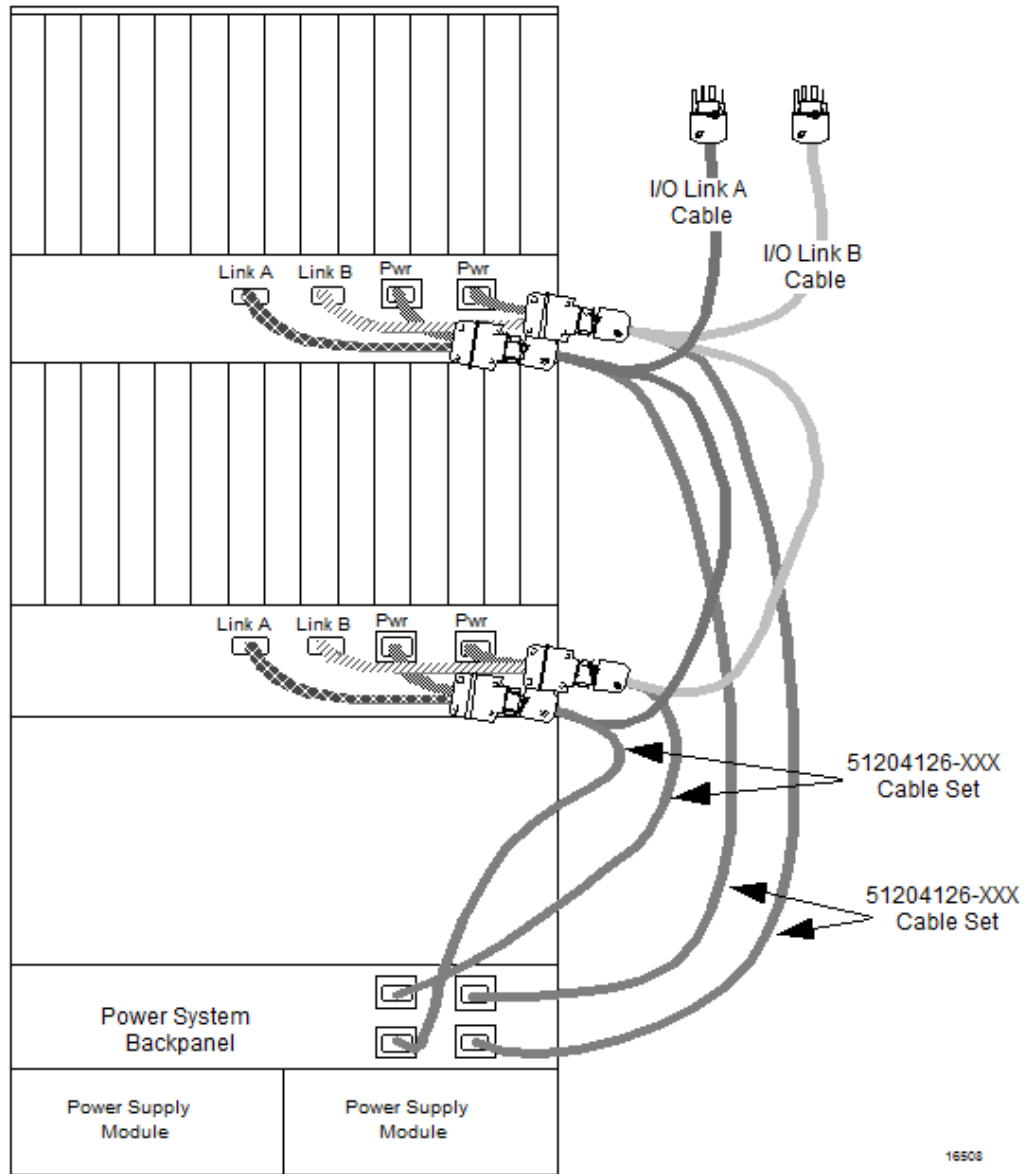
Power cable I/O Link protector adapters

The following figure is an illustration of a pair of power cable I/O Link protector adapters, cable A and cable B.

Figure 61 Power Cable I/O Link Protector Adapters
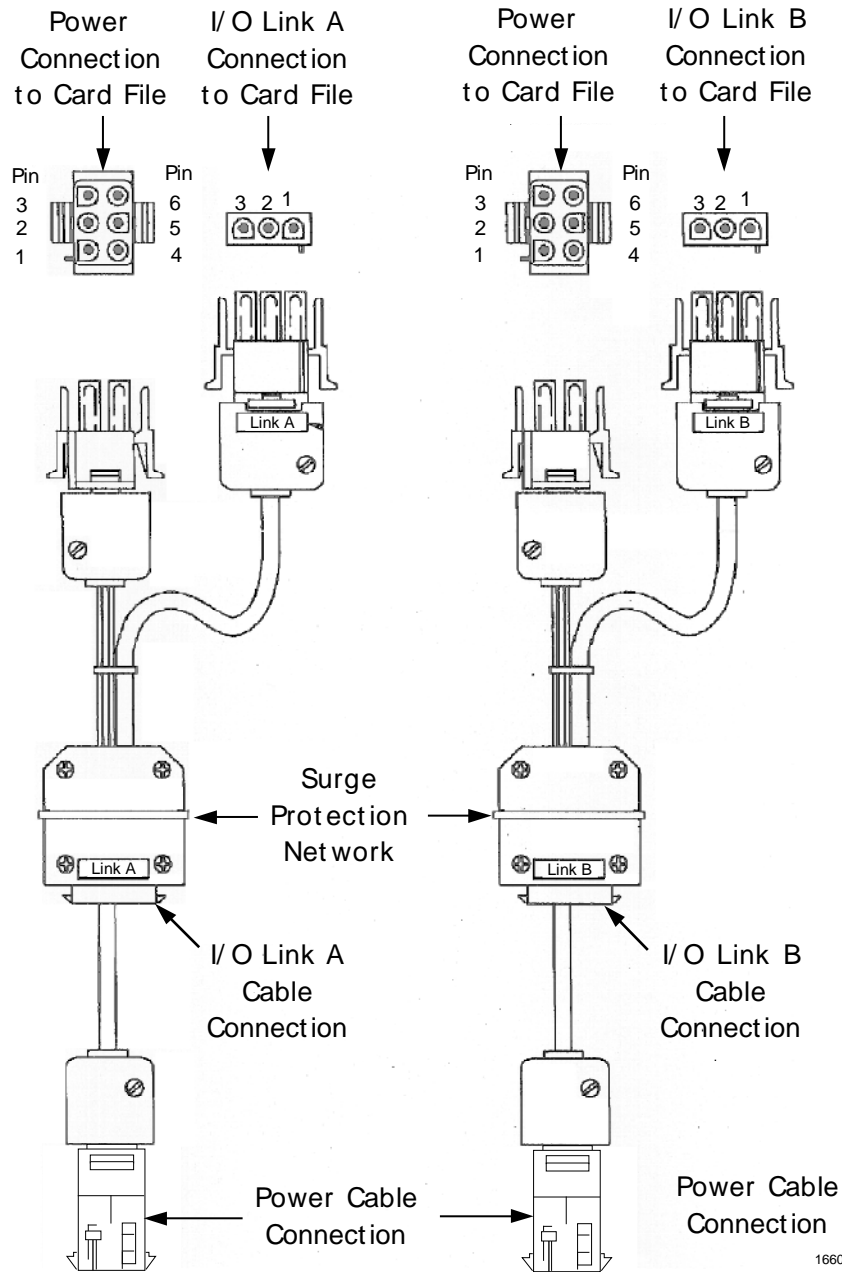
2.25 IOP to FTA Cabling

Introduction

Each IOP has a cable that connects it to its associated FTA.

Standard FTAs

The cables for standard FTAs leave the FTAs at the top or center, travel up or down the right side of the vertical FTA Mounting Channel, go over or under the center divider, and then connect to the associated IOP card file connector on the 7-Slot or 15-Slot card file backpanel.

Galvanically Isolated FTAs

When mounted on a horizontal FTA Mounting Channel, the cables for Galvanically Isolated FTAs leave the top side of the FTAs, travel up or down the left side of the horizontal FTA Mounting Channel, go over or under the center divider, and then connect to the associated IOP connector on the 7-Slot or 15-Slot card file backpanel.

Galvanically Isolated FTAs can also be mounted on vertical FTA Mounting Channels. When they are, the reverse of the cabling rules that apply for the standard FTAs apply for Galvanically Isolated FTAs because the vertical orientation of the FTA Mounting Channel is reversed.

External cabinet installation

The FTAs can also be installed on a panel that is external to the cabinet, up to 50 meters (164 feet) cable length from the IOP. Shielded FTA cables must be used whenever the FTA is located outside of the HPMM cabinet complex. See the *High-Performance Process Manager Installation* manual for additional information.

Typical cable routing

The following figure for an illustration of typical cable routing for a standard FTA in a cabinet or cabinet complex.

Figure 62 IOP to FTA Cabinet Cabling
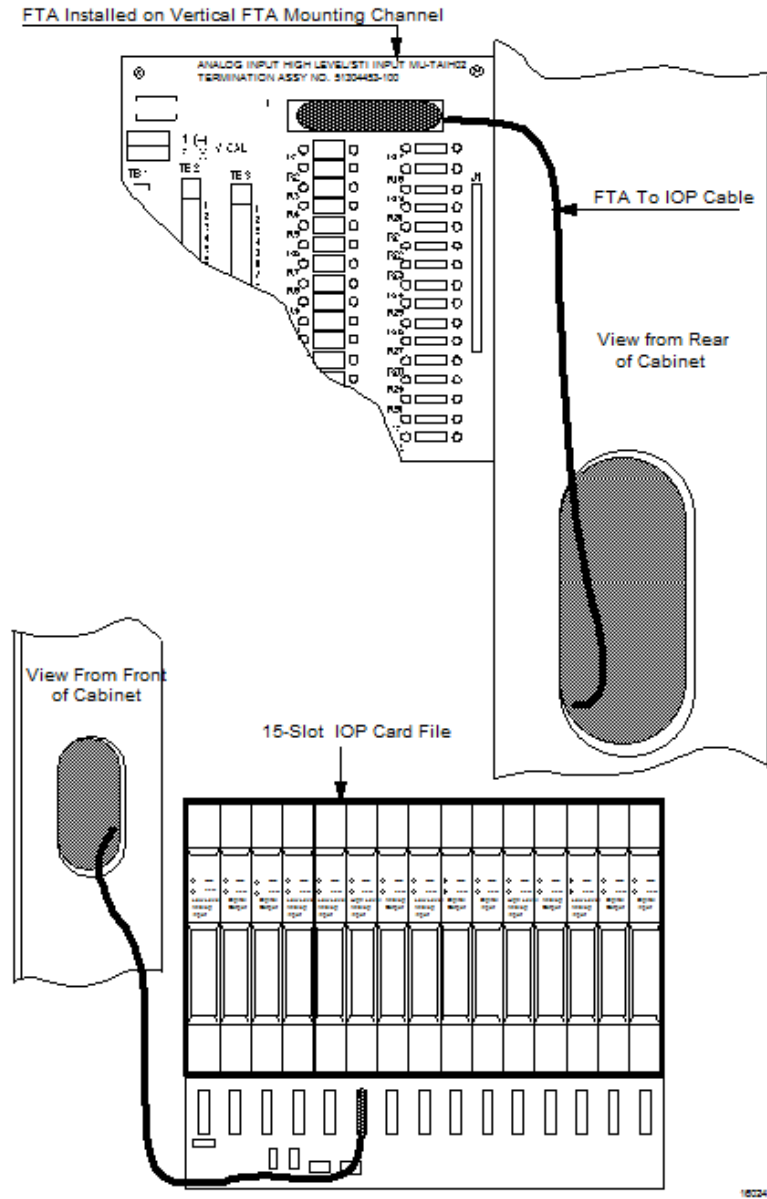
2.26 Power Adapter Cabling

Introduction

Using a standard FTA cable, the model MU-TLPA02 Power Adapter can be located up to 50 meters (164 feet) distance from the card file containing the associated IOP card. The Power Adapter connects to one or two FTAs that can be installed at a remote location up to 305 meters (1000 feet) from the Power Adapter. Figure 63, Figure 64, and Figure 65 illustrate its application with the Low Level Multiplexer, Serial Device Interface, and Serial Interface IOPs respectively.

LLMux interconnections

The following figure illustrates the Power Adapter interconnections for a Low Level Multiplexer application.

Figure 63 Power Adapter Interconnections – LLMux Application
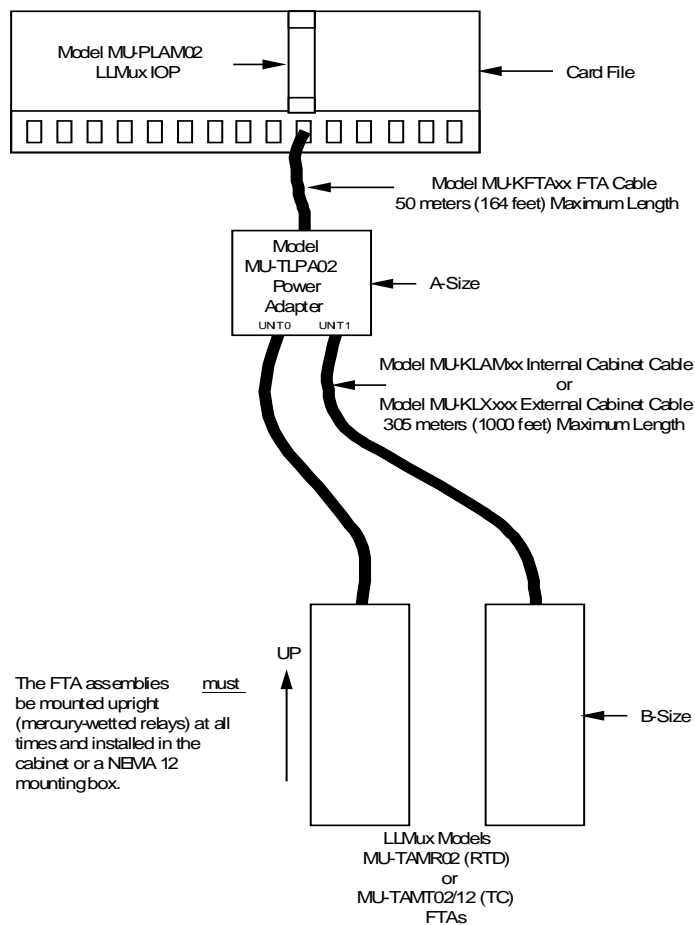
SDI interconnections

The following figure illustrates the Power Adapter interconnections for a Serial Device Interface application.

Figure 64 Power Adapter Interconnections – SDI Application
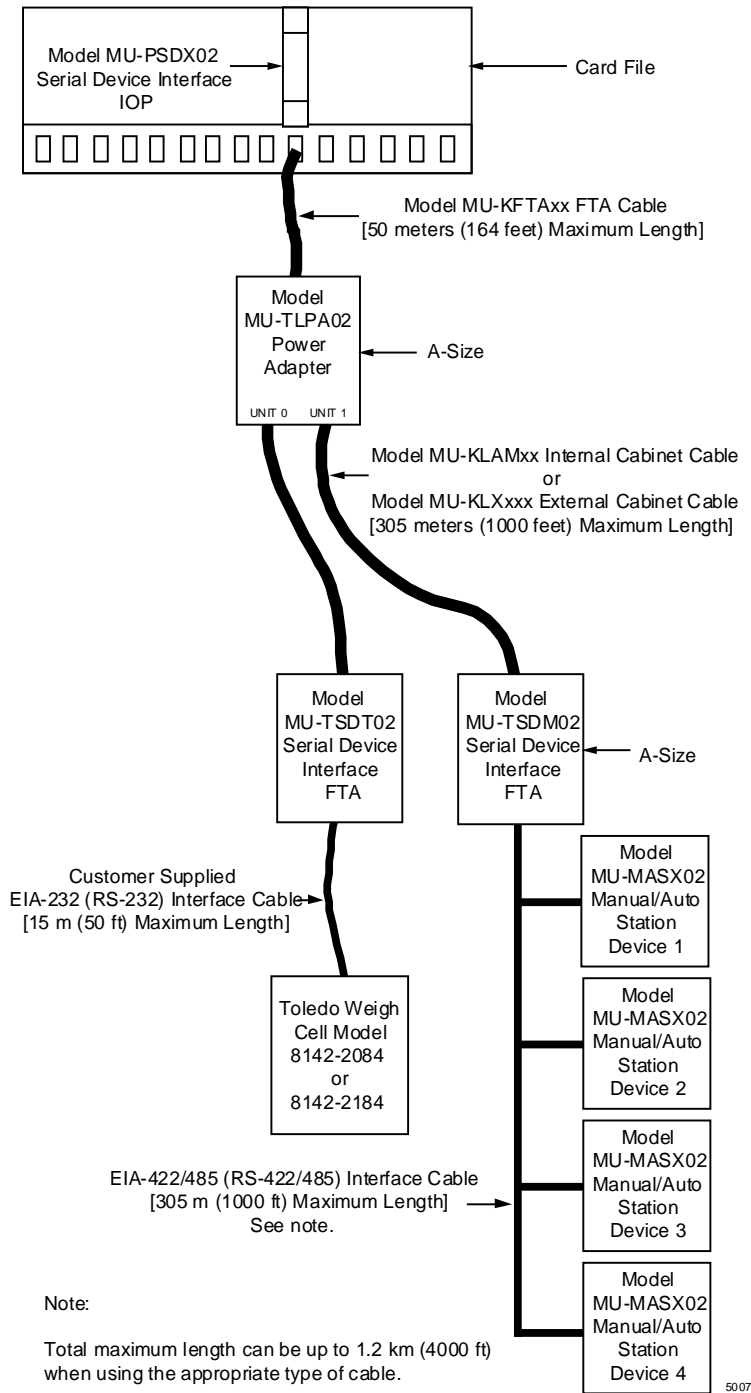
SI interconnections

The following figure illustrates the Power Adapter interconnections for a Serial Interface application.

Figure 65 Power Adapter Interconnections – SI Application
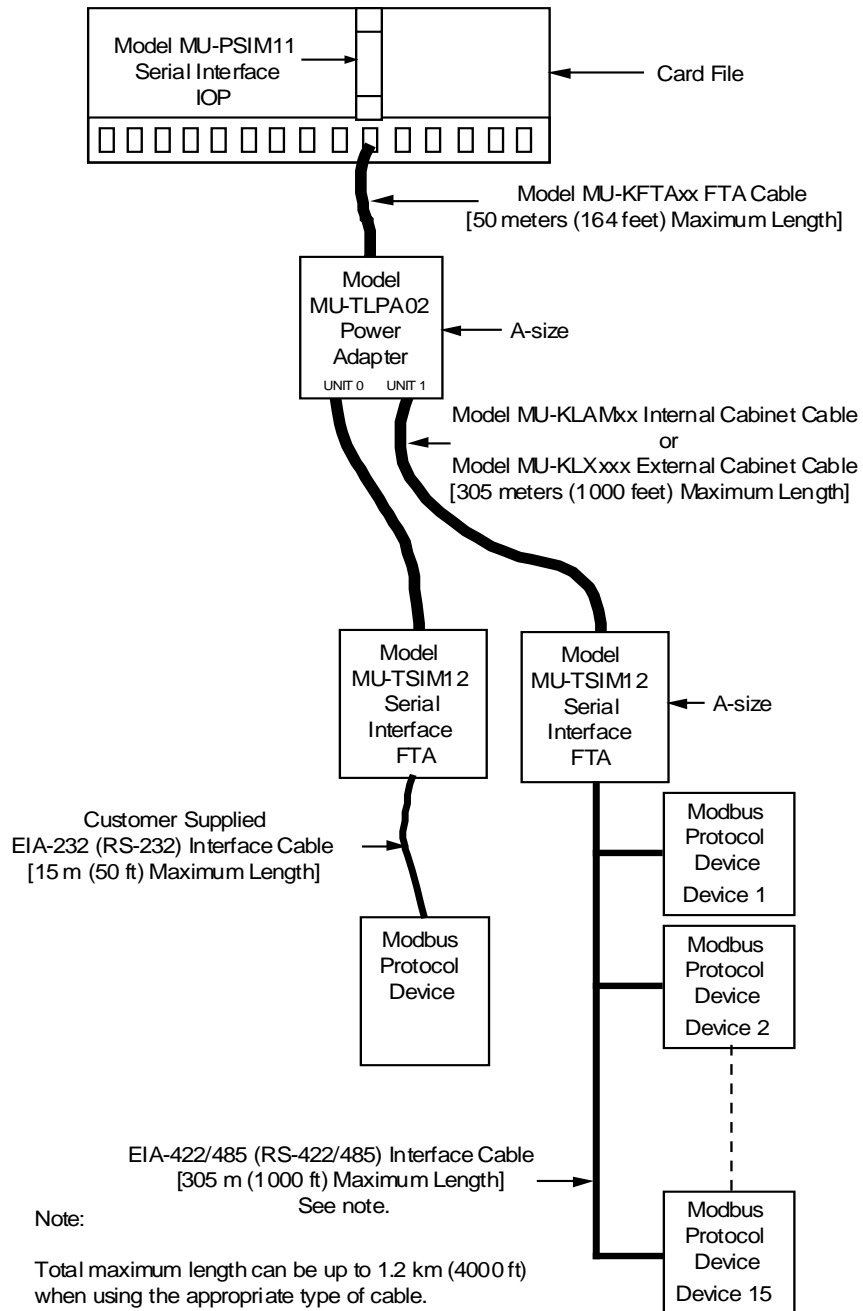
2.27 UCN Cable System

Introduction

The Universal Control Network (UCN) provides communication between High-Performance Process Manager Modules (HPMMs) and the Network Interface Module (NIM) on the LCN as illustrated in the following figure. Use of the two-drop UCN cable tap is illustrated.

Figure 66 Universal Control Network (UCN) Components

The figure shows the UCN Cable System with the following labeled elements:

- LCN "A" Coaxial Cable
- LCN "B" Coaxial Cable
- LCN System — Install per the procedure found in the LCN Planning manual.
- Universal Station
- Network Interface Module
- Network Interface Module
- History Module
- Redundant Pair
- 75 ž Terminator
- UCN Drop Cables (50 meters (164 feet) maximum length)
- UCN Trunk Cables *
- "A"
- "B"
- HPM — HPMM HPMM
- * Each trunk cable (segment) length is restricted to multiples of a basic length (2.6 meters (8.53 feet) for the standard RG-11 type UCN Trunk).
- Ground Stud
- Dot designates the isolated trunk port
- Optional Armored Trunk
- HPM — HPMM
- Note that redundant devices on the same UCN should use the same taps.
- HPM — HPMM
- HPM — HPMM
- 75 ž Terminator
- 75 ž Terminators in All Unused Taps
- 32758

Redundant UCN cables

Communication is accomplished on a redundant cable system consisting of Cable A and Cable B. Trunk cables are interconnected by taps that allow connection of drop cables from both the Cable A and Cable B. Redundant HPMMs should have their A cables connected to the same A tap, and their B cables connected to the same B tap.

Cable tap types

The cable taps used on the UCN are available in 2-drop, 4-drop, and 8-drop models as illustrated in the following figure.

Figure 67 UCN Taps
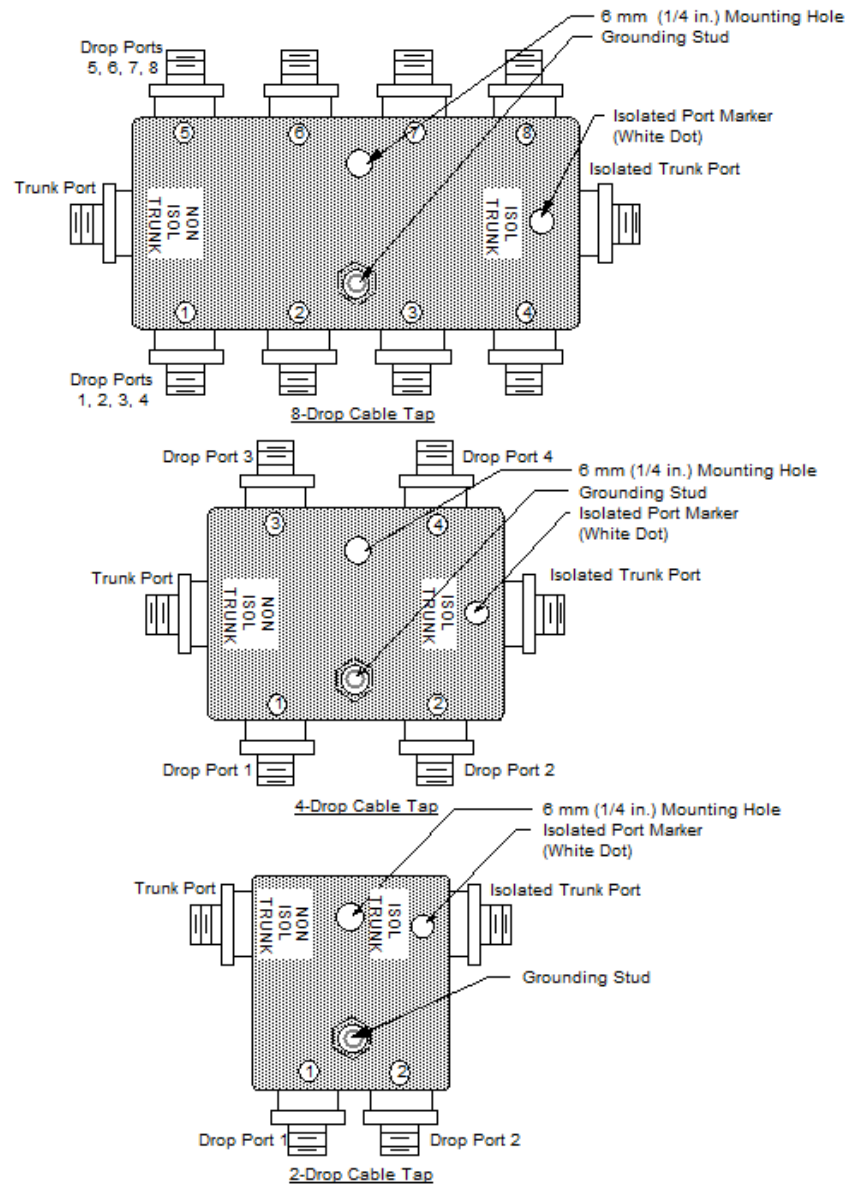
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Cable tap usage

Two-drop cable taps are used for connecting the UCN to a redundant or nonredundant High-Performance Process Manager at a location. Four-drop cable taps are used when there are two redundant High-Performance Process Managers (four HPMMs), or multiple nonredundant HPMs at a location. The eight-drop cable tap supports up to four redundant (eight HPMMs) or eight nonredundant High-Performance Process Managers at a location.

Isolated port identification

Each tap has an indicator dot located near the isolated port connector.

CAUTION	Cables between taps must be connected so that each cable segment connects the isolated port of one tap to the nonisolated port on the next tap

Card file backpanel connections

The following figure illustrates the A and B UCN drop cable connections to the HPM UCN Interface module in a 7-Slot HPMM card file.

Figure 68 UCN Drop Cable Connections to a 7-Slot HPMM Card File
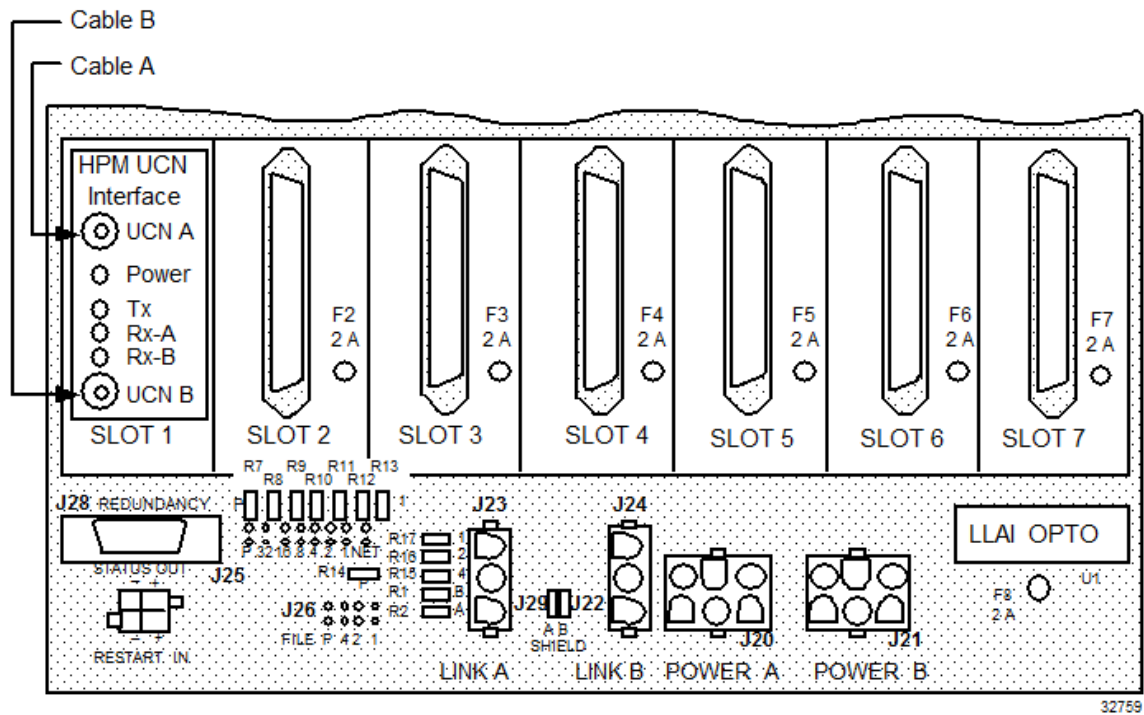
2.28 EUCN Cable System

Introduction

The Enhanced Universal Control Network (EUCN) provides communication between the Enhanced High-Performance Process Manager Modules (EHPMs) and the Enhanced Network Interface Module (ENIM) on the LCN as illustrated in the following figure.

ATTENTION

With TPN R686, the Enhanced Network Bridge (ENB) is introduced. The ENB is a variant of the NIM that allows communication between the LCN and both UCN and EUCN networks. It can communicate over coaxial-based UCN and FTE-based EUCN communication networks and provides a gateway function between the UCN and the EUCN. The ENB also facilitates on-process migration from HPM to EHPM (assuming you have redundant HPMs). For more information, see section "Cable troubleshooting guidelines for EUCN" on page 155.

Figure 69 Enhanced Universal Control Network (EUCN) Components
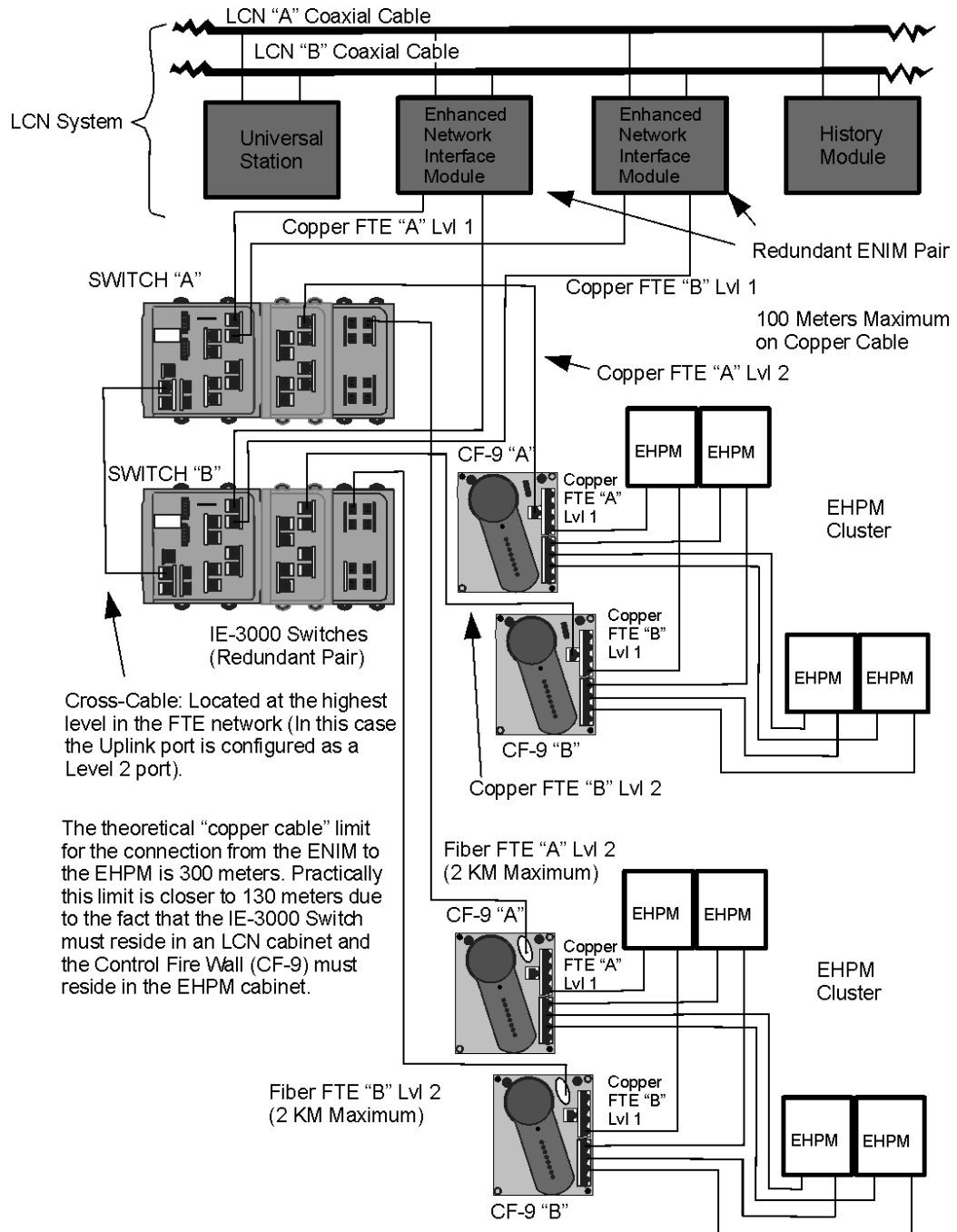
Redundant EUCN FTE cables

Communication is accomplished on a redundant cable system consisting of FTE Cable A and FTE Cable B. Fiber cables are interconnected by switches that are redundant allowing the connection of patch cables from both the FTE Cable A and FTE Cable B. Redundant EHPMs should have their FTE A cables connected to the same FTE A switch module, and their FTE B cables connected to the same FTE B switch module.

$FTESTS Cable Error Scenarios

The following sections show how the the FTE cable faults are reported on the $FTESTS displays:

> **ATTENTION**
>
> The term "$FTESTS displays" include both $FTESTS1 and $FTESTS2 displays.
>
> - $FTESTS1 display shows the FTE status of the UCN nodes assigned to the selected ENIM, and is filtered by the UCN Node Number, which has a range of 01-64.
>
> - $FTESTS2 display shows the status of all the FTE devices in the FTE community and is filtered by the FTE Device Index, which has a range of 01-509.

Table 11 EHPM Cable Faults

Error scenario	$FTESTS2 displays (this EHPM)	$FTESTS2 displays (all other EUCN nodes)
No FTE cable problems		
If FTE cable A on an EHPM node has a problem		
If FTE cable B on an EHPM node has a problem		
If both FTE cable A and FTE cable B on an EHPM node have a problem		

Table 12 ENIM Cable Faults

Error scenario	$FTESTS2 displays (this ENIM)	$FTESTS2 displays (all other EUCN nodes)
If FTE cable A on an ENIM has a problem		
If FTE cable B on an ENIM has a problem		
If both FTE cable A and	Single ENIM:	

FTE cable B on an ENIM have a problem		
	Redundant ENIM:	

ATTENTION

A disjoined node (for example, a double FTE cable fault) will still be shown in the "FAIL" (meaning X X X X) state on the $FTESTS2 schematic, but will no longer contribute to the overall composite FTE community status.

Note: The RESET STATS target can still be used to remove the indication of disjoined nodes.

LCN system alarm can also be caused by a switch uplink failure (for example, CF9), check your upper-level network topology to confirm this.

Table 13 Crossover Cable Faults

Error scenario	$FTESTS2 displays (all EUCN nodes)
If the top level cross cable connecting the Yellow and Green switches are correctly functioning.	
If the top level cross cable connecting the Yellow and Green Switches is removed or has a problem.	

Table 14 EUCN Crossed Cable Faults

Error scenario	$FTESTS2 displays (this EHPM)	$FTESTS2 displays (all other EUCN nodes)
If the FTE cable A and FTE cable B cables on an EHPM are switched - FTE A (yellow) to the Green Switch and FTE B (green) to the Yellow switch		
If the FTE cable A is removed or has a problem on an EHPM with the crossed cables connected		
If the FTE cable B is removed or has a problem on an EHPM with the crossed cables connected		
Top Level Cross cable between the Yellow and Green Switches is disconnected		
If the FTE cable A and B on an EHPM are connected to the correct switch.		

Cable troubleshooting guidelines for EUCN

This section shows how the UCN cable faults and FTE cable faults are reported on the UCN Status Display and $FTESTS displays for EHPM/ENIM/ENB.

Troubleshooting a EUCN or hybrid (UCN/EUCN) cable error begins with the UCN Status Display. Beginning with TPN R686, a new FTE CABLE STATUS field has been added for both ENIM and ENB nodes (this field is not available for NIMs). The UCN CABLE STATUS reflects all cable related failures including both UCN and FTE cable faults. This composite UCN and FTE status is required to generate cable related system events, and alert users with an alarm via the existing system alarm mechanism.

For an ENB, if only the UCN CABLE STATUS is in the FAIL state, then it is an UCN coaxial cable fault. Also, a disjoined node (for example, a double FTE cable fault) will still be shown in the "FAIL" (meaning X X X X) state on the $FTESTS2 schematic but will no longer contribute to the overall composite FTE community status. In case of a disjoined node (for example, a double FTE cable fault), the EUCN node would transition to the OFFNET state on the UCN Status Display. For both ENIM and ENB, if there are UCN cable faults and FTE cable faults, then first eliminate FTE cable faults.

Select the UCN CABLE STATUS line's value to invoke the $FTESTS1 display (filtered by the UCN Node Number) and FTE CABLE STATUS line's value to invoke the $FTESTS2 display (which is indexed by the FTE Device Index).

Reminder: In the case of an UCN Cable Fault, the HM Journal indicates "SILENCEA" (or SILENCEB). The SILENCEA or SILENCEB is marked against the UCN node.

UCN Cable Fault	`UCN  03 ND  25 FILE_1    OK    HPMM    OK  FULL    UCNCBLEV   SILENCEA`

Note: Beginning with TPN R686, the HM Journal will now indicate FTE cable faults as "SIL_FTEA" and "SIL_FTEB" always against Node 00 for the specific EUCN Network Number.

In the case of a node in the FTE community (for example, an ES-T node), the HM Journal indicates only SIL_FTEA (or SIL_FTEB), which is marked always against Node 00 for the specific EUCN Network Number.

FTE Cable Fault	`UCN  03 ND  00 FILE_1    OK    HPMM    OK  FULL    UCNCBLEV   SIL_FTEA`

In the case of a FTE Cable Fault for a EUCN node, the HM Journal indicates both SILENCEA (or SILENCEB) and SIL_FTEA (or SIL_FTEB). The SILENCEA (or SILENCEB) is marked against the EUCN node, and the SIL_FTEA (or SIL_FTEB) is marked against Node 00.

FTE Cable Fault for a EUCN node	`UCN  03 ND  25 FILE_1    OK    HPMM    OK  FULL    UCNCBLEV   SILENCEA` `UCN  03 ND  00 FILE_1    OK    HPMM    OK  FULL    UCNCBLEV   SIL_FTEA`

This section describes specific failure scenarios and the methods used in diagnosing the fault. All scenarios will assume the network topology as described in the following section in Figure 70.

System network topology

This section describes an ENB connected hybrid EUCN/UCN network as an example. The following figure depicts the network topology of the system being discussed. Although the ENB network topology is shown, the same troubleshooting techniques also apply to ENIM (FTE-only) systems.

For simplicity, it is assumed that ENIM/ENB is connected to a L1 switch. All EHPMs are connected to CF9s. L1 switches including CF9s are connected to L2 Switches. The L2 Switches are at the top of the FTE network and are connected by a crossover Ethernet cable. An ES-T is connected to L2 and is displaying an FTE Status display on the Native Window. The Native Window displays the status of the UCN as viewed by the ENIM/ENB pair.

Figure 70: ENB network topology example
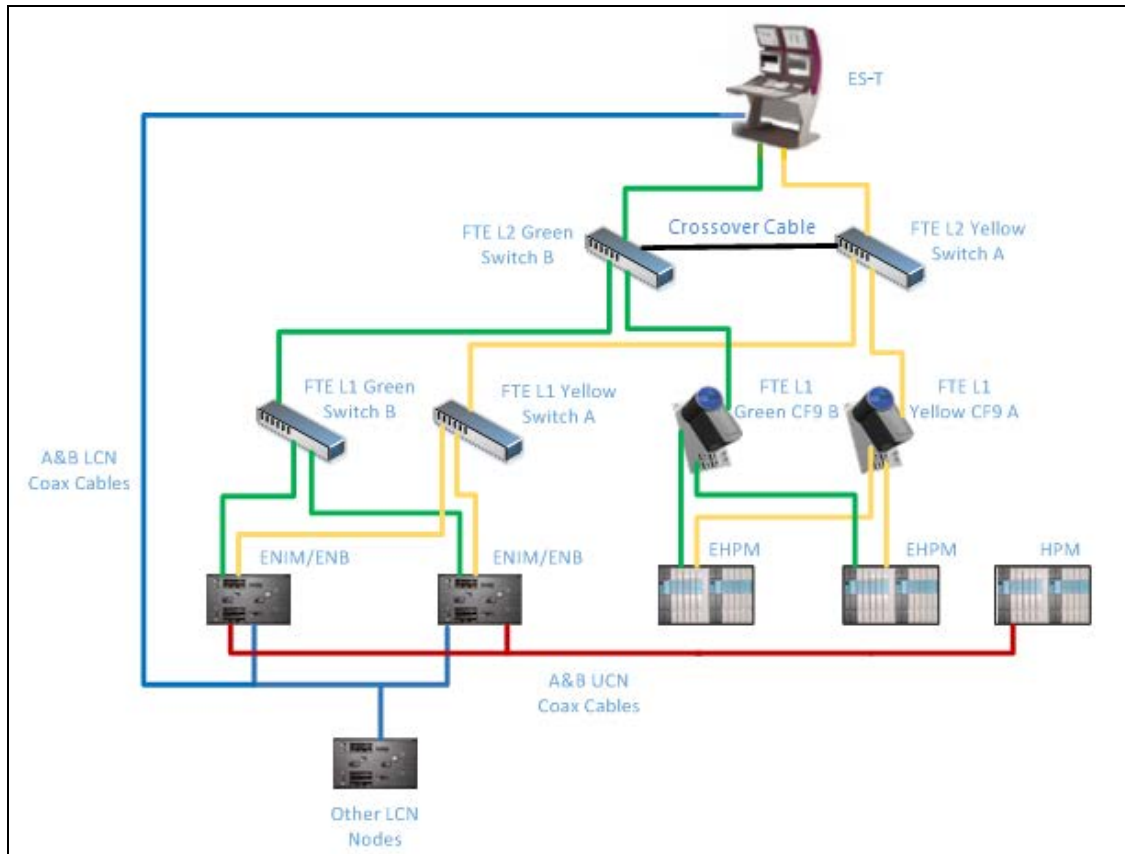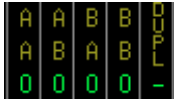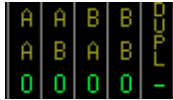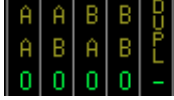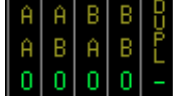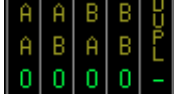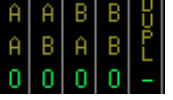
Table 15 ENB network topology terminology

Cable	Cable connection
CF9 Downlink Cable	Cable connecting the CF9 and the EHPM
CF9 Uplink Cable	Cable connecting the CF9 and the L2 Switch
L1 Switch Downlink Cable	Cable connecting the L1 Switch and the ENIM/ENB
L1 Switch Uplink Cable	Cable connecting the L1 Switch and the L2 Switch
A&B UCN Coax Cables	Redundant UCN Coax cables (the red line indicates both A & B cable and the pair is not shown)
A&B LCN Coax Cables	Redundant LCN Coax cables (the blue line indicates both A & B cable and the pair is not shown)
FTE Crossover Cable	An Ethernet crossover cable connected between the top level Yellow and Green Switches.

Table 16 ENB Cable Faults

Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB with cable faults)	$FTESTS2 displays (all other EUCN nodes)
No FTE cable problems	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B / 0 0 0 0 −	A A B B DUPL / A B A B / 0 0 0 0 −
						FTE composite status	
						A->A: OK, A->B: OK, B->A: OK, B->B: OK	
If FTE cable A on a Primary ENB node has a problem	A SIL	B SIL	A NSY *	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B / X X X 0 −	A A B B DUPL / A B A B / X 0 X 0 −
						FTE composite status	
						A->A: SIL, A->B: SIL, B->A: SIL, B->B: OK	
If FTE cable B on a Primary ENB node has a problem	A SIL	B SIL	A NSY	B NSY *	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B / 0 X X X −	A A B B DUPL / A B A B / 0 X 0 X −
						FTE composite status	
						A->A: OK, A->B: SIL, B->A: SIL, B->B: SIL	
If both FTE cable A and FTE cable B on a primary ENB have a problem. Primary fails, Secondary takes over as the primary	A SIL	B SIL	A NSY *[1]	B NSY *[1]	**OK/OK** UCN: OFFNET/OK LCN: FAIL/WARNING	A A B B DUPL / A B A B / X X X −	A A B B DUPL / A B A B / 0 0 0 0 −
						FTE composite status	
						A->A: OK, A->B: OK, B->A: OK, B->B: OK	
If both FTE cable A and FTE cable B on a secondary ENB have a problem	A SIL	B SIL	A NSY *	B NSY *	**FAIL/OK** UCN: OK/BACKUP LCN: OK/SEVERE	A A B B DUPL / A B A B / X X X −	A A B B DUPL / A B A B / 0 0 0 0 −
						FTE composite status	
						A->A: OK, A->A: OK, A->A: OK, B->B: OK	
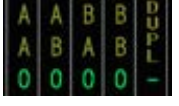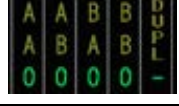
Condition	A SIL	B SIL	A NSY	B NSY	Status	Display	Display
No UCN coaxial cable problems	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B L / 0 0 0 0 -	A A B B DUPL / A B A B L / 0 0 0 0 -
						FTE composite status	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	
If UCN cable A on an ENB node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/OK** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B L / 0 0 0 0 -	A A B B DUPL / A B A B L / 0 0 0 0 -
	*					**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	
If UCN cable B on an ENB node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/OK** UCN: OK/BACKUP LCN: OK/BACKUP	A A B B DUPL / A B A B L / 0 0 0 0 -	A A B B DUPL / A B A B L / 0 0 0 0 -
		*				**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	
If both UCN cable A and B on an ENB node have a problem	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/OFFNET LCN: FAIL/WARNING	A A B B DUPL / A B A B L / 0 0 0 0 -	A A B B DUPL / A B A B L / 0 0 0 0 -
Primary fails, Secondary takes over as the primary	*[1]	*[1]				**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	

[1] **Note:** The A SIL, B SIL, A NSY, and B NSY indications only appear for an instant and then shows blank due to node failure.

Note: If any SIL or NSY bits are set, then the corresponding cables are backlit on the UCN Status Display, if the UCN CABLE STATUS target is chosen.

Table 17 EHPM Cable Faults

Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (EHPM with cable faults)	$FTESTS2 displays (all other EUCN nodes)
No FTE cable problems	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/BACKUP LCN: OK/BACKUP		
						FTE composite status	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	
If FTE cable A on an EHPM node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP		
	*					**FTE composite status**	
						A->A | A->B | B->A | B->B	
						SIL | SIL | OK | OK	
If FTE cable B on an EHPM node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP		
		*				**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | SIL | SIL	
If both FTE cable A and FTE cable B on a Primary EHPM node have a problem. Primary fails, Secondary takes over as the primary	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: PARTFAIL/OFFNET LCN: OK/BACKUP		
	*[1]	*[1]				**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	
If both FTE cable A and FTE cable B on a Secondary EHPM node have a problem	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: PARTFAIL/OFFNET LCN: OK/BACKUP		
	*[1]	*[1]				**FTE composite status**	
						A->A | A->B | B->A | B->B	
						OK | OK | OK | OK	

[1] **Note:** The A SIL, B SIL, A NSY, and B NSY indications only appear for an instant and then shows blank due to node failure or loss of communication.

Note: If any SIL or NSY bits are set, then the corresponding cables are backlit on the UCN Status Display, if the UCN CABLE STATUS target is chosen.

Table 18 UCN Node (PM/APM/HPM) Cable Faults (Primary NIM node is an ENB)

Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (PM/APM/HPM with cable faults)	$FTESTS2 displays (all other EUCN nodes)
No UCN coaxial cable problems	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
If UCN cable A on a PM/APM/HPM node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/OK** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
	*						
If UCN cable B on a PM/APM/HPM node has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/OK** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
		*					
If both UCN cable A and B on a PM/APM/HPM node have a problem Primary fails, Secondary takes over as the primary	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: PARTFAIL/OFFNET LCN: OK/BACKUP	N/A	N/A
	*[1]	*[1]					

Note: PM/APM/HPM are UCN nodes and hence the $FTESTS displays are not applicable.

[1] **Note:** The A SIL, B SIL, A NSY, and B NSY indications only appear for an instant and then shows blank due to node failure.

Note: If any SIL or NSY bits are set, then the corresponding cables are backlit on the UCN Status Display, if the UCN CABLE STATUS target is chosen.

Table 19 UCN Node (PM/APM/HPM) Cable Faults (Primary NIM node is a NIM)

Error scenario	UCN COMM STATUS				UCN CABLE STATUS	$FTESTS2 displays (this PM/APM/HPM with cable faults)	$FTESTS2 displays (all other EUCN nodes)
No UCN coaxial cable problems	A SIL	B SIL	A NSY	B NSY	**OK** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
If UCN cable A on a PM/APM/HPM node has a problem	A SIL *	B SIL	A NSY	B NSY	**FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
If UCN cable B on a PM/APM/HPM node has a problem	A SIL	B SIL *	A NSY	B NSY	**FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	N/A	N/A
If both UCN cable A and B on a PM/APM/HPM node have a problem Primary fails, Secondary takes over as primary	A SIL *[1]	B SIL *[1]	A NSY	B NSY	**FAIL** UCN: PARTFAIL/OFFNET LCN: OK/BACKUP	N/A	N/A

Note: PM/APM/HPM are UCN nodes and hence the $FTESTS displays are not applicable. The FTE CABLE STATUS field is not available for NIMs.

[1] **Note:** The A SIL, B SIL, A NSY, and B NSY indications only appear for an instant and then shows blank due to node failure.

Note: If any SIL or NSY bits are set, then the corresponding cables are backlit on the UCN Status Display, if the UCN CABLE STATUS target is chosen.

Table 20 CF9 switch/uplink port failure
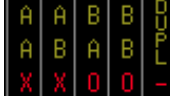
Error scenario	UCN COMM STATUS (EHPM)				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (EHPM connected to CF9 with cable faults)
If CF9 A is powered down or CF9 A Uplink Port has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	(display)	(display)

FTE composite status

A->A	A->B	B->A	B->B
SIL	SIL	OK	OK

Error scenario	UCN COMM STATUS (EHPM)				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (EHPM connected to CF9 with cable faults)
If CF9 B is powered down or CF9 B Uplink Port has a problem	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP	(display)	(display)

FTE composite status

A->A	A->B	B->A	B->B
OK	OK	SIL	SIL

Error scenario	UCN COMM STATUS (EHPM)				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (EHPM connected to CF9 with cable faults)
If both CF9 A and CF9 B is powered down/ both CF9 A and CF9 B uplink ports have a problem	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OFFNET/OFFNET LCN: OK/BACKUP	(display)	(display)

FTE composite status

A->A	A->B	B->A	B->B
OK	OK	OK	OK

Table 21 ES-T/ESVT FTE Cable Faults
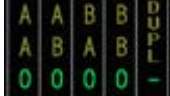
Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (L2 node that has a FTE Cable A problem)
If FTE Cable A on an L2 node connected to a FTE L2 Switch has a problem (for example, ES-T FTE Cable A fault)	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: N/A LCN: OK/BACKUP	(display)	(display)

FTE composite status

A->A	A->B	B->A	B->B
SIL	SIL	OK	OK

Table 22 Crossover Cable Faults

Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (all other EUCN nodes)
If the top level cross cable connecting the Yellow and Green switches are correctly functioning.	A SIL	B SIL	A NSY	B NSY	**OK/OK** UCN: OK/BACKUP LCN: OK/BACKUP		

FTE composite status

A->A	A->B	B->A	B->B
OK	OK	OK	OK

Error scenario	UCN COMM STATUS				UCN CABLE STATUS/FTE CABLE STATUS	$FTESTS2 displays (ENB)	$FTESTS2 displays (all other EUCN nodes)
If the top level cross cable connecting the Yellow and Green Switches is removed or has a problem.	A SIL	B SIL	A NSY	B NSY	**FAIL/FAIL** UCN: OK/BACKUP LCN: OK/BACKUP		

FTE composite status

A->A	A->B	B->A	B->B
OK	SIL	SIL	OK

Diagnosing Complex EUCN FTE Network Faults

Complex EUCN FTE Network Faults occur when multiple network faults are injected at different levels of the network topology. These faults cause complex communication path fault indications as well as system behaviors.

Communication Path

When analyzing FTE faults, it is important to remember that the faults are reported from the viewpoint of the reporting node. UCN cable faults are reported by each individual node and will only be faulted if the fault prevents hearing from any other FTE node on a given interface. $FTESTS1 or $FTESTS2 is strictly the view of the specified Primary ENIM/ENB generated by listening to FTE diagnostic frames from every FTE community member. When invoking $FTESTS1 or $FTESTS2 a EUCN network number and primary ENIM/ENB is specified.

The FTE status reported is from the view of this node. When utilizing the Experion System Management FTE/Heartbeat Status Display, the display will be from the viewpoint of the node on which the status display is invoked. When utilizing the Experion Station FTE status display, the display is from the viewpoint of the Experion Server to which station is connected. Because each of these views is from a different point in the network, the difference in the view can be helpful in determining the actual location of the network fault(s).

To diagnose faults, a network topology diagram is imperative. Utilizing the $FTESTS2 schematic, mark the faults indicated on the network topology diagram. Once faults have been mapped, view the diagram keeping in mind that the faults are as viewed by the specified Primary ENIM/ENB. This will usually identify the location of the faults. In the case of multiple faults, it can be difficult to identify all faults at once. Fix the most obvious issue first and then proceed with other faults. Performing the same analysis using alternative views and marking a seperate copy of the network topology can also be helpful. Once multiple views are available compare the views and identify the common faults in the views.

Example 1: EST05 has a bad cable A. From the view of the Primary ENIM/ENB (using $FTESTS2 schematic) only the ES-T has a bad A->A, A->B status. From the view of the ES-T (as shown in Figure 72), all nodes have bad A->A, B->A statuses except for the local node which also has A->B status bad.

Figure 71 $FTESTS2 view – EST05 has Cable A fault

Primary ENIM/ENB	0 0 0 0 –	Primary EHPM	0 0 0 0 –
Secondary ENIM/ENB	0 0 0 0 –	Secondary EHPM	0 0 0 0 –
		EST05	X X 0 0 –

Figure 72 FTE Status from view of EST05 – EST05 has Cable A fault

PdTag	Device Index	● A -> A	● A -> B	● B -> A	● B -> B
EHPM Y109	109	SILENT	OK	SILENT	OK
EHPM 5295	295	SILENT	OK	SILENT	OK
EHPM Y296	296	SILENT	OK	SILENT	OK
ENIM5091	91	SILENT	OK	SILENT	OK
ENIM W092	92	SILENT	OK	SILENT	OK
TXMT ACT01	154	SILENT	OK	SILENT	OK
TXMT ACT12	156	SILENT	OK	SILENT	OK
TXMT EST01	130	SILENT	OK	SILENT	OK
TXMT EST04	134	SILENT	OK	SILENT	OK
EST05	138	SILENT	SILENT	SILENT	OK
TXTE 0160	160	SILENT	OK	SILENT	OK
TXTE 0162	162	SILENT	OK	SILENT	OK

System Behavior

System behavior, especially controller redundancy, can be another useful diagnostic input. ENIM/ENB and controllers use a similar redundancy philosophy. If a primary node loses both network connections (both FTE A and FTE B) and the secondary status indicates that it is good, then the primary node will fail and the secondary will take over. This failure requires that there be NO communication on either the A or B connection as viewed by the local controller. If there is any received traffic on either FTE interface, a failover will not take place.

If for instance, an L1 A switch is down and a B downlink to the primary EHPM is broken, it will appear that the primary EHPM has a double cable fault – from the viewpoint of the ENIM/ENB and the node will appear OFFNET. From the viewpoint of the primary EHPM however, the A path through the CF9 will be good and through that connection it can receive EUCN redundancy messages from its partner. The primary EHPM will therefore not failover. Process control will be maintained by the Primary EHPM although view and advanced control via the ENIM/ENB will be broken. Because the ENIM/ENB has a view to the secondary EHPM, the ENIM/ENB will retain FULL control and when one of the faults is corrected, view and advanced control will resume.

Also note that in this case – since the secondary is in BACKUP indicating a good connection with the primary, a swap-over could be initiated and the secondary would take over, view would be restored, and advanced control would resume.

Figure 73 UCN Status for L1 Switch A down and CF9 B downlink fault


```
UCN CABLE STATUS: FAIL              UCN 03 STATUS
FTE CABLE STATUS: FAIL

01 NIM 02|25 HPM 26|37 PM  38|39 APM 40|
   OK    | OFFNET   |   OK    |   OK    |
 BACKUP  | BACKUP   | BACKUP  | BACKUP  |
A/B  A/B |      B/A |A/B  A/B |A/B  A/B |
```
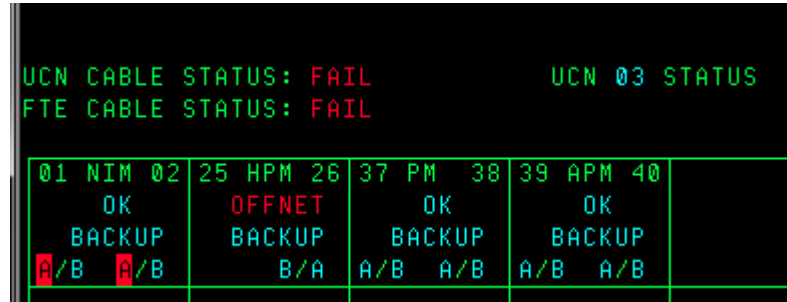
Figure 74 $FTESTS for L1 Switch A down and CF9 B downlink fault

Primary ENIM/ENB		Primary EHPM	
Secondary ENIM/ENB		Secondary EHPM	

EUCN Switches

EUCN FTE network security is achieved with the use of Level 1 Honeywell CF9 and Level 2 Industrial Ethernet switch (Cisco IE 3000) configurations. In larger EUCN topologies, you must configure the industrial Ethernet switch as a Level 1 and Level 2 switch, known as *split switch* configuration.

In a *split switch,* a designated portion of the ethernet switch operates as a Level 1 switch and the remaining portion as a level 2 switch.

Figure 75 Control Firewall (CF9)
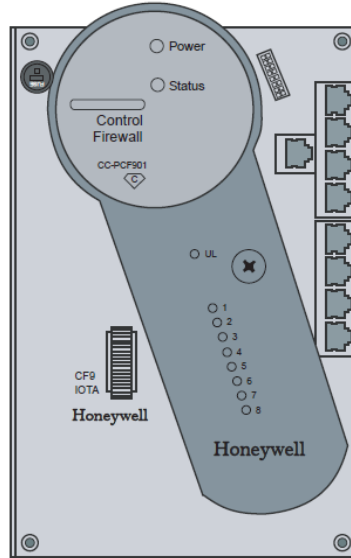
Figure 76 Ethernet Switch
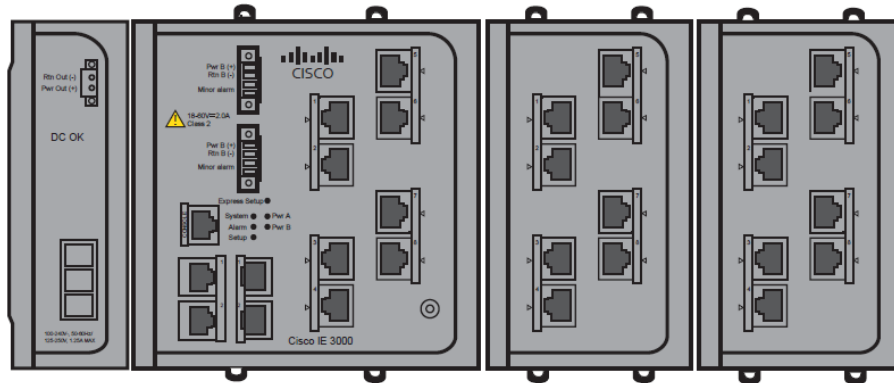
Card file backpanel connections

The following figure illustrates the FTE A and FTE B EUCN drop cable connections to the EHPM FTE Interface module in a 7-Slot HPMM card file.

Figure 77 Drop Cable Connections to a 7-Slot HPMM Card File for EHPM
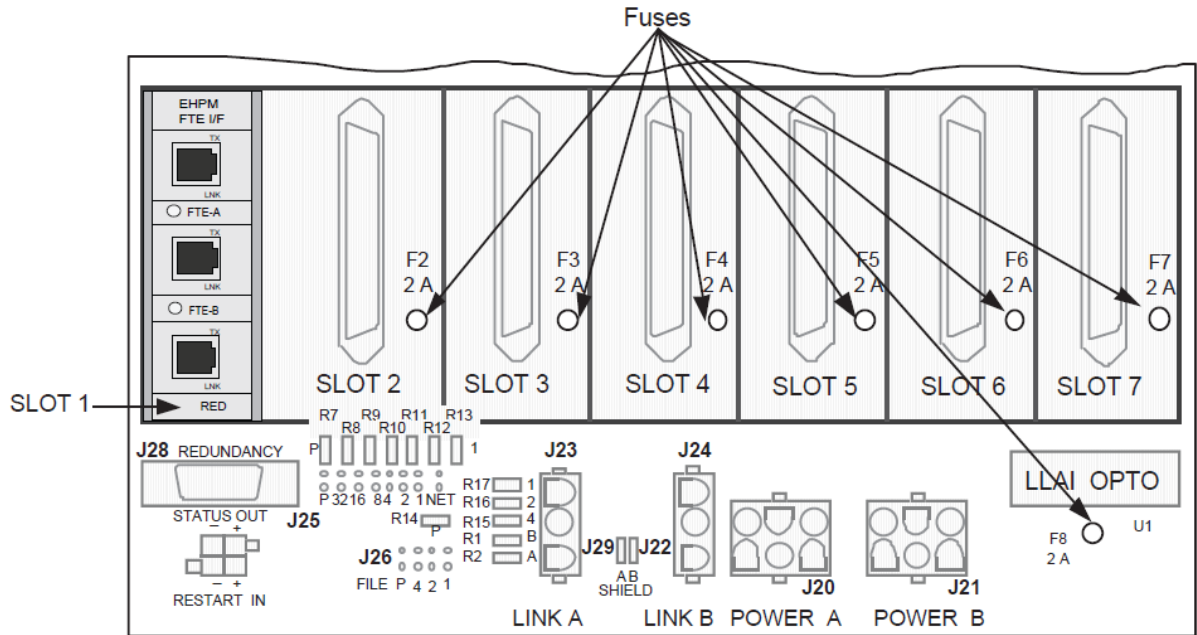
Status indicators on the FTE Switch

Interpretation of Cisco IE 3000 Front Panel & Port LED Indicators

You can use the LEDs to monitor the switch status, activity, and performance. The figure below shows the front panel LEDs, and the following sections describe them.
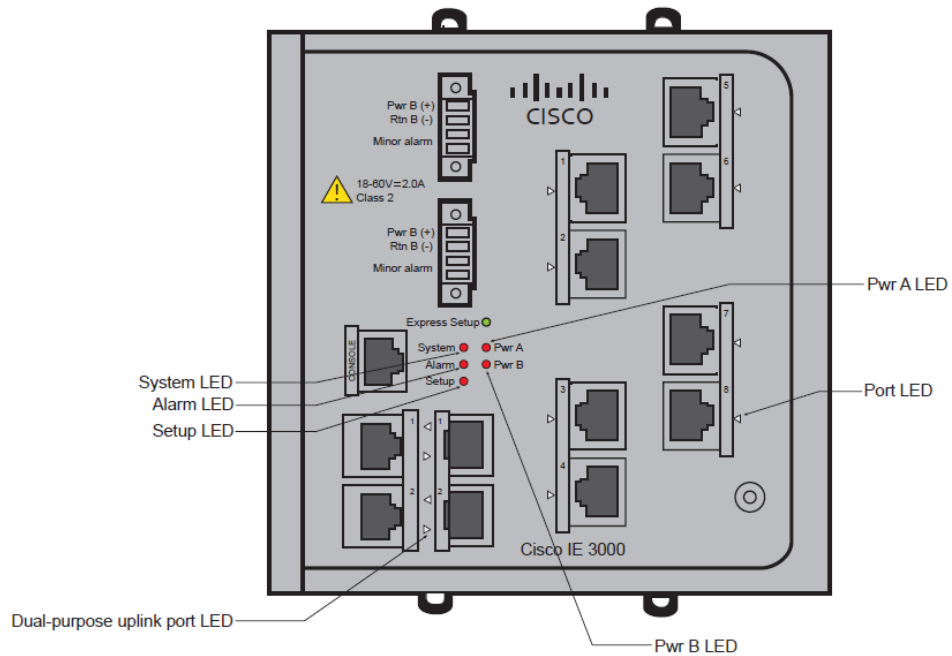
Initial Switch set up using "Express Setup"

System LED

LED Color	Description
Blinking green	The switch power-on self-test (POST) is running.
Solid green	POST has completed.
Red	The switch has failed POST.

Setup LED

LED Color	Description
Blinking green	The switch is not configured.
Solid green	Start a browser session on the PC.

Port LED

LED Color	Description
Blinking green	The switch Express Setup button is pressed. A Category 5 Ethernet cable connects the blinking switch port to the Ethernet port on a PC.

Pwr A LED

LED Color	Description
Solid green	The switch is properly powered up.
Dark (Off)	The switch is not powered up.

Verifying Port Connectivity

After the switch port is connected to another device.

Port LED

LED Color	Description
Amber	The switch is establishing a link to the connected device. This process takes about 30 seconds.
Solid green	The switch and target device have established a link.
Dark (Off)	The target device might not be turned on or there might be a cable problem.

Normal Operating Mode

The switch is completely configured and connectivity with the target device is already established.

LED Color	Description
Flashing green	Communication between the port and target device is occurring.
Flashing green interspersed with flashing amber OR solid amber	A problem exists with this port to target device interface.Check the port configuration and cable integrity. If OK and condition still persists, contact

	Honeywell Technical Assistance Center.
Flashing amber	Communication with the target device has failed.
Dark (Off)	The target device might not be turned on or there might be a cable problem.

System LED

LED Color	Description
Green	Indicates normal operation.
Red or amber	There might be a hardware problem.Contact the Honeywell Technical Assistance Center.

Setup LED

LED Color	Description
Dark (Off)	Indicates normal operation.
Red or amber	There might be a hardware problem.Contact the Honeywell Technical Assistance Center.

Alarm LED

LED Color	Description
Green	Indicates normal operation.
Red or amber	A preconfigured alarm set point has been exceeded.Contact the Honeywell Technical Assistance Center.

Pwr A LED

LED Color	Description
Green	The switch is properly powered up.
Red or amber	The switch is not powered up.Contact the Honeywell Technical Assistance Center.

Pwr B LED: Applies only if redundant power sources are connected

LED Color	Description
Solid green	The switch is properly powered up.
Red or amber	The switch is not powered up.Contact the Honeywell Technical Assistance Center.

Control Firewall status indicators

Control Firewall Startup

The following table summarizes the stages the CF9 goes through after power is applied to its IOTA during startup. The CF9 repeats these stages every time power is cycled Off/On or the pins on its reset pad are shorted.

Stage	Description
1	Power Light Emitting Diode (LED) lights (green)
2	Status LED is red while the CF9 runs its power-on self test (POST).
3	When the CF9 POST completes, the Status LED turns green and the FTE port LEDs blink green and off for all connected ports when there is traffic, and remain steady green for connected ports when there is no traffic. The LEDs for unconnected FTE ports are off.

CF9 LED Descriptions

The following illustration and table identify and describe the indications associated with the LEDs on the CF9.
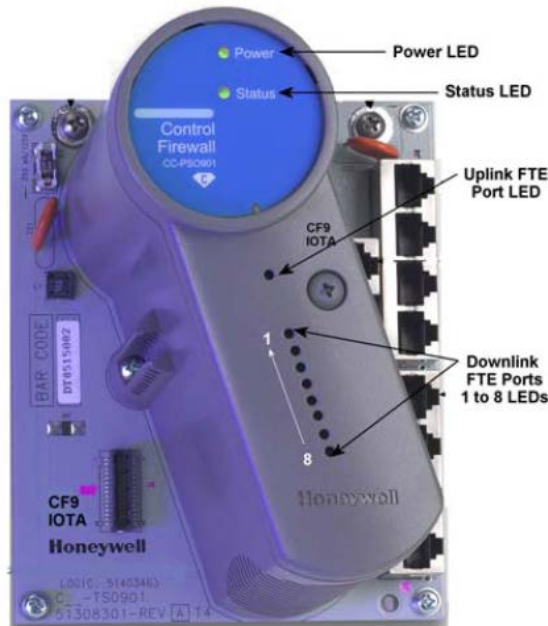
LED	State				
	Off	**Green**	**Red**	**Blinking green**	**Green with brief flicker**
Power	No Power	Power On	N/A	N/A	N/A
Status	No Power of Fault	Normal Operation	Running POST	*See Note*	N/A
Downlink	No Power or	Link Present,	N/A	Link	Too Many

Ports 1 to 8	No Cable Connected	No Traffic		Present, Traffic	Attached Devices
Uplink Port	No Power or No Cable Connected	Link Present, No Traffic	N/A	Link Present, Traffic	N/A
Note: The CF9 has detected a soft failure and is working in a diminished state. Typical causes are a disconnected uplink port cable or a downlink port with too many attached devices. (Only one device can be attached to a CF9 downlink port.)					

2.29 UCN Node Address Pinning

Introduction

The UCN node address on the card file backpanel is configured in the factory, but the node address can be changed or require verification in the field during installation.

One or two HPMM card files

A High-Performance Process Manager cabinet can have one or two (if redundant) card files that contain HPMMs, and possibly none or several card files that contain only IOPs. A card file that contains an HPMM must always be configured (pinned) for a UCN node address. The UCN node address pinning of a card file that contains only IOPs is ignored (not used).

Odd address pinning

The UCN node address for an HPMM is always configured as an odd number. The odd UCN node address is the address of the primary HPMM. The next consecutive address (even) is reserved for the secondary HPMM, whether physically present or not. For example, a UCN node address of 11 for the High-Performance Process Manager is odd, which is acceptable. A node address of 8 is even and is unacceptable for a primary HPMM.

Whether a card file contains the primary or secondary (redundant) High-Performance Process Manager Module (HPMM), it must always be configured (pinned) for the primary HPMM UCN node address, which is an odd number. Software takes care of the even node number for the backup HPMM.

Secondary HPMM determination

The system software logically determines the primary and secondary HPMM, either automatically or by System Console intervention.

Two methods of pinning

Two methods of UCN node address pinning are described later in this section. The HPM files normally use jumpers to define (pin) the UCN node address. Zero-ohm resistors (used in place of jumpers) are soldered in at the factory only by special request.

7-Slot card file pinning

The following figure illustrates the location on a Left 7-Slot card file backpanel where the odd UCN node address must be configured (pinned). The location on Right 7-Slot card file backpanel is identical.

Figure 78 Left 7-Slot Card File UCN Node Address Pinning
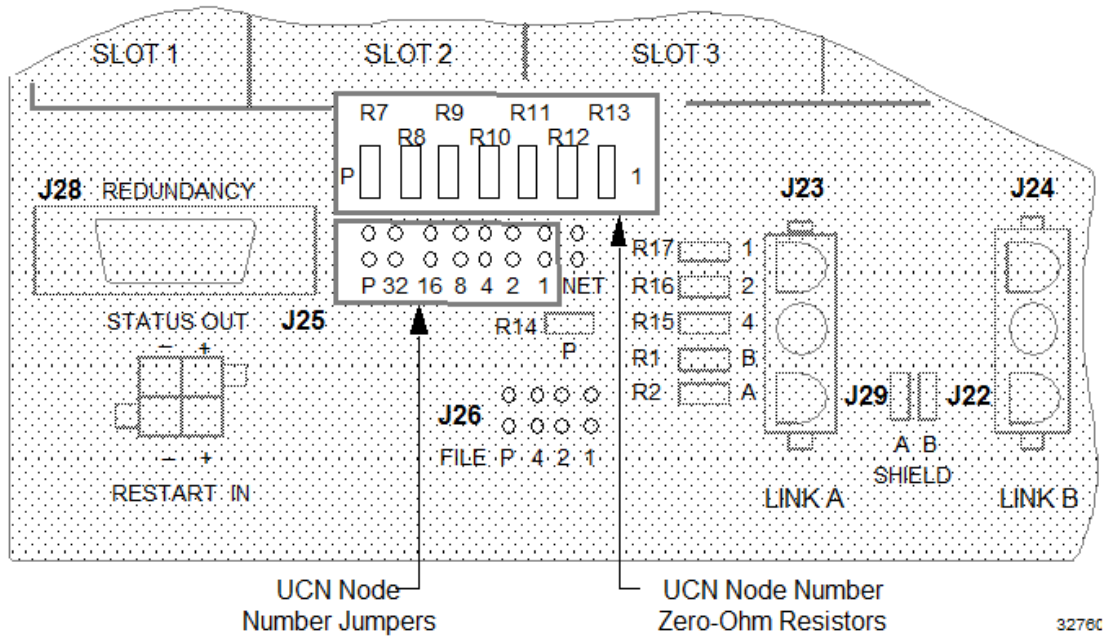
15-Slot card file pinning

The following figure illustrates the location on a 15-Slot card file backpanel where the odd UCN node address must be configured (pinned).

Figure 79 15-Slot Card File UCN Node Address Pinning
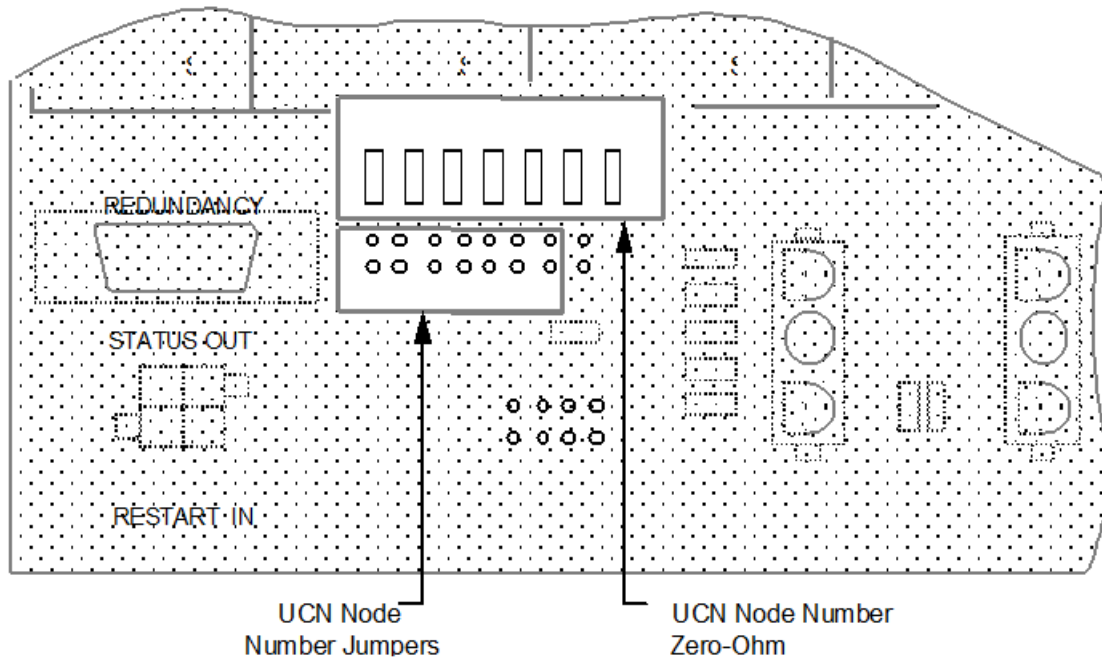
Two pinning methods

The High-Performance Process Manager has two means of configuring the UCN node address.

- Plug jumpers — Also known as "padlock" or "cowbell" jumpers
- Zero-ohm resistor jumpers — Basically, jumper wires that are soldered on the backpanel printed wire board.

Currently the factory ships HPMs with plug jumpers unless the customer specifically requests zero-ohm resistor jumpers. Since both versions may exist in the field, both versions are covered in the following examples.

Pinning method differences

Plug jumpers are convenient to set up and change. Zero-ohm resistor jumpers are reliable and permanent. One method or the other must be disabled at initial installation before the system will function properly.

Odd number of jumpers required

For either address selection method, the hardware is designed so that an odd number of jumpers must be used. That is, regardless of the numerical value of the node address, the parity (P) plug/resistor jumper must be added or removed to provide an odd number of jumpers.

Plug jumper method

To use the plug jumpers to configure the UCN node address, take diagonal cutters and remove all the zero-ohm resistor jumpers as illustrated in the following figure (if they exist). As an example, to configure a HPM for a UCN node address of 11, install jumpers at positions 1, 2, and 8 (1 + 2 + 8 = 11) by bridging the two circuit pins at each position. Because an odd number of jumpers are used, the P (parity) jumper must be removed along with those at positions 4, 16, and 32. The unused plug jumpers can be stored at their positions by hanging them on one pin.

Figure 80 UCN Node Address Pinning Using Plug Jumpers
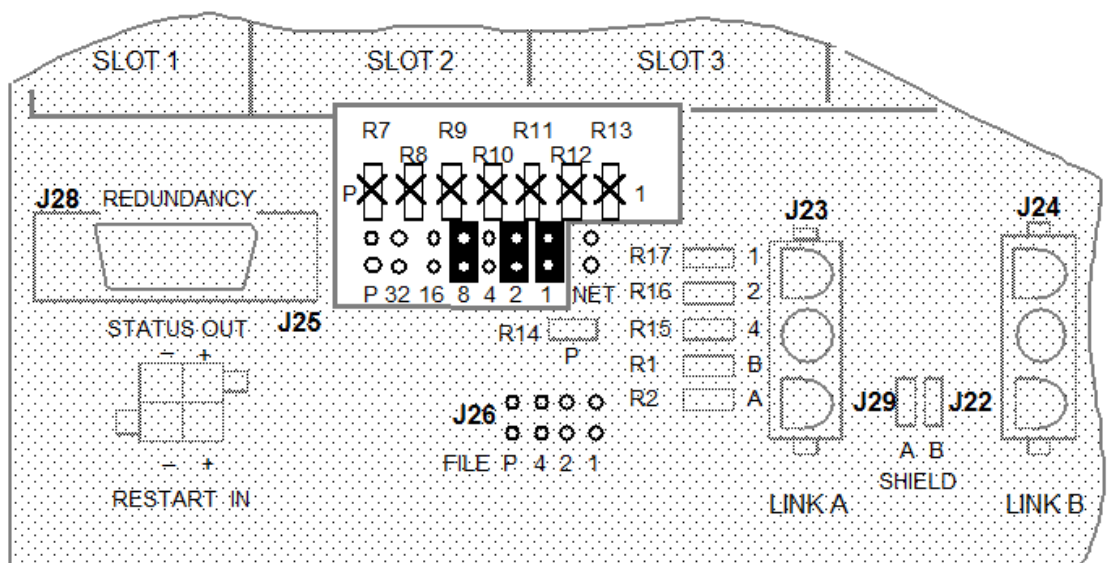
Zero-ohm jumper method

To use zero-ohm resistors to configure the UCN node address, unplug, discard, or store all the plug jumpers as noted above. As an example in the following figure, to configure a High-Performance Process Manager for a UCN node address of 11, do not remove the resistors at the 1, 2, and 8 (1 + 2 + 8 = 11) positions. Because an odd number of resistors are required, the P (parity) jumper must be removed along with those at positions 4, 16, and 32. Use a diagonal cutter to clip out the unwanted resistors.

Figure 81 UCN Node Address Pinning Using Zero-Ohm Resistors
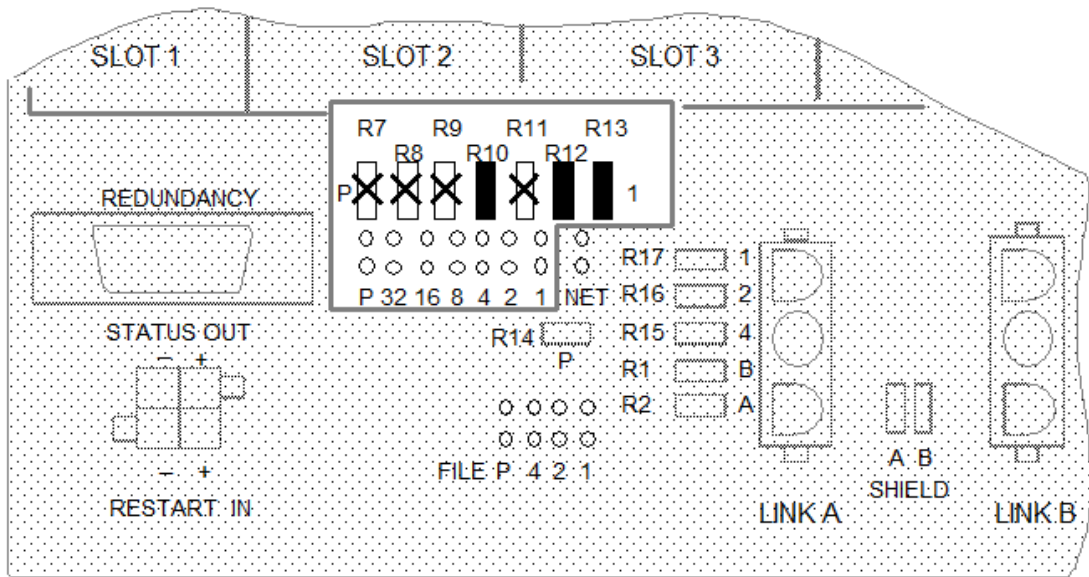
FTE Device Index Addressing

The rotary BCD switches that set the FTE device index are located on the EHPM FTE Interface assembly. These switches set the FTE Device index which is used as the lowest octet of the IP Address. See figure **Figure 80 - EHPM FTE Interface Module**

The PDTag of the EHPPM or ENIM is the node type plus the UCN index. The FTE annunciation message contains the PDTag which includes the UCN Address, the IP Address in use, and the FTE Device Index. This provides all of the information required for address resolution for EUCN connections.

Figure 82 - EHPM FTE Interface Module
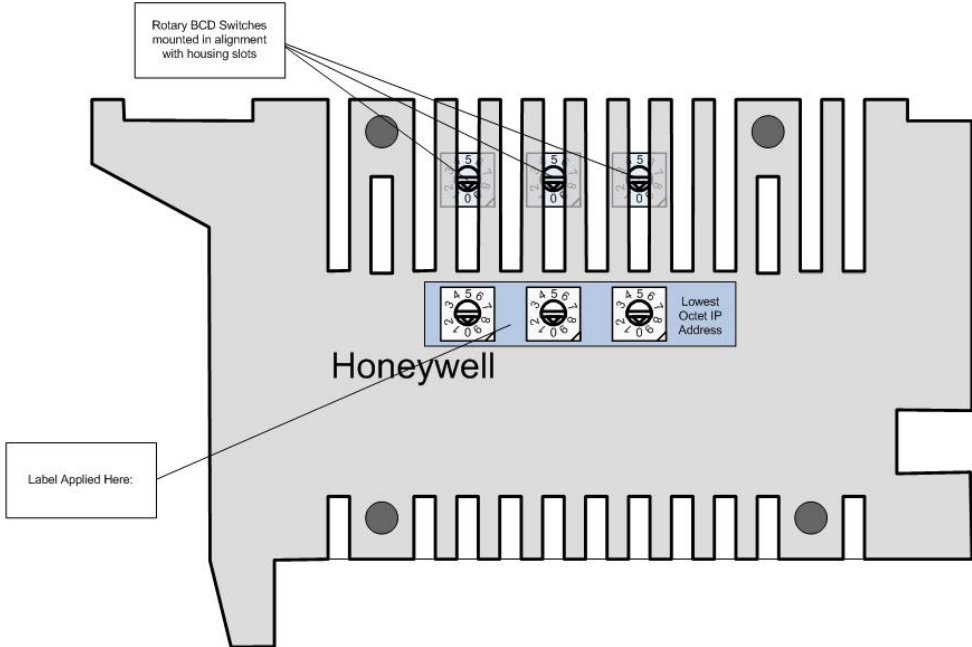
2.30 I/O Link Interface Address Pinning

Introduction

Input/Output Processor (IOP) cards can be installed in any of the four types of card files that are available for installation in a High-Performance Process Manager subsystem. The four types of card files are:

- Left 7-Slot card file

- Right 7-Slot card file

- 15-Slot card file (New design – accommodates an HPMM)

- IOP Only 15-Slot card file (exists in current PMs and APMs)

The IOP Only 15-Slot card file is a current PM/APM card file that can continue to be used when a PM or APM subsystem is upgraded to an HPM subsystem.

I/O Link Interface configuration

All card files must be hardware configured (pinned) for an address on the I/O Link Interface. I/O Link Interface address selection is implemented (pinned) with jumpers (or zero-ohm resistors) on each card file backpanel.

Consecutive address assignment

The card file I/O Link Interface addresses must be configured (pinned) consecutively. However, three addressing schemes must be considered and they are based upon the High-Performance Process Manager's card file configuration.

Two methods of pinning

Two methods of I/O Link Interface address pinning are described later in this subsection. The HPM files normally use jumpers to define (pin) the card file address. Zero-ohm resistors that are used in place of jumpers are soldered in at the factory only by special request.

Nonredundant HPMM subsystem

For a HPM subsystem with a nonredundant HPMM and supporting I/O card files, the card file that contains the HPMM must be pinned for an I/O Link Interface address of zero (0), and the I/O card files that contain IOPs must be pinned for consecutive addresses that start at one (1).

See Figure 81 for the location of the jumpers on the 7-Slot card file and Figure 84 for the location of the jumpers on the 15-Slot card file. If IOP Only card files are used, see Figure 81.

Remember that software will see these card file addresses as a value of +1 when compared to the value actually pinned. (i. e. pinned value of 0 = card file 1, pinned value of 1 = card file 2, etc.)

Figure 83 Left 7-Slot Card File I/O Link Interface Address Pinning
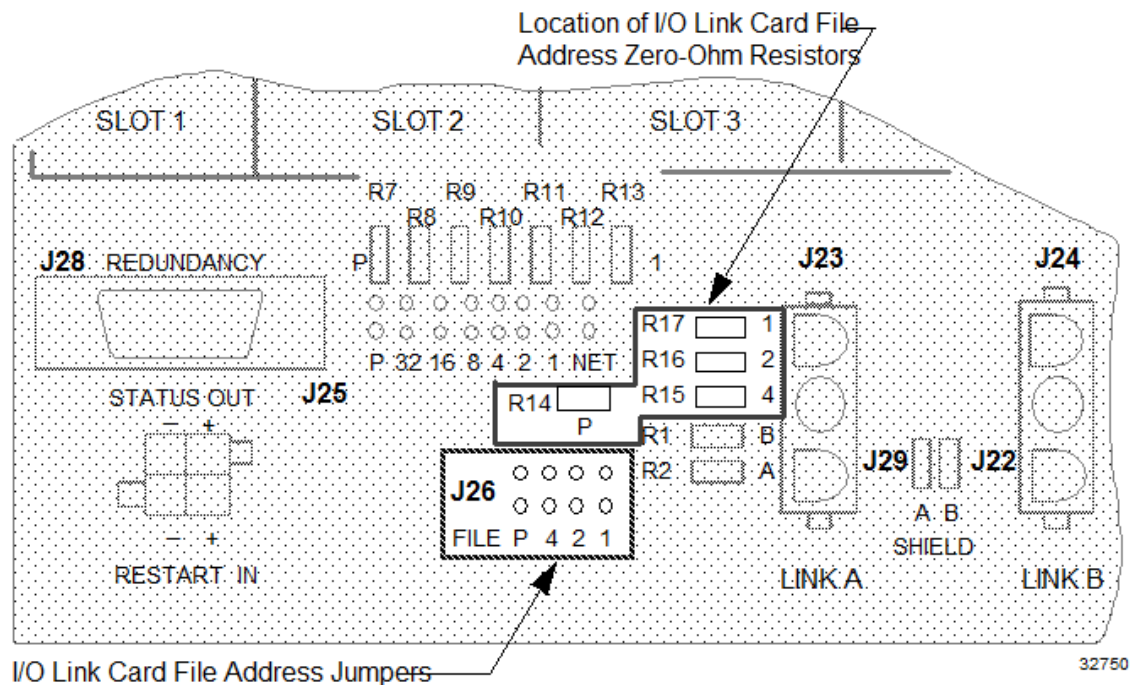
7-Slot card files

If the HPMM is resident in a Left 7-Slot card file and its Right 7-Slot card file exists, <u>both</u> 7-Slot card files must be pinned for an I/O Link Interface address of zero (0). The I/O card files that contain IOPs must be pinned for consecutively addresses that start at one (1).

15-Slot card file redundant HPMM subsystem

When redundant HPMMs are installed in two 15-Slot card files, the first card file must be configured for I/O Link Interface address zero (0) and the second card file must be configured for I/O Link Interface address one (1). Any additional I/O card files in the HPM subsystem must be addressed consecutively, starting at I/O Link Interface address two (2). See the following figure for the location of the jumpers on the 15-Slot card file.

Figure 84 15-Slot Card File I/O Link Interface Address Pinning
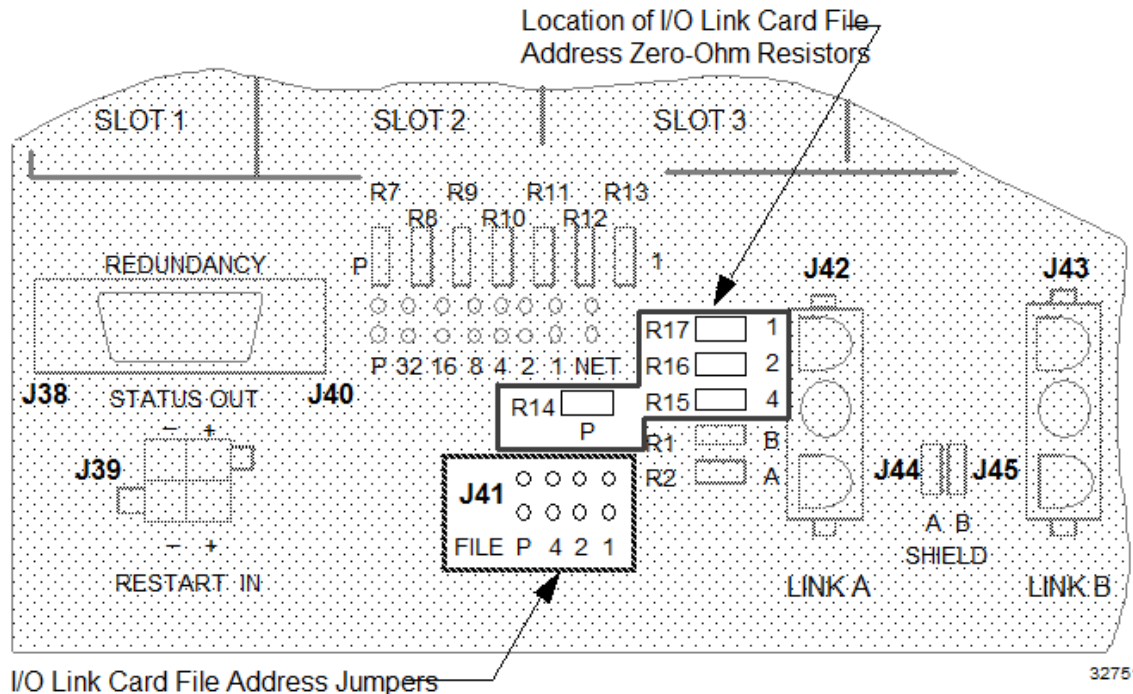
7-Slot card file redundant HPM subsystem

When redundant HPMMs are installed in left and right 7-Slot card files, both 7-Slot card files must be configured for the same I/O Link Interface address of zero (0) since the left 7-Slot card file contains I/O slots 3 through 7, and the right 7-Slot card file contains I/O slots 9 through 15. Any additional I/O card files in the subsystem must be addressed consecutively, starting at I/O Link Interface address one (1). See Figure 81 for the location of the jumpers on the 7-Slot card files.

IOP Only card file pinning location

The following figure illustrates the location on the IOP Only card file backpanel where the I/O Link Interface address is configured. The IOP Only card file may be part of the residual hardware from the upgrade of a PM or APM subsystem to an HPM subsystem.

Figure 85 IOP Only Card File I/O Link Interface Address Pinning
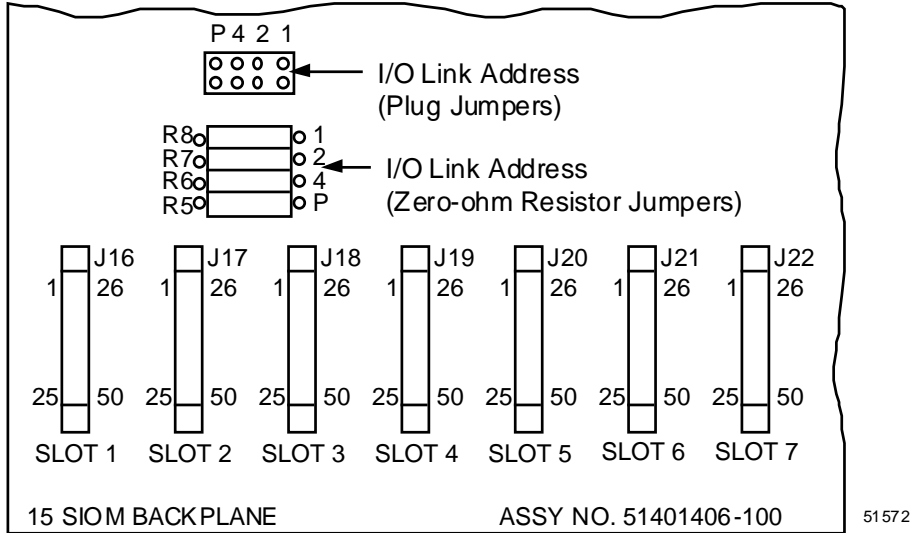
ATTENTION

The numerical address displayed on the Operator Console displays is numbered one higher than the actual configured binary address. The binary card file address of 0 is displayed as a numerical address of 1 on the system displays.

Two pinning methods

A choice of two methods can be used to implement the I/O Link Interface addressing on the card file.

- Plug jumpers
- Zero-ohm resistor jumpers

One method only

One of the two methods must be disabled. Both cannot be active. Remove all jumpers and use the zero-ohm resistors or clip out the zero-ohm resistors and use the jumpers. The jumper method (without the resistors) is the most common method.

Jumper method example

I/O Link Interface address configuration using plug jumpers is demonstrated with the following example.

Refer to Figure 86 to locate the card file pinning area (J26) in the following discussion.

Assume an I/O card file is to be configured for an I/O Link Interface hardware address of 4. The Operator Console will display this card file's I/O Link Interface address as 5. Take diagonal cutters and remove all the zero-ohm resistors. Install a plug jumper to bridge both pins at position 4. Because this single jumper constitutes an odd number of jumpers, remove the P (parity) plug jumper as well as all others.

Even though the J-number (J26 in this case) differs between the 7-Slot and 15-Slot card files, the method of pinning the card file address remains the same.

Figure 86 Left 7-Slot Card File I/O Link Interface Address Pinning with Plug Jumpers
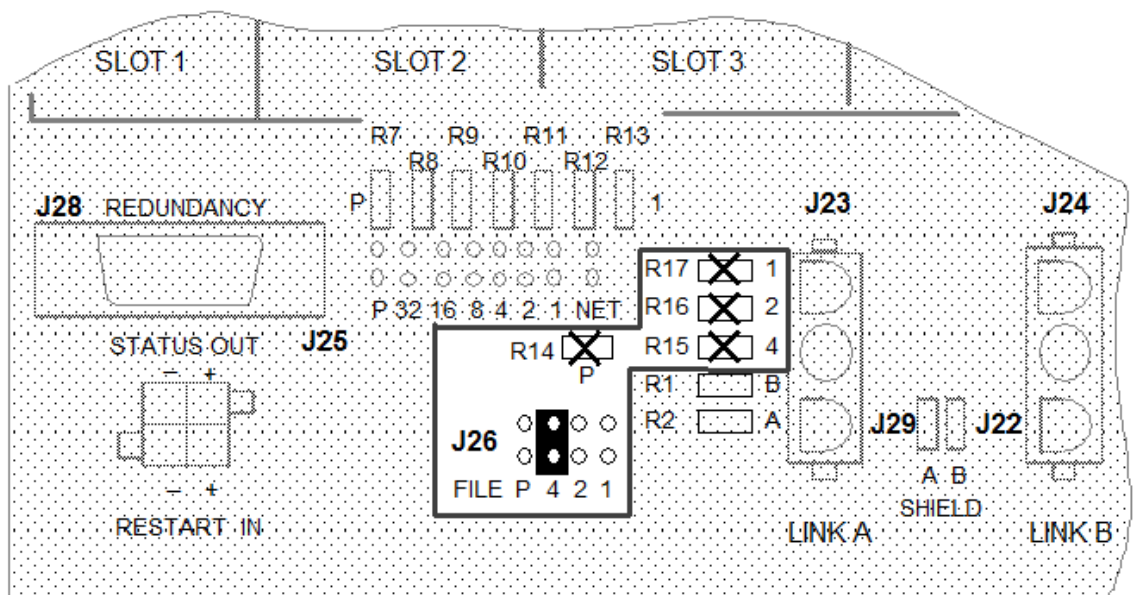
Zero-ohm resistor jumper pinning example

I/O Link Interface address configuration using zero-ohm resistor jumpers is demonstrated with the following 7-Slot card file example.

Refer to Figure 85 to locate the card file resistor jumper area in the following discussion.

An I/O card file is to be configured for an I/O Link Interface hardware address of 3. The Operator Console will display this card file's address as 4. Remove all the plug jumpers and set them aside. A logic one is created by leaving the zero-ohm resistor in place and a zero is created by removing the zero-ohm resistor. Leave the zero-ohm resistors at positions 1 and 2 (1 + 2 = 3), and leave the P (parity) zero-ohm resistor because an odd number of jumpers is required. Remove all other zero-ohm resistors with diagonal cutters.

Even though the jack number (J28 in this case) differs between the 7 and 15-Slot card files, the method of pinning the card file address remains the same.

Figure 87 Left 7-Slot Card File I/O Link Interface Address Pinning with Zero-Ohm Resistors
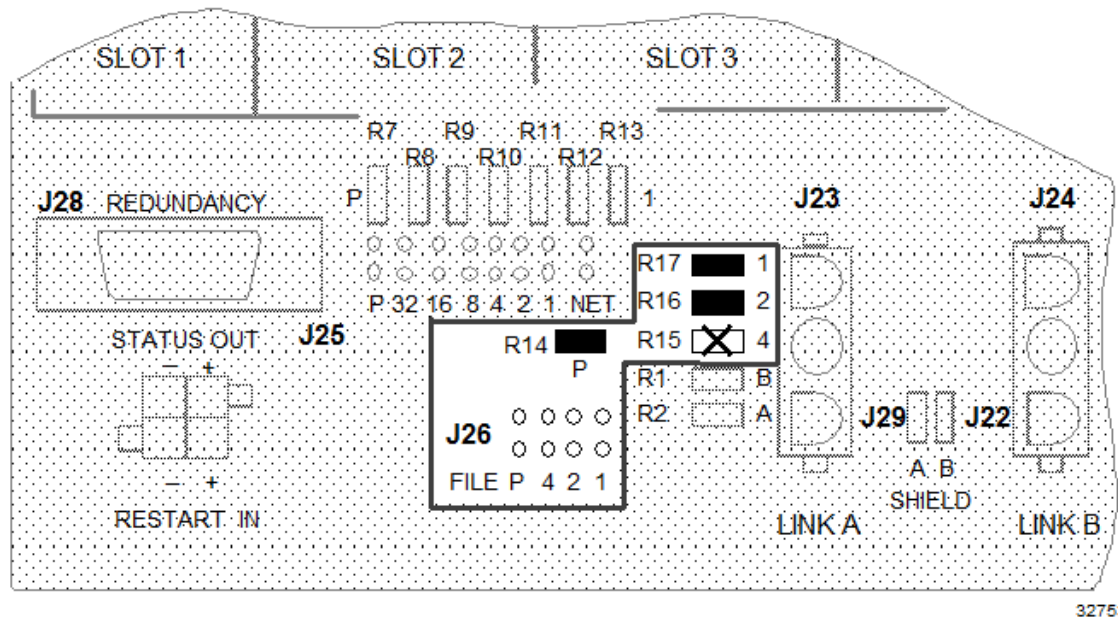
| CAUTION | If a zero-ohm resistor jumper is incorrectly removed, do not attempt to correct the problem by resoldering the jumper. The backpanel is easily damaged. Instead, remove all the zero-ohm resistor jumpers and configure the card file's I/O Link Interface address with the plug jumpers. |

2.31 Firmware/Hardware/Software Correlation

Relationship

A definite correlation exists between the High-Performance Process Manager's firmware, hardware, and software. An explanation of this relationship and the latest information can be found in Appendix K of the *Customer Release Guide* manual.

3. UCN Status Displays

3.1 Overview

Introduction

The information in this section is intended to assist the reader in the operation and understanding of UCN Status displays as a service tool for the High-Performance Process Manager equipment. The UCN Status displays consist of three categories of displays, the NIM Detail Status displays, the HPMM Detail Status displays, and the IOP Detail Status displays for the following types of Input/Output Processors (IOPs).

- High Level Analog Input (HLAI)
- Low Level Analog Input (LLAI)
- Analog Output (AO)
- Digital Input (DI)
- Digital Output (DO)
- Smart Transmitter Interface (STI)
- Smart Transmitter Interface Multivariable (STIM)
- Low Level Multiplexer (LLMux)
- Remote Hardened Low Level Multiplexer (RHMUX)
- Pulse Input (PI)
- Serial Device Interface (SDI)
- Serial Interface (SI)
- Digital Input Sequence Of Events (DISOE)

References

Numerous references in this section are made to figures that represent screen prints of the actual Universal Station Console displays. It should be possible for the reader to make use of either the figures in this section, or the screen display on an available Universal Station hosting the Operator or Universal personality as a training or service tool.

Release 600 software displays

The displays shown in this section are reproductions of console screens created by Release 600 software.

3.2 Display Definitions

IOM definition

A common word in the display discussion is the term "IOM." The Input /Output Module (IOM) is the Input/Output Processor (IOP) card that resides in an High-Performance Process Manager card file. It interfaces to an associated Field Termination Assembly (FTA). In the case of redundancy, the IOM consists of two IOPs with the associated FTA.

Target selection

Often, a figure has the title of a display followed by the name of a target on a display, such as: **IOM IOL INFO**. This is the target that must be selected on a previous display to produce the display in the figure.

NIM Detail Status Displays

These displays provide the operator with access to the current status of a primary or secondary NIM as a UCN node. The display contains a fixed portion showing the current state of the NIM on the UCN and a set of targets that invoke displays of the UCN Driver configuration and the NIM local UCN statistics. The NIM Local UCN Statistics display has a target that allows the operator to reset the UCN Driver statistics for test purposes.

HPMM Detail Status Displays

These displays provide the operator with access to the current status of a primary or secondary HPMM. The display contains a fixed portion that shows the current status of the HPMM on the UCN and a set of targets that permits display of the following information.

- The status of the HPMM as a node on the I/O Link Interface

- The status of the I/O Link Supervisor (IOS) for a primary HPMM

- The current version/revision/personality and firmware version of the HPMM's I/O Link, Communications, and Control processors

- Configuration of the HPMM Control processor (primary HPMM only)

- The current UCN communications statistics with reset capabilities

- The error information captured in the HPMM memory

- The current Soft failures in the HPMM

- A summary of the current I/O Link status of each IOP attached to the primary HPMM

> **ATTENTION**
>
> With TPN R684, when the EHPM or ENIM is configured and loaded, the text **EHPM** or **ENIM** is displayed respectively in the Auxiliary Status area on the UCN Status Display.
>
> This Auxiliary Status area of the UCN node shows any one of the following:
>
> - Control State status – when the **Control States** target is selected.
> - Auto Checkpoint state – when the **Auto Checkpt** target is selected.
> - UCN Cable status – when the **UCN Cable Status** target is selected.
> - EUCN Node Type – when no target is selected or when the **Load/Save Restore** or **Run States** target is selected.

IOP Detail Status Displays

These displays provide the operator with access to the current status of a given IOP in the High-Performance Process Manager. The display consists of a fixed portion showing information common to all IOPs, and a variable portion showing information dependent on the IOP type. The display provides operator interaction that permits the following activity.

- Resetting of the IOP error counts

- Enabling/disabling of the IOP calibration operations

- Display and alteration of the IOP specific parameters

3.3   Detail Status Display Selection Procedures

Introduction

There are three types of Detail Status displays that can be selected. The following subsections detail the procedures to invoke the initial Detail Status display. The "Display Operation" subsection (in "UCN Status Displays") details the use of the display targets and descriptions of the displays.

NIM Detail Status Display procedure

Use the following procedure to select a NIM Detail Status display.

Step	Action
1	Depress the **<SYST STAT>** (System Status) key on the console to invoke the System Status display. The System Status display is shown in Figure 88.

Step	Action
2	Choose the NIM node on the display grid and then select the **NTWK/HWY** target on the System Status display for the network you wish to examine to invoke the UCN Status display. The UCN Status display is shown in Figure 89.
3	Choose the NIM of interest on the display grid and then select the **DETAIL STATUS** target on the UCN Status display to invoke the NIM Detail Status display. The NIM Detail Status display is shown in Figure 91.

System Status display

Figure 88 System Status Display

15244

UCN Status display

Figure 89 UCN Status Display
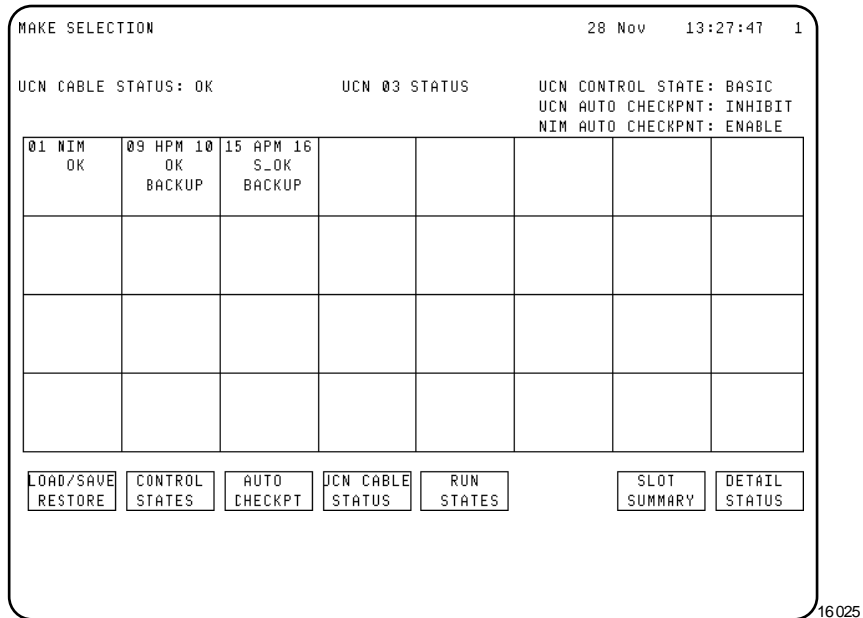
```
MAKE SELECTION                              28 Nov    13:27:47   1


UCN CABLE STATUS: OK           UCN 03 STATUS      UCN CONTROL STATE: BASIC
                                                  UCN AUTO CHECKPNT: INHIBIT
                                                  NIM AUTO CHECKPNT: ENABLE
 01 NIM   09 HPM 10 15 APM 16
    OK       OK       S_OK
          BACKUP    BACKUP



 LOAD/SAVE  CONTROL   AUTO   UCN CABLE   RUN            SLOT    DETAIL
  RESTORE   STATES  CHECKPT   STATUS    STATES        SUMMARY  STATUS

                                                                        16 025
```

Figure 90 UCN Status Display – EHPM/ENIM
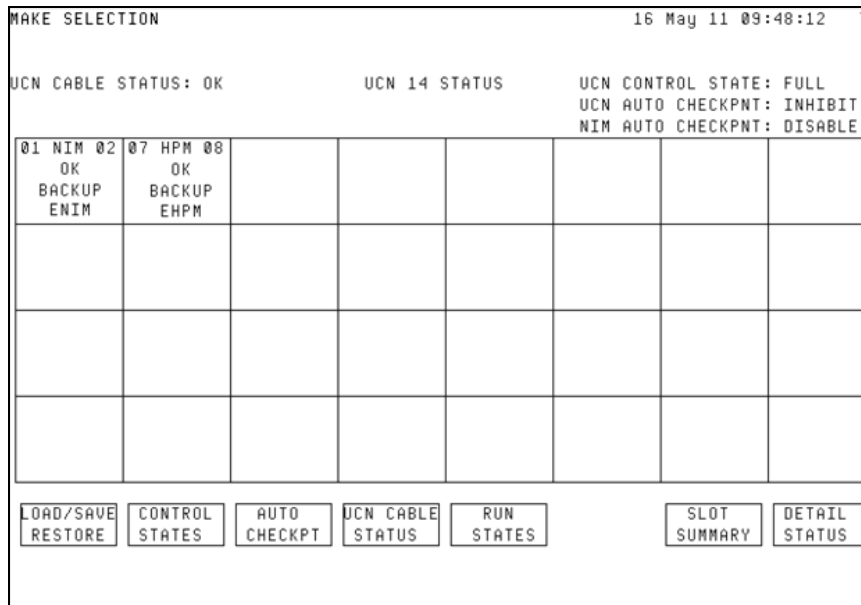
```
MAKE SELECTION                          16 May 11 09:48:12    7


UCN CABLE STATUS: OK           UCN 14 STATUS      UCN CONTROL STATE: FULL
                                                  UCN AUTO CHECKPNT: INHIBIT
                                                  NIM AUTO CHECKPNT: DISABLE
 01 NIM 02 07 HPM 08
    OK       OK
  BACKUP   BACKUP
   ENIM     EHPM



 LOAD/SAVE  CONTROL   AUTO   UCN CABLE   RUN            SLOT    DETAIL
  RESTORE   STATES  CHECKPT   STATUS    STATES        SUMMARY  STATUS
```

ATTENTION

With TPN R684, when the EHPM or ENIM is configured and loaded, the text **EHPM** or **ENIM** is displayed respectively in the Auxiliary Status area on the UCN Status Display.

This Auxiliary Status area of the UCN node shows any one of the following:

- Control State status – when the **Control States** target is selected.
- Auto Checkpoint state – when the **Auto Checkpt** target is selected.
- UCN Cable status – when the **UCN Cable Status** target is selected.
- EUCN Node Type – when no target is selected or when the **Load/Save Restore** or **Run States** target is selected.

NIM Detail Status display

Figure 91 NIM Detail Status Display

```
MAKE SELECTION                                          22 Mar 95 12:30:12   9




                   UCN DRIVER DATA :
   ┌─────────┐       PROTOCOL VERSION : 00  PROTOCOL REVISION : 01    MODEM REV : 26
   │  UCN    │        UCN LLC VERSION : 3B   UCN LLC REVISION : 01       TBC REV : 00
   │ STATS   │         DRIVER VERSION : 3B    DRIVER REVISION : 01
   ├─────────┤
   │ NIM DVR │
   │ CONFIG  │     NUMBER OF EVENT RECEIVERS :  000
   └─────────┘
                   TOKEN RING MEMBER ?  YES






   ┌─────────┐     P/S    PRIMARY  UCN CHANNEL   CHANNELA
   │ UCN  10 │     STATUS OK       UCN AUTO SWAP ENABLE
   │ NODE  3 │
   │ TYPE NIM│
   └─────────┘
```

HPMM Detail Status Display procedure

Use the following procedure to select an HPMM Detail Status display.

Step	Action
1	Depress the **<SYST STAT>** (System Status) key on the console to invoke the System Status display. The System Status display is shown in Figure 88.
2	Choose the NIM node on the display grid and then select the **NTWK/HWY** target on the System Status display for the network you wish to examine to invoke the UCN Status display. The UCN Status display is shown in Figure 89.
3	Choose the HPM of interest on the display grid and then select the **DETAIL STATUS** target on the UCN Status display to invoke the HPM Status display. The HPM Status display is shown in Figure 92.
4	Choose the HPMM (primary or secondary) of interest on the display grid and then select the **DETAIL STATUS** target on the HPM Status display to invoke the primary or secondary HPMM Detail Status display. The primary and secondary HPMM Status displays are shown in Figure 94 and Figure 95, respectively.

HPM Status display

Figure 92 HPM Status Display
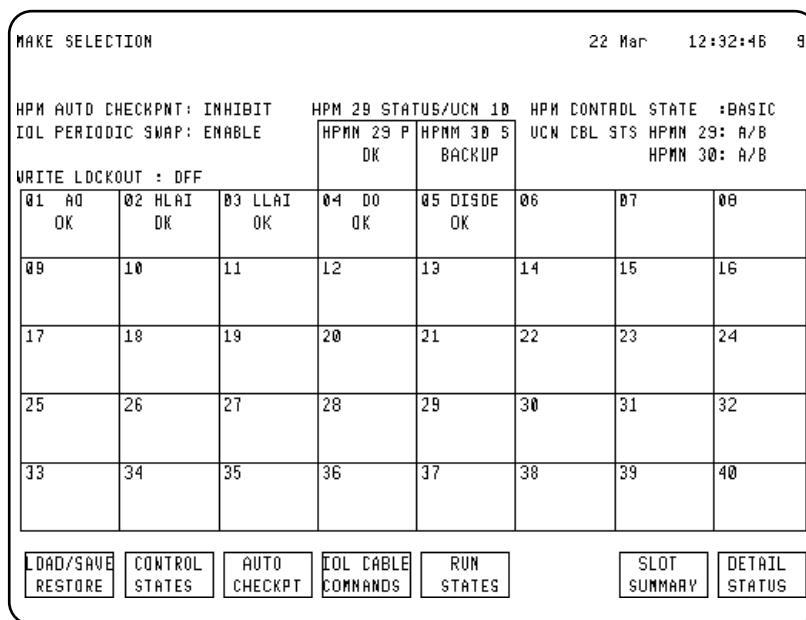
Figure 93 HPM Status Display – EHPM

```
MAKE SELECTION                                        19 May 11 17:32:06

HPM AUTO CHECKPNT: INHIBIT      HPM 07 STATUS/UCN 14   HPM CONTROL STATE  :FULL
IOL PERIODIC SWAP: ENABLE       HPMM 07 P HPMM 08 S    UCN CBL STS HPMM 07: B/A
                                    OK      BACKUP                 HPMM 08: B/A
WRITE LOCKOUT : OFF                EHPM      EHPM
┌─────────┬─────────┬─────────┬─────────┬─────────┬─────────┬─────────┬─────────┐
│01 DISOE │02   DO  │03   AO  │04   AO  │05 HLAI  │06   DO  │07   AO  │08   AO  │
│    OK   │    OK   │  OK /BKP│  OK /BKP│  OK /BKP│    OK   │    OK   │    OK   │
├─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┤
│09 HLAI  │10   DO  │11   DO  │12   DI  │13   AO  │14   AO  │15 HLAI  │16       │
│    OK   │    OK   │    OK   │    OK   │    OK   │    OK   │    OK   │         │
├─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┤
│17   DI  │18   DO  │19   DO  │20 DISOE │21   DO  │22 DISOE │         │         │
│    OK   │    OK   │    OK   │    OK   │    OK   │    OK    │         │         │
├─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┤
│25       │26       │27       │28       │29       │30       │31       │32       │
│         │         │         │         │         │         │         │         │
├─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┼─────────┤
│33       │34       │35       │36       │37       │38       │39       │40       │
│         │         │         │         │         │         │         │         │
└─────────┴─────────┴─────────┴─────────┴─────────┴─────────┴─────────┴─────────┘

┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐      ┌────────┐┌────────┐
│LOAD/SAVE││CONTROL ││  AUTO  ││IOL CABLE││  RUN   │      │ SLOT   ││ DETAIL │
│RESTORE ││ STATES ││CHECKPT ││COMMANDS ││ STATES │      │SUMMARY ││ STATUS │
└────────┘└────────┘└────────┘└────────┘└────────┘      └────────┘└────────┘
```

Primary HPMM Detail Status display

Figure 94 Primary HPMM Detail Status Display

```
MAKE SELECTION                                   22 Mar    12:34:37    9




            HLAI     Non-redundant .........
┌─────────┐ ┌──────────┐
│ UCN   10│ │ HPM   29 │ MODULE   2 PHYS ADDR 131 FILE   1 CARD    4
└─────────┘ └──────────┘
STS OK          ACTUAL TYPE HLAI      FTA Connect CONN_A
Status:
HARDWARE REV 59  FIRMWARE REV 5.0   LAST HARD FAILURE UNKNOWN


ACTIVE CABLE  CHANNELA CHN A ERR :      0 CHN A SIL :     0  ┌─────────────┐
LAST COMM ERR NONE      CHN B ERR :      0 CHN B SIL :     0  │RESET MODULE │
                                                             │COMM ERRORS  │
                                                             └─────────────┘
FTA PRESENT                   NO STANDBY MANUAL
COLD POWERUP LAST EXECUTED   SWITCHED ACTIVE

┌─────────────────┐  ┌─────────────────┐  ┌─────────────────────┐
│    Box Soft     │  │    Slot Soft    │  │   Slots with Soft   │
│    Failures     │  │    Failures     │  │      Failures       │
└─────────────────┘  └─────────────────┘  └─────────────────────┘

CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE STATE
```

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Secondary HPMM Detail Status display

Figure 95 Secondary HPMM Detail Status Display

IOP Detail Status Display procedure

Use the following procedure to select an IOP Detail Status display.

Step	Action
1	Depress the **<SYST STAT>** (System Status) key on the console to invoke the System Status display. The System Status display is shown in Figure 88.
2	Choose the NIM node on the display grid and then select the **NTWK/HWY** target on the System Status display for the network you wish to examine to invoke the UCN Status display. The UCN Status display is shown in Figure 89.
3	Choose the HPM that is associated with the IOP of interest on the display grid and then select the **DETAIL STATUS** target on the UCN Status display to invoke the HPM Status display. The HPM Status display is shown in Figure 92.
4	Choose the IOP of interest on the display grid and then select the **DETAIL STATUS** target on the HPM Status display to invoke the IOP Detail Status display. An example of an IOP Detail Status display is shown in Figure 96.

IOP Detail Status display

Figure 96 IOP Detail Status Display


```
MAKE SELECTION                                  22 Mar    12:34:37   9



             HLAI    Non-redundant ........
  ┌──────┐ ┌────────┐
  │ UCN  LO│ │ HPM  29│ MODULE   2 PHYS ADDR 131 FILE   1 CARD    4
  └──────┘ └────────┘
  STS OK        ACTUAL TYPE HLAI     FTA Connect CONN_A
  Status:
  HARDWARE REV 59  FIRMWARE REV 5.0    LAST HARD FAILURE UNKNOWN

  ACTIVE CABLE  CHANNELA CHN A ERR :     0 CHN A SIL :      0   ┌─────────────┐
  LAST COMM ERR NONE     CHN B ERR :     0 CHN B SIL :      0   │ RESET MODULE│
                                                               │ CONM ERRORS │
  FTA PRESENT                 NO STANDBY MANUAL                 └─────────────┘
  COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

  ┌───────────────┐   ┌───────────────┐   ┌──────────────────┐
  │   Box Soft    │   │   Slot Soft   │   │  Slots with Soft │
  │   Failures    │   │   Failures    │   │     Failures     │
  └───────────────┘   └───────────────┘   └──────────────────┘

  CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE STATE




```

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3.4   Display Operation

Introduction

The following subsections describe the selection procedures for the UCN Status display, and its associated displays. The status, statistics, and targets on the displays are also described.

UCN Status Displays

The UCN Status display is shown in the following figure. The display is obtained by selecting the <**SYST STATS**> (System Status) key on the console and then selecting the **PROCESS NETWORK STATUS** target on the display for the network you wish to examine.

Figure 97 UCN Status Display
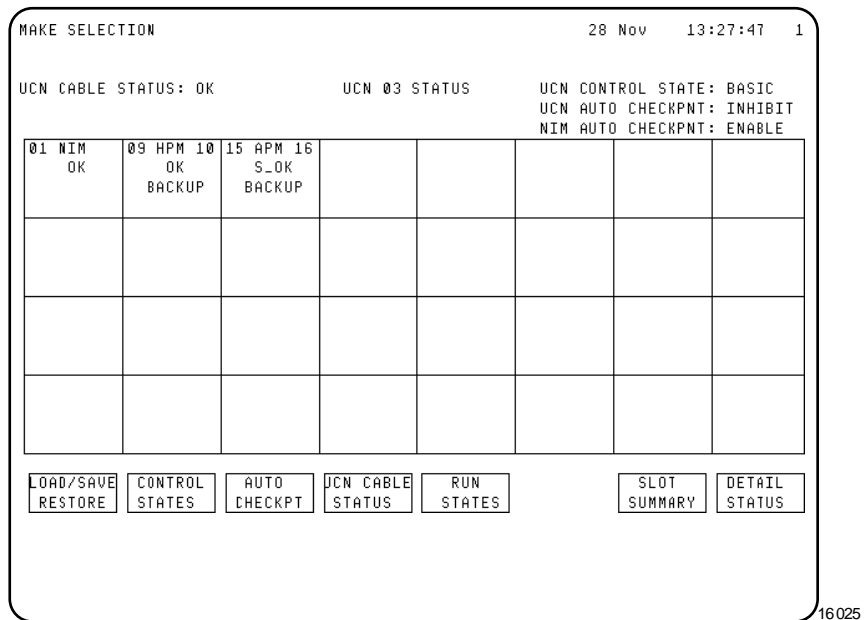
```
 MAKE SELECTION                                    28 Nov    13:27:47   1


 UCN CABLE STATUS: OK              UCN 03 STATUS        UCN CONTROL STATE: BASIC
                                                        UCN AUTO CHECKPNT: INHIBIT
                                                        NIM AUTO CHECKPNT: ENABLE
 ┌────────┬────────┬────────┬────────┬────────┬────────┬────────┐
 │01 NIM  │09 HPM 10│15 APM 16│        │        │        │        │
 │   OK   │   OK   │  S_OK  │        │        │        │        │
 │        │ BACKUP │ BACKUP │        │        │        │        │
 ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 │        │        │        │        │        │        │        │
 └────────┴────────┴────────┴────────┴────────┴────────┴────────┘

 ┌────────┬────────┬────────┬────────┬────────┐      ┌────────┬────────┐
 │LOAD/SAVE│CONTROL │ AUTO   │UCN CABLE│  RUN  │      │ SLOT   │DETAIL  │
 │RESTORE │ STATES │CHECKPT │ STATUS │ STATES │      │SUMMARY │STATUS  │
 └────────┴────────┴────────┴────────┴────────┘      └────────┴────────┘

                                                                    16 025
```

Three display sections

The display is divided into three sections.

Top section of display

The top section of the display provides information about the Universal Control Network (UCN).

The UCN status at the top of the display is defined in the following table.

Table 23 UCN Status Display – UCN/NIM Status

Term	Definition
UCN CABLE STATUS	Indicates status of the UCN cables. (OK or FAIL)
UCN CONTROL STATE	There are two control states. The BASIC state does not permit LCN devices to write to any devices on the UCN. The FULL state permits LCN devices to write to the UCN devices.
UCN AUTO CHECKPNT	There are two automatic UCN Checkpoint states. The ENABLE state permits automatic Checkpointing. The database is saved in the History Module periodically for the devices that are individually Checkpoint enabled. The INHIBIT state prevents all devices on the UCN from Checkpointing.
NIM AUTO CHECKPNT	There are two automatic NIM Checkpoint states. The ENABLE state permits automatic Checkpointing. The database is saved in the History Module periodically for the devices that are individually Checkpoint enabled. The DISABLE state prevents all devices on the UCN from Checkpointing.

Middle section of display

The "status boxes" in the middle grid-like section of the display provide the status of the configured UCN node.

Type of device

The type of device on the UCN is identified at the upper center of the status box, such as HPM, APM, PM, LM, or NIM.

Primary or secondary

When redundant, the numerals in the left and right upper corners identify the primary and secondary (if present) node addresses of the device, respectively.

Device status

Two lines in the center of the status box indicate the device's primary and secondary (if present) status. For the HPM, the first line is the composite status of the primary HPMM, and the second line is the status of the secondary HPMM. The composite primary HPMM status reflects the status of the HPMM and all the IOPs.

Auxillary status

With TPN R684, when the EHPM or ENIM is configured and loaded, the text **EHPM** or **ENIM** is displayed respectively in the Auxiliary Status area on the UCN Status Display.

This Auxiliary Status area of the UCN node shows any one of the following:

- Control State status – when the **Control States** target is selected.

- Auto Checkpoint state – when the **Auto Checkpt** target is selected.

- UCN Cable status – when the **UCN Cable Status** target is selected.

- EUCN Node Type – when no target is selected or when the **Load/Save Restore** or **Run States** target is selected.Status box target

The status box is also a target. A command target selected at the bottom of the display will execute the command, if applicable, for the status box chosen.

Selecting the status box target

When chosen, the status box is backlighted blue and the primary HPMM address is highlighted in white. Choosing the same status box a second time, before selecting a command target, highlights the secondary HPMM address. A status box selection toggles between the primary HPMM address and the secondary HPMM address each time it is chosen. Selecting a command target will execute a command against the primary or secondary HPMM, whichever has been chosen.

Primary HPMM status

The possible status of the primary HPMM is defined in the following table with the color of the text indicated.

Table 24 UCN Status Display – Primary HPMM Status

Term	Definition
OK (Text color – blue)	Processing is in progress.
ALIVE (Text color – yellow)	Power is present, but no database or personality program is loaded.
IDLE (Text color – yellow)	The database and personality program are loaded, but no processing is in progress.
IOIDLE (Text color – yellow)	One or more IOPs are in the Idle state.
LOADING (Text color – yellow)	The HPM is being loaded with its personality program and database.
NOTCONFG (Text color – yellow)	There is no UCN node configured for the HPM's UCN node address.
POWERON (Text color – yellow)	The HPM is responding to the UCN but has not performed its self-tests. This is a transitory state that occurs when the HPMM is first powered on.
CONFGMIS (Text color – red)	The configured node type for the HPM's UCN node does not match the actual node type.
FAIL (Text color – red)	The HPM has a Hard failure and access to IOP status and data is unavailable. HPM control functions have ceased. Effectively, this is a total failure.

Term	Definition
OFFNET (Text color – red)	The HPM is not responding on the UCN because 1) it does not exist, 2) power is off, or 3) there is a hardware failure that prohibits a response.
PARTFAIL (Text color – red)	There are one or more Partial failures.
PF_IDLE (Text color – red)	There are one or more Partial failures and the HPMM is in the Idle state.
PF_IOIDL (Text color – red)	There are one or more Partial failures, and at least one IOP is in the Idle state.

Secondary HPMM status

The possible status of the secondary HPMM is defined in the following table with the color of the text indicated.

Table 25 UCN Status Display – Secondary HPMM Status

Term	Definition
BACKUP (Text color – blue)	Processing is in progress and the secondary HPMM database is synchronized with the primary HPMM database.
BKUP_SF (Text color – blue)	The HPMM is in the Run state, but has a Soft failure.
ALIVE (Text color – yellow)	Power is present, but no database or personality program is loaded.
BACKUP (Text color – yellow)	The secondary HPMM is in the Idle state, or its database is not synchronized with the primary HPMM.
BKUP_SF (Text color – yellow)	The HPMM is in the Idle state, but has a Soft failure.

LOAD/SAVE RESTORE Target

Selection of the **LOAD/SAVE RESTORE** command target on the UCN Status display invokes additional targets at the bottom of the display either to load the personality program, restore the database, or save the database for the UCN device chosen by its status box as shown in the following figure.

Figure 98 UCN Status Display – LOAD/SAVE RESTORE Target Selected

```
MAKE SELECTION                                09 Nov    12:53:17   1


UCN CABLE STATUS: OK              UCN 03 STATUS    UCN CONTROL STATE: BASIC
                                                  UCN AUTO CHECKPNT: INHIBIT
                                                  NIM AUTO CHECKPNT: ENABLE
 01 NIM    09 HPM 10 15 APM 16
    OK        OK       S_OK
            BACKUP    BACKUP




 LOAD/SAVE  CONTROL   AUTO    UCN CABLE    RUN         SLOT      DETAIL
 RESTORE    STATES   CHECKPT   STATUS    STATES      SUMMARY    STATUS
 PROGRAM   RESTORE    SAVE     LADDER    LADDER      CANCEL      ENTER
 LOAD       DATA      DATA      LOAD      SAVE
```

16030
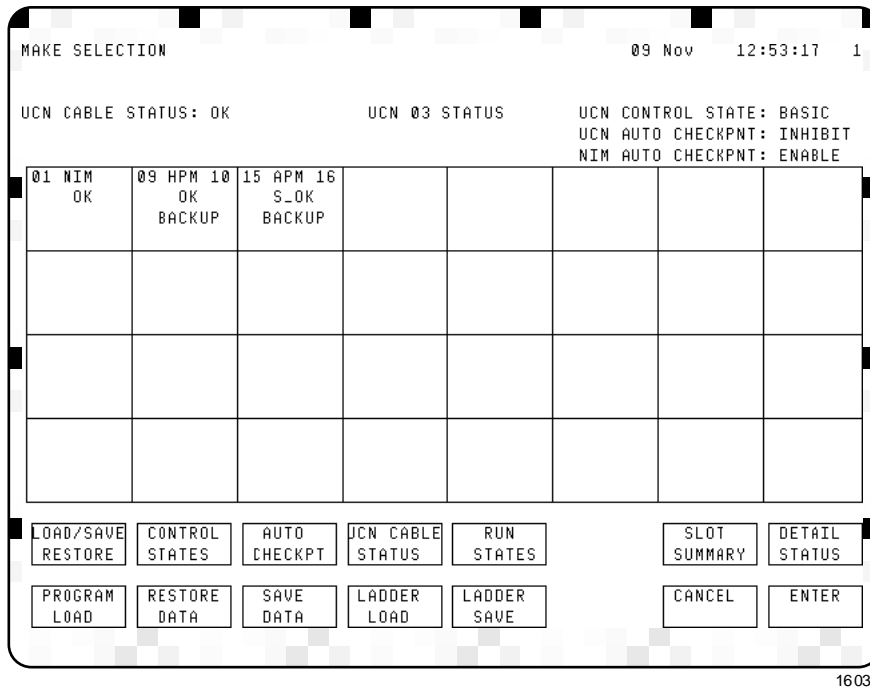
Not applicable for NIM

The LOAD/SAVE RESTORE target functions are not applicable when a NIM is chosen on the UCN Status display.

Command targets

The command targets at the bottom of the display in Figure 98 perform the functions defined in Table 26 UCN Status Display – LOAD/SAVE RESTORE.

LOAD/SAVE RESTORE display targets

The command targets at the bottom of the display in Figure 98 perform the functions that are defined in the following table.

Table 26 UCN Status Display – LOAD/SAVE RESTORE

Target	Function
PROGRAM LOAD	Loads the program and data to the chosen UCN device. The device must be in the Alive state. The command is executed by selecting the ENTER target.
RESTORE DATA	Restores the database to the chosen UCN device. The device must be in the Idle state. The command is executed by selecting the ENTER target.
SAVE DATA	Saves the database from the chosen UCN device into either the History Module or removable media. This is sometimes called "Checkpointing." The command is executed by selecting the ENTER target.
LADDER LOAD	This is a Logic Manager function.
LADDER SAVE	This is a Logic Manager function.
CANCEL	Clears the LOAD PROGRAM, RESTORE DATA, SAVE DATA, LADDER LOAD, LADDER SAVE, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen LOAD/SAVE RESTORE function to be executed.

CONTROL STATES Target

Selecting the **CONTROL STATES** command target on the UCN Status display in the following figure invokes additional targets at the bottom of the display to change the control state of the UCN or the UCN device chosen by its status box.

Figure 99 UCN Status Display – CONTROL STATES Target Selected

16031
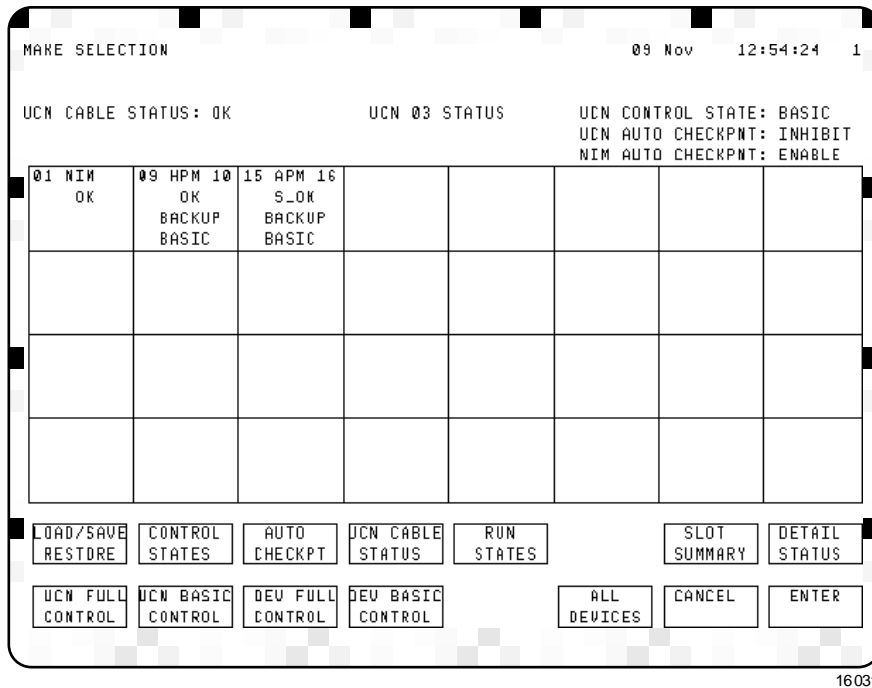
Not applicable for NIM

The CONTROL STATES target functions are not applicable when a NIM is chosen on the UCN Status display.

CONTROL STATES display targets

The command targets at the bottom of the display in Figure 99 perform the functions defined in the following table.

Table 27 UCN Status Display – CONTROL STATES Target Selected

Target	Function
UCN FULL CONTROL	Changes the UCN's control state to FULL. The command is executed by selecting the ENTER target.
UCN BASIC CONTROL	Changes the UCN's control state to BASIC. The command is executed by selecting the ENTER target.
DEV FULL CONTROL	Changes the HPM's control state to FULL. The command is executed by selecting the ENTER target.
DEV BASIC CONTROL	Changes the HPM's control state to BASIC. The command is executed by selecting the ENTER target.
ALL DEVICES	Causes all the UCN devices to be affected by a control state change.
CANCEL	Clears the UCN FULL CONTROL, UCN BASIC CONTROL, DEV FULL CONTROL, DEV BASIC CONTROL, ALL DEVICES, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen CONTROL STATES function to be executed.

AUTO CHECKPT Target

Selection of the **AUTO CHECKPT** command target invokes additional targets at the bottom of the display to change the Checkpointing state of the UCN or of the UCN device chosen by its status box as shown in the following figure.

Figure 100 UCN Status Display – AUTO CHECKPT Target Selected


```
MAKE SELECTION                                    09 Nov    12:55:13   1


UCN CABLE STATUS: OK              UCN 03 STATUS      UCN CONTROL STATE: BASIC
                                                    UCN AUTO CHECKPNT: INHIBIT
                                                    NIM AUTO CHECKPNT: ENABLE
 01 NIM    09 HPN 10 15 APM 16
    OK         OK       S_OK
            BACKUP    BACKUP
            INHIBIT   INHIBIT




 LOAD/SAVE  CONTROL   AUTO     UCN CABLE    RUN              SLOT     DETAIL
 RESTORE    STATES    CHECKPT  STATUS       STATES         SUMMARY   STATUS

 UCN CKPT   UCN CKPT  DEV CKPT DEV CKPT                    CANCEL    ENTER
 ENABLE     INHIBIT   ENABLE   INHIBIT
```

16032
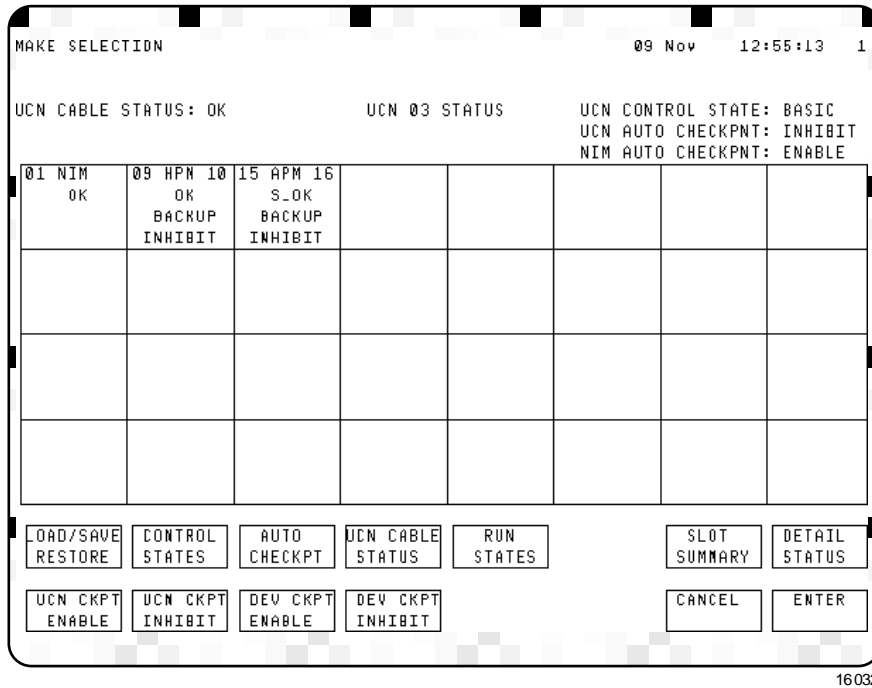
Not applicable for NIM

The AUTO CHECKPT target functions are not applicable when a NIM is chosen on the UCN Status display.

AUTO CHECKPT display targets

The command targets at the bottom of the display in Figure 100 perform the functions defined in the following table.

Table 28 UCN Status Display – AUTO CHECKPT Target Selected

Target	Function
UCN CKPT ENABLE	Enables automatic Checkpointing of all the UCN devices. The command is executed by selecting the ENTER target.
UCN CKPT INHIBIT	Disables automati Checkpointing of all the UCN devices. The command is executed by selecting the ENTER target.
DEV CKPT ENABLE	Enables automatic Checkpointing of the UCN device chosen by its status box. The command is executed by selecting the ENTER target.
DEV CKPT INHIBIT	Disables automatic Checkpointing of the UCN device chosen by its status box. The command is executed by selecting the ENTER target.
CANCEL	Clears the UCN CKPT ENABLE, UCN CKPT INHIBIT, DEV CKPT ENABLE, DEV CKPT INHIBIT, and ENTER command targets.
ENTER	The ENTER target must be selected for the chosen AUTO CHECKPT function to be executed.

UCN CABLE STATUS Target

Selection of the **UCN CABLE STATUS** target on the UCN Status display as shown in the following figure invokes additional targets at the bottom of the display to change the active UCN cable or enable/disable automatic cable swapping.

Figure 101 UCN Status Display – UCN CABLE STATUS Target Selected


```
MAKE SELECTION                                    18 Sep    07:23:40   1


UCN CABLE STATUS: OK          UCN 03 STATUS    UCN CONTROL STATE: BASIC
                                               UCN AUTO CHECKPNT: INHIBIT
                                               NIM AUTO CHECKPNT: ENABLE
 01 NIM   09 HPM 10 15 APM 16
    OK        OK        OK
           BACKUP    BACKUP
 A/B     A/B  A/B  A/B  A/B
```

16115
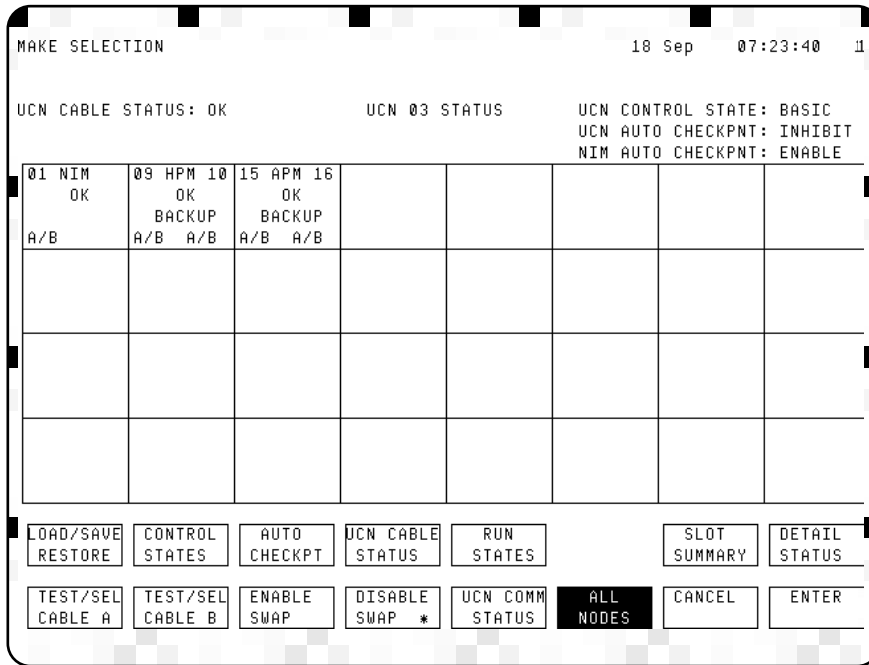
UCN COMM STATUS target

If a UCN node is selected after the **UCN COMM STATUS** target is selected, the **ENABLE SWAP** and **DISABLE SWAP** targets are removed at the bottom of the display, and the **TEST/SEL CABLE A** and **TEST/SEL CABLE B** targets are replaced by the **BACKUP CABLE TST** target as shown in Figure 102 and Figure 103.

BACKUP CABLE TST target

If the **BACKUP CABLE TST** target is selected, the UCN node will perform the Backup Cable test.

NIM node/UCN CABLE STATUS targets selected

Figure 102 UCN Status Display – NIM Node and UCN CABLE STATUS Targets Selected

```
MAKE SELECTION                              12 Sep    08:45:51   1

WARNING: FOR DIAGNOSTIC USE ONLY; CAN CAUSE CABLE FAILURES
UCN CABLE STATUS: OK               UCN 03 STATUS     UCN CONTROL STATE: BASIC
                                                    UCN AUTO CHECKPNT: INHIBIT
                                                    NIM AUTO CHECKPNT: ENABLE
01 NIM | 09 HPM 10 | 15 APM 16
   OK  |    OK     |    OK
       |  BACKUP   |  BACKUP
B/A    | B/A   B/A | B/A   B/A






LOAD/SAVE  CONTROL    AUTO    UCN CABLE    RUN              SLOT     DETAIL
RESTORE    STATES   CHECKPT   STATUS      STATES          SUMMARY   STATUS

  BACKUP            ENABLE   DISABLE   UCN COMM   ALL     CANCEL    ENTER
CABLE TST            SWAP    SWAP  *   STATUS    NODES
```
16 126

HPM node/UCN CABLE STATUS targets selected

Figure 103 UCN Status Display – HPM Node and UCN CABLE STATUS Targets Selected

```
MAKE SELECTION                              18 Sep 95 07:25:30   1

WARNING: FOR DIAGNOSTIC USE ONLY; CAN CAUSE CABLE FAILURES
UCN CABLE STATUS: OK               UCN 03 STATUS     UCN CONTROL STATE: BASIC
                                                    UCN AUTO CHECKPNT: INHIBIT
                                                    NIM AUTO CHECKPNT: ENABLE
01 NIM | 09 HPM 10 | 15 APM 16
   OK  |    OK     |    OK
       |  BACKUP   |  BACKUP
B/A    | B/A   B/A | B/A   B/A






LOAD/SAVE  CONTROL    AUTO    UCN CABLE    RUN              SLOT     DETAIL
RESTORE    STATES   CHECKPT   STATUS      STATES          SUMMARY   STATUS

  BACKUP            ENABLE   DISABLE   UCN COMM   ALL     CANCEL    ENTER
CABLE TST            SWAP    SWAP  *   STATUS    NODES
```

UCN CABLE STATUS targets

The following table defines the functions of the **UCN CABLE STATUS** targets.

Table 29 UCN CABLE STATUS Target Selected

Target	Function
TEST/SEL CABLE A	Initiates a Backup Cable Test sequence for UCN cable A. If no faults are detected, UCN cable A is activated for all UCN devices. The command is executed by selecting the ENTER target.
TEST/SEL CABLE B	Initiates a Backup Cable Test sequence for UCN cable B. If no faults are detected, UCN cable B is activated for all UCN devices. The command is executed by selecting the ENTER target.
ENABLE SWAP	Enables periodic swapping of the UCN cables. The command is executed by selecting the ENTER target.
DISABLE SWAP	Disables periodic swapping of the UCN cables. The command is executed by selecting the ENTER target.
ALL NODES	Enables all UCN nodes to be affected by the cable function.
CANCEL	Clears the BACKUP CABLE TST, TEST/SEL CABLE A, TEST/SEL CABLE B, ENABLE SWAP, DISABLE SWAP, UCN COMM STATUS, ALL NODES, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen UCN CABLE STATUS function to be executed.

Target	Function
UCN COMM STATUS	Selecting the UCN COMM STATUS target produces the UCN Network Statistics display as shown in Figure 104 which displays the statistics of the UCN nodes and provides the capability to do a global reset of the communications statistics. The reset is executed by first selecting the RESET STATS target and then selecting the ENTER target. When a node (NIM or HPM) is selected on the UCN Network Statistics display, the TEST/SEL CABLE A, TEST/SEL CABLE B, ENABLE SWAP, and DISABLE SWAP targets are replaced by the BACKUP CABLE TST target as shown in Figure 105. Selecting one of the SELECT NODES targets on the UCN Statistics display displays the statistics for a group of sixteen UCN nodes.The initial UCN Network Statistics display provides statistics for the first group of sixteen (16) nodes on the Universal Control Network that you previously selected. There are four groups. The node group of interest is chosen by selecting one of four targets, SELECT NODES 1-16 (initially displayed), 17-32, 33-48, or 49-64. The UCN Network Statistics 1-16 display selected by the SELECT NODES 1-16 target is shown in Figure 104 and Figure 105. Selecting the RESET STATS target, followed by selecting the ENTER target, resets the UCN node statistics. When the BACKUP CABLE TST target is selected, followed by selecting the ENTER target on the UCN Statistics display, the selected UCN node will perform a test of the UCN backup cable (the one not currently selected). This will test the selected node's transmitter and the other nodes' receivers on the backup cable. When the TEST/SEL CABLE A or TEST/SEL CABLE B target is selected, followed by the ENTER command, the selected NIM will execute the Backup Cable test unless double cable faults are present. In this case, it will direct the NIM to recover the view to all nodes on the selected cable if possible. This assumes that the cable selected has been repaired.

ATTENTION

With TPN R684, on EUCN systems, UCN coaxial cables are replaced by FTE cables. FTE does not use the concept of "Active" cable, rather it selects the best path to communicate with target nodes. EUCN continues to show active cable for consistency and an indication that cable commands can be sent and processed; however, "Active" cable plays no part in cable redundancy.

UCN Network Statistics display

Figure 104 UCN Network Statistics Display

```
MAKE SELECTION                                  12 Sep    08:48:52   ⌐

                    UCN STATISTICS - NETWORK    ┌─ 3 ─┐

 ND TYP CBL  A   B   A   B  SWAP NOISE FRAME PASS  CKSUM REPTR AUTO  TIME SYNCH
            SIL SIL NSY NSY DIS. COUNT FRAGS RPTS  ERRS  ERRS  RECON    STATUS
 ───────────────────────────────────────────────────────────────────────────

  1  NIM  A                   0    3    10    0     0     0   FAILED
  2
  3
  4
  5
  6
  7
  8
  9  HPM  A                   0    0     0    0     0     0   FAILED
 10  HPM  A                   0    0     0    0     0     0   FAILED
 11
 12
 13
 14
 15  APM  A                   0    0     0    0     0     0   FAILED
 16  APM  A                   0    0     0    0     0     0   FAILED

Select  │ 1-16 │17-32│TEST/SEL│TEST/SEL│Enable │Disable │Reset │ALL  │ENTER│
Nodes   │33-48 │49-64│CABLE A │CABLE B │Swap   │Swap *  │Stats │NODES│     │
```
                                                                    15 248

UCN Network Statistics display with UCN node chosen

Figure 105 UCN Network Statistics Display – UCN Node Selected

```
MAKE SELECTION                                  12 Sep    08:49:42   ⌐

                    UCN STATISTICS - NETWORK    ┌─ 3 ─┐

 ND TYP CBL  A   B   A   B  SWAP NOISE FRAME PASS  CKSUM REPTR AUTO  TIME SYNCH
            SIL SIL NSY NSY DIS. COUNT FRAGS RPTS  ERRS  ERRS  RECON    STATUS
 ───────────────────────────────────────────────────────────────────────────

  1  NIM  A                   0    3    10    0     0     0   FAILED
  2
  3
  4
  5
  6
  7
  8
  9  HPM  A                   0    0     0    0     0     0   FAILED
 10 ████████████████████████  0    0     0    0     0    0█  FAILED
 11
 12
 13
 14
 15  APM  A                   0    0     0    0     0     0   FAILED
 16  APM  A                   0    0     0    0     0     0   FAILED

Select  │ 1-16 │17-32│BACKUP    │              │Reset │ALL  │ENTER│
Nodes   │33-48 │49-64│CABLE TST │              │Stats │NODES│     │
```
                                                                    15 249
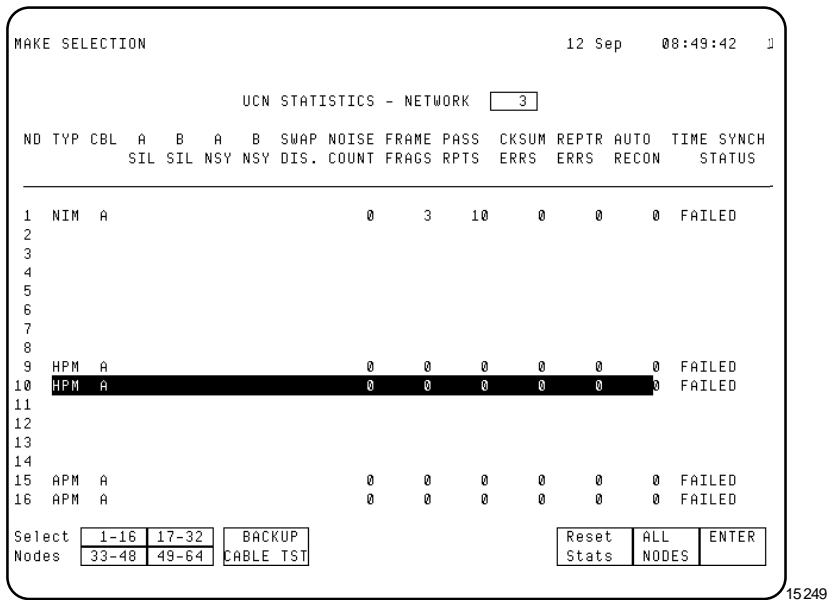
UCN Network Statistics display definitions

The information in the UCN Network Statistics display is defined in the following table.

Table 30 UCN Network Statistics Display Definitions

Term	Definition
ND	The node number.
TYP	The hardware type of node (NIM, LM, HPM, APM, or PM).
CBL	The active UCN cable (A or B).
A SIL	An asterisk indicates the node detected a silence event for Cable A.
B SIL	An asterisk (*) indicates the node detected a silence event for Cable B.
A NSY	An asterisk (*) indicates the node detected a noise event for Cable A.
B NSY	An asterisk (*) indicates the node detected a noise event for Cable B.
SWAP DIS	An asterisk (*) indicates that UCN cable auto-swap is disabled (partial frame with missing start delimiter).
NOISE COUNT	The total number of times the node detected a noise event (partial frame with missing end delimiter).
FRAME FRAGS	The total number of times the node detected frame fragments.
PASS RPTS	The total number of times the node retried a token pass to a successor node.
CKSUM ERRS	The total number of times the node detected a checksum error.
REPTR ERRS	The total number of times the node detected a repeater error.
AUTO RECON	The total number of times the node attempted auto reconnect.
TIME SYNCH STATUS	The status of the node's Time Synch. (INITIAL, FAILED, SYNC FAILED, DEGRADED, LCN BAD, LCN OK, or OK).

Table 31 EUCN Network Statistics Display Definitions

Term	Definition
ND	The node number.
TYP	For EHPM, the node type on this display shows HPM.
CBL	The indication of a cable failure is the same as with the traditional coaxial cable. However with FTE, the EUCN network can ride through a single cable fault per node. Multiple cable faults can be mixed across nodes (For example, a fault on cable **A** on EHPM 7, and a fault on cable **B** on EHPM 9). In FTE, the definition of the **active** cable has no meaning. FTE does not have an active cable. However, it uses the best cable, and both the cables are connected through the crossover cable.
A SIL	If one of the FTE cables is disconnected or has failed, then the **A SIL** is marked with an asterisk. This also causes the UCN cable to be marked/alarmed as **FAIL**.
B SIL	If one of the FTE cables is disconnected or has failed, then the **B SIL** will be marked with an asterisk. This will also cause the UCN cable to be marked/alarmed as **FAIL**.
A NSY	If the cross-over cable (at the FTE switch) is disconnected, then both the **A NSY** or **B NS** is marked, and this also causes the UCN cable to be marked/alarmed as **FAIL**.
B NSY	If the cross-over cable (at the FTE switch) is disconnected, then both the **A NSY** or **B NS** is marked, and this also causes the UCN cable to be marked/alarmed as **FAIL**.
SWAP DIS	An asterisk (*) indicates that UCN cable auto-swap is disabled (partial frame with missing start delimiter).
NOISE COUNT	For FTE, this statistic has no meaning, it is always zero (0).
FRAME FRAGS	For FTE, this statistic has no meaning, it is always zero (0).
PASS RPTS	For FTE, this statistic has no meaning, it is always zero (0).
CKSUM ERRS	For FTE, this statistic has no meaning, it is always zero (0).
REPTR ERRS	For FTE, this statistic has no meaning, it is always zero (0).
AUTO RECON	The total number of times the node attempted auto reconnect.
TIME SYNCH STATUS	The status of the node's Time Synch. (INITIAL, FAILED, SYNC FAILED, DEGRADED, LCN BAD, LCN OK, or OK).

RUN STATES Target

Selection of the **RUN STATES** command target on the UCN Status display as shown in the following figure invokes additional targets at the bottom of the display to startup or idle the chosen UCN device.

Figure 106 UCN Status Display – RUN STATES Target Selected
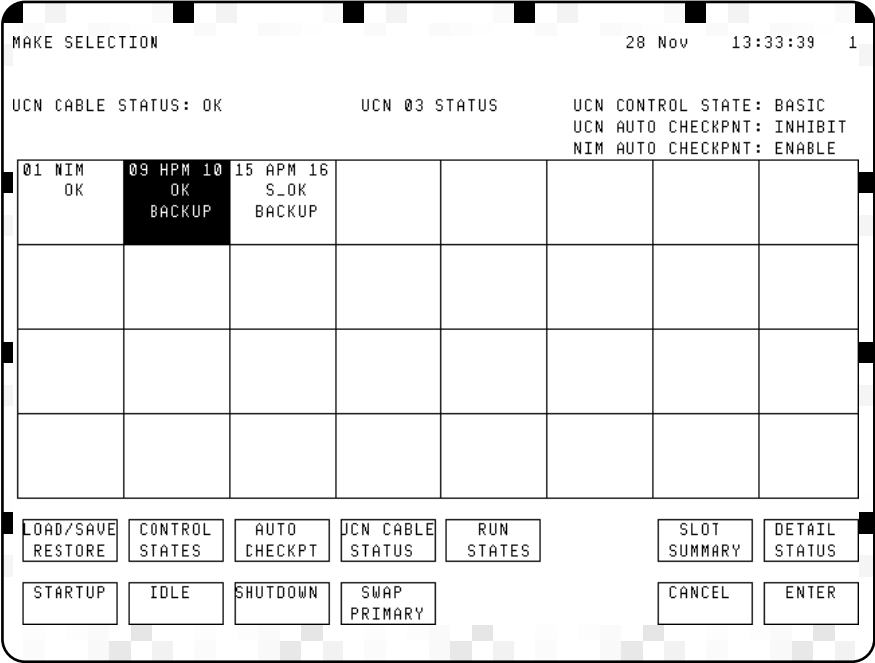
```
┌─────────────────────────────────────────────────────────────────┐
│ MAKE SELECTION                             28 Nov    13:33:39   1  │
│                                                                   │
│ UCN CABLE STATUS: OK          UCN 03 STATUS    UCN CONTROL STATE: BASIC │
│                                                UCN AUTO CHECKPNT: INHIBIT │
│                                                NIM AUTO CHECKPNT: ENABLE │
│  ┌────────┬────────┬────────┬────────┬────────┬────────┬────────┐ │
│  │01 NIM  │09 HPM 10│15 APM 16│        │        │        │        │ │
│  │   OK   │   OK   │  S_OK  │        │        │        │        │ │
│  │        │ BACKUP │ BACKUP │        │        │        │        │ │
│  ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤ │
│  │        │        │        │        │        │        │        │ │
│  │        │        │        │        │        │        │        │ │
│  ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤ │
│  │        │        │        │        │        │        │        │ │
│  │        │        │        │        │        │        │        │ │
│  ├────────┼────────┼────────┼────────┼────────┼────────┼────────┤ │
│  │        │        │        │        │        │        │        │ │
│  │        │        │        │        │        │        │        │ │
│  └────────┴────────┴────────┴────────┴────────┴────────┴────────┘ │
│  ┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐    ┌────────┐┌────────┐ │
│  │LOAD/SAVE││CONTROL ││  AUTO  ││UCN CABLE││  RUN   │    │  SLOT  ││ DETAIL │ │
│  │RESTORE ││STATES  ││CHECKPT ││STATUS  ││STATES  │    │SUMMARY ││STATUS  │ │
│  └────────┘└────────┘└────────┘└────────┘└────────┘    └────────┘└────────┘ │
│  ┌────────┐┌────────┐┌────────┐┌────────┐              ┌────────┐┌────────┐ │
│  │STARTUP ││  IDLE  ││SHUTDOWN││  SWAP  │              │ CANCEL ││ ENTER  │ │
│  │        ││        ││        ││PRIMARY │              │        ││        │ │
│  └────────┘└────────┘└────────┘└────────┘              └────────┘└────────┘ │
└─────────────────────────────────────────────────────────────────┘
                                                            16033
```

Not applicable for NIM

The RUN STATES target functions are not applicable when a NIM is chosen on the UCN Status display.

RUN STATES display targets

The command targets at the bottom of the display in Figure 106 perform the functions defined in the following table.

Table 32 UCN Status Display – RUN STATES Target Selected

Target	Function
STARTUP	Provides COLD and WARM STARTUP targets for starting the HPM on the UCN that was chosen by its status box. Changes the HPM chosen and all the IOPs that have a valid database from the Idle state to the OK state. The HPM will then begin processing data. The command is executed by selecting the ENTER target.
IDLE	The HPM is placed in a state where its microprocessor is running, but the HPM is not controlling the process. The HPM and all IOPs are set to the Idle state. The command is executed by selecting the ENTER target.
SHUTDOWN	Changes the chosen HPM from the Idle state to the Alive state. To place the HPM back in service after SHUTDOWN, its program and database must be reloaded using the LOAD/SAVE RESTORE target. The command is executed by selecting the ENTER target.
RECOVER	The RECOVER target replaces the SHUTDOWN target when the HPM indicates a fail status. Selecting the RECOVER target executes a SHUTDOWN command that results in the HPM recovering automatically, if possible, or entering the Alive state. The Alive state is the state from which an operator would initiate a reload and the eventual recovery.
SWAP PRIMARY	Swaps HPMMs in the chosen HPM. The present primary HPMM becomes the secondary HPMM. The command is executed by selecting the ENTER target.
CANCEL	Clears the STARTUP, IDLE, SHUTDOWN, SWAP PRIMARY, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen RUN STATES function to be executed.

REBOOT	Beginning with Experion R511.5, the RUN STATES target in the Native Window's UCN Status and UCN Detailed Status displays has the REBOOT option for a C300PM. A C300PM in IDLE/BACKUP state can be rebooted using this option.
	NOTE: When a C300PM is in OFFNET state in Native Window, the RUN STATES target does not show the REBOOT option in Native Window. It shows the default option SHUTDOWN, which is not applicable for a C300PM in OFFNET state.
	Use the following action to perform reboot operation.
	• From Firmware Manager, right-click on the Device Index and click REBOOT.

SLOT SUMMARY Target

Selection of the **SLOT SUMMARY** command target on the UCN Status display as shown in Figure 107 invokes the Slot Summary Menu display. The point type of interest is selected on the display. The selection provides a Slot Summary display for the point type that displays the contents (point ID, descriptor, and active/inactive state) in the chosen HPM.

Choose the HPM of interest on the UCN Status display selection grid and then select the **SLOT SUMMARY** target.

Figure 107 UCN Status Display – SLOT SUMMARY Target Selected

```
MAKE SELECTION                                    22 Mar   12:52:27   9

                            SLOT SUMMARY

      UCN 10  DEVICE  29  MODULE HPMM



            ■  LOGIC POINTS

            ■  DIGITAL COMPOSITE POINTS

            ■  TIMER POINTS

            ■  FLAG POINTS

            ■  NUMERIC POINTS

            ■  REGULATORY CONTROL POINTS

            ■  REGULATORY PV POINTS

            ■  PROCESS MODULE POINTS

            ■  ARRAY POINTS

            ■  DEVICE CONTROL POINTS
```

16034
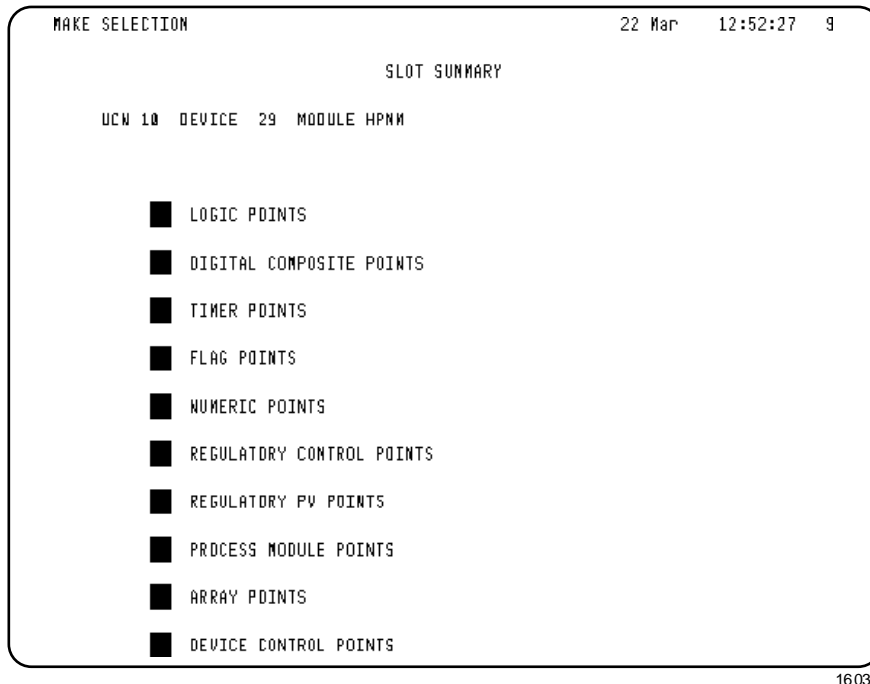
Not applicable for NIM

The SLOT SUMMARY target functions are not applicable when a NIM is chosen on the UCN Status display.

REGULATORY CONTROL POINTS target

An example of this is the Process Module Points display as shown in the following figure. Selecting the **REGULATORY CONTROL POINTS** target on the Slot Summary Menu display invokes the display. The Slot Summary display provides access to commands that active or deactivates slots.

Figure 108 UCN Status Display – REGULATORY CONTROL POINTS Target Selected

```
 MAKE SELECTION                               22 Mar   12:53:27   9

                            SLOT SUMMARY

      UCN 10  DEVICE  29  MODULE HPMM – REGCTL              PAGE   1

            SLOT    POINT ID        DESCRIPTOR       PTEXECST

             1
             2
             3
             4
             5
             6
             7
             8
             9
            10
            11
            12
            13
            14
            15
            16


        ┌────────┐  ┌────────┐                       ┌──────────┐
        │  PAGE  │  │  SLOT  │                       │  POINT   │
        │ SELECT │  │ SELECT │                       │TYPE MENU │
        └────────┘  └────────┘                       └──────────┘
```

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Process Module Points display targets

Three targets are available on the Process Module Points display.

- Selecting the **PAGE SELECT** target produces a **ENTER PAGE NUMBER** response. Enter the page number of interest.

- Selecting the **SLOT SELECT** target produces a **ENTER SLOT NUMBER** response. Enter the slot number of interest.

- The **POINT TYPE MENU** target returns you to the Slot Summary Menu display.

DETAIL STATUS Target

Selection of the **DETAIL STATUS** command target on the UCN Status display invokes either the NIM Detail Status display as shown in Figure 91 or the HPM Status display as shown in Figure 109.

System Error Journal Messages

In an Enhanced Universal Control Network (EUCN), the FTE cable errors reported in HM error messages are interpreted in the same way as the UCN cable errors.

3.5   HPM Status Displays

Introduction

The following subsections describe the selection procedures for the HPM Status display, and its associated displays. The status, statistics, and targets on the displays are also described.

HPM Status Displays

The HPM Status display is shown in the following figure. The display is obtained by selecting the <**SYST STATS**> (System Status) key on the console and then selecting the **PROCESS NETWORK STATUS** target on the display for the network you wish to examine. Choose the High-Performance Process Manager associated with the HPMM to be displayed. Select the **DETAIL STATUS** target to obtain the HPMM Status display.

Figure 109 HPM Status Display


```
MAKE SELECTION                                    22 Mar    12:54:49    9


HPM AUTO CHECKPNT: INHIBIT    HPM 29 STATUS/UCN 10  HPM CONTROL STATE   :BASIC
IOL PERIODIC SWAP: ENABLE     HPMM 29 P HPMM 30 S   UCN CBL STS HPMM 29: A/B
                                   OK      BACKUP               HPMM 30: A/B
WRITE LOCKOUT : OFF
 01    AO      02 HLAI    03 LLAI    04    DO    05 DISOE   06        07        08
       OK         OK         OK          OK         OK

 09        10         11         12         13         14        15        16

 17        18         19         20         21         22        23        24

 25        26         27         28         29         30        31        32

 33        34         35         36         37         38        39        40

 LOAD/SAVE  CONTROL    AUTO     IOL CABLE    RUN                SLOT      DETAIL
  RESTORE   STATES    CHECKPT   COMMANDS    STATES            SUMMARY    STATUS

                                                                          16 036
```

Three display sections

The display is divided into three sections.

Top section of display

The top section of the display provides information about the UCN and High-Performance Process Manager.

The UCN and HPM status at the top of the display is defined in the following table.

Table 33 HPM Status Display – UCN and HPM Status

Term	Definition
HPM AUTO CHECKPNT	Indicates whether automatic Checkpoint storage to the History Module is enabled. (ENABLE or INHIBIT)
IOL PERIODIC SWAP	Indicates whether the I/O Link communications cable selection (cable A or cable B) is swapped periodically. (ENABLE or INHIBIT)
HPM CONTROL STATE	When in the BASIC state, LCN devices, such as the AM or CM, are prohibited from writing to the HPM. If in the FULL state, LCN devices are permitted to write to the HPM, providing the entire UCN is also in the FULL state.
UCN CBL STS	Identifies the HPMM's UCN node and identifies the active and inactive UCN cables, A or B. (B/A or A/B)

Middle section of display

The middle grid-like section of the display provides status information about the primary and secondary (if redundant) HPMMs and IOPs in the High-Performance Process Manager.

Status boxes

There are two HPMM "status boxes" and 40 IOP "status boxes" that represent the 40 possible IOP addresses on the I/O Link (IOL). All "status boxes" are targets and are backlighted a blue color when chosen for execution by the command targets at the bottom of the display.

HPMM status boxes

The HPMM information at the top of the middle grid-like section of the display defines the status of the HPMM. On the status display of a redundant HPMM subsystem, the left "status box" provides the status of the HPMM that is physically located in HPMM card file 1. The right "status box" provides the status of the HPMM that is located in HPMM card file 2.

Primary and secondary HPMMs

In the HPMM status boxes, the letters "P" and "S" identify which HPMM is the primary HPMM and which HPMM is the secondary HPMM, respectively.

HPMM node number

The numerals in the status box indicate each HPMM's UCN node address. The odd address is always associated with the primary HPMM.

HPMM operational states

The HPMM can be in various operational states. The status states are defined in Table 34 and Table 35.

Primary HPMM status

The possible status of the primary HPMM is defined in the following table with the color of the text indicated.

Table 34 HPM Status Display – Primary HPMM Status

Term	Definition
OK (Text color – blue)	Processing in the primary HPMM is in progress.
ALIVE (Text color – yellow)	Power has been applied to the primary HPMM, but no database or personality program has been loaded into the HPMM.
ALIVESF (Text color – yellow)	Power has been applied to the primary HPMM, but no database or personality program has been loaded into the HPMM. One of the powerup diagnostic tests has failed, but the HPMM is still capable of a program load.
IDLE (Text color – yellow)	The database and personality program has been loaded into the primary HPMM, but no processing is in progress.
LOADING (Text color – yellow)	The HPMM is being loaded with its personality program and data.
NOTCONFG (Text color – yellow)	There is no UCN node configured for the HPMM's UCN node address.
POWERON (Text color – yellow)	The HPMM is responding to the UCN but has not performed its self-tests. This is a transitory state that occurs when the HPMM is first powered on.
CONFGMIS (Text color – red)	The configured node type for the HPMM's UCN node address does not match the actual node type.
FAIL (Text color – red)	The HPM has a Hard failure and access to IOP status and data is unavailable. HPM control functions have ceased. Effectively, this is a total failure.
IDLESF (Text color – red)	The HPMM is in the Idle state and has one or more Soft failures.
OFFNET (Text color – red)	The HPMM is not responding on the UCN because 1) it does not exist, 2) power is off, or 3) there is a hardware failure that prohibits a response.
SOFTFAIL (Text color – red)	The HPMM is in the Run state and has one or more Soft failures.

Note: The EHPM differs from the HPM since it uses FTE cables that provide an IP Address. The EHPM node must receive an IP address to function properly. If at least one FTE cable is not connected, then the

EHPM cannot be loaded, and will also not be shown as "ALIVE" in the UCN Status Display. At least one FTE cable must be connected for the EHPM to receive an IP address.

Secondary HPMM status

The possible status of the secondary HPMM is defined in the following table with the color of the text indicated.

Table 35 HPM Status Display Definitions – Secondary HPMM Status

Term	Definition
BACKUP (Text color – blue)	Processing in the secondary HPMM is in progress and the secondary database is synchronized with the primary database.
BKUP_SF (Text color – blue)	The HPMM is in the Run state, but has a Soft failure.
ALIVE (Text color – yellow)	Power has been applied to the secondary HPMM, but no database or personality program was loaded into the HPMM.
BACKUP (Text color – yellow)	The secondary HPMM is in the Idle state, or its database is not synchronized with the primary HPMM.
BKUP_SF (Text color – yellow)	The HPMM is in the Idle state, but has a Soft failure.

ATTENTION

The indication of a cable failure is the same for both the traditional coaxial cable and the FTE. However, with EUCN, the FTE functions through a single cable fault per node, that is, the FTE functions if there is a fault on Cable A of one node. Faults on both the Cable A and Cable B of the EUCN are known a double fault. A double fault causes one or more nodes to be unable to communicate over the EUCN, resulting in loss-of-view, loss of AM control and/or loss of peer-to-peer control.

40 IOP status boxes

The IOP information, at the middle grid-like section of the display, defines the status of each IOP. There are 40 status boxes, representing 40 I/O link addresses. Not all status boxes may be occupied.

IOP status box definitions

The number in the upper left corner of the status box is the I/O Link address assigned to the IOP. The IOP type is identified in the upper center portion of the status box, such as HLAI or AO. In the center of the status box is the status of the IOP(s). If a slash (/) appears in the status statement, redundant IOPs, A and B respectively, are present.

IOP synchronization status

An "S" to the left of IOP A's status and to the right of IOP B's status represents the synchronization status of the redundant IOP pair. The "S" has two backlighting colors, red for **SYNC_FAIL** and yellow for **SYNC_WARNING**. A **SYNC_FAIL** status indicates the IOP has tried several times to synchronize the database between the IOPs with no success. A **SYNC_WARNING** status indicates the IOP is attempting, or will attempt soon, to synchronize the secondary's database with the primary's database.

IOP status states

For redundant Analog Output IOPs, IOP A is the preferred (biased) primary IOP.

IOP A status states

The possible status of IOP A is defined in the following table with the color of the text indicated.

Table 36 HPM Status Display – IOP A Status

Term	Definition
BKP (Text color – blue)	IOP A is currently the secondary IOP and processing in the IOP is in progress.
OK (Text color – blue)	IOP A is currently the primary and processing in the IOP is in progress.
BKP (Text color – yellow)	IOP A is currently the secondary IOP and in the Idle state.
IDL (Text color – yellow)	IOP A is currently the primary IOP, but no processing is in progress.
BSF (Text color – red)	IOP A is currently the secondary IOP and processing is in progress, but a Soft failure has been detected in the IOP.
CFG (Text color – red)	The IOP type that occupies this card slot has a configuration mismatch.
NR (Text color – red)	IOP A is not responding on the I/O Link Interface.
SF (Text color – red)	IOP A is currently the primary IOP and processing is in progress, but a Soft failure has been detected in the IOP.

IOP B status states

The possible status of IOP B is defined in the following table with the color of the text indicated.

Table 37 HPM Status Display – IOP B Status

Term	Definition
BKP (Text color – blue)	IOP B is currently the secondary IOP and processing in the IOP is in progress.
OK (Text color – blue)	IOP B is currently the primary and processing in the IOP is in progress.
BKP (Text color – yellow)	IOP B is currently the secondary IOP and in the Idle state.
IDL (Text color – yellow)	IOP B is currently the primary IOP, but no processing is in progress.
BSF (Text color – red)	IOP B is currently the secondary IOP and processing is in progress, but a Soft failure has been detected in the IOP.
CFG (Text color – red)	The IOP type that occupies this card slot has a configuration mismatch.
NR (Text color – red)	IOP B is not responding on the I/O Link Interface.
SF (Text color – red)	IOP B is currently the primary IOP and processing is in progress, but a Soft failure has been detected in the IOP.

Command targets

The command targets at the bottom of the display in Figure 109 perform the functions defined in the tables that follow.

LOAD/SAVE RESTORE Target

Selection of the **LOAD/SAVE RESTORE** command target on the HPM Status display as shown in the following figure invokes additional targets at the bottom of the display to either load the personality program, restore the database, or save the database for the HPMM or IOP chosen by its status box.

Figure 110 HPM Status Display – LOAD/SAVE RESTORE Target Selected
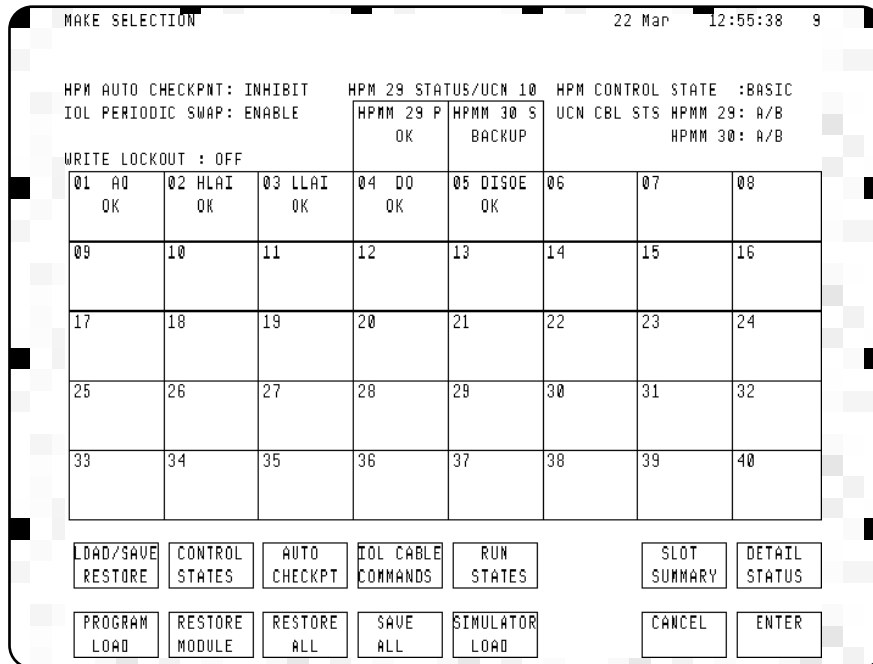
16 037

LOAD/SAVE RESTORE display targets

The command targets at the bottom of the display in Figure 110 perform the functions defined in the following table.

Table 38 HPM Status Display – LOAD/SAVE RESTORE Target Selected

Target	Function
PROGRAM LOAD	Loads the on-process (regular) personality program and the selected database to the chosen HPMM. If the primary HPMM is chosen, the database is also restored in all IOPs that are in the Idle state. The command is executed by selecting the ENTER target.
RESTORE MODULE	Restores the database in the chosen HPMM or IOP. The module must be in the Idle state (not valid for the secondary HPMM). The command is executed by selecting the ENTER target.
RESTORE ALL	Restores the database in the chosen HPMM and all IOPs. The modules must be in the Idle state. The command is executed by selecting the ENTER target.
SAVE ALL	Saves the database from the chosen HPMM and all IOPs into either the History Module or removable media. This is sometimes called "Checkpointing." The command is executed by selecting the ENTER target.
SIMULATOR LOAD	Loads the I/O Simulator personality and selected database to the chosen HPMM. If the primary HPMM is chosen, the database is also restored in all simulated IOPs that are in the Idle state. The command is executed by selecting the ENTER target.
CANCEL	Clears the PROGRAM LOAD, RESTORE MODULE, RESTORE ALL, SAVE ALL, and ENTER command targets from the display.
ENTER	Executes the LOAD/SAVE RESTORE function command.

CONTROL STATES target

Selecting the **CONTROL STATES** command target on the HPM Status display as shown in the following figure invokes additional targets at the bottom of the display to change the control state of the HPMM chosen by its status box.

Figure 111 HPM Status Display – CONTROL STATES Target Selected
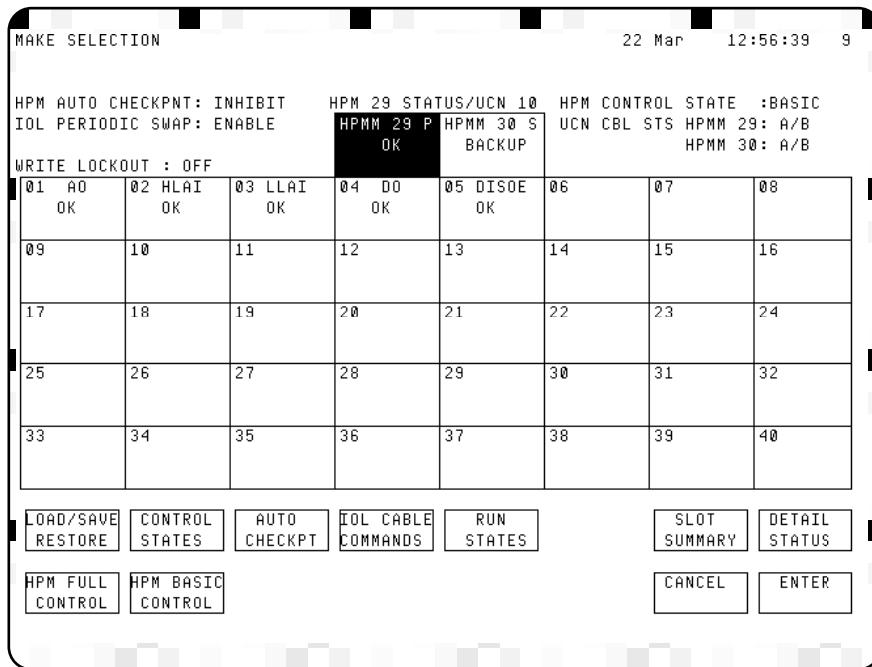
16038

CONTROL STATES display targets

The command targets at the bottom of the display in Figure 111 perform the functions defined in the following table.

Table 39 HPM Status Display – CONTROL STATES Target Selected

Target	Function
HPM FULL CONTROL	Changes the UCN's control state to FULL. The command is executed by selecting the ENTER target.
HPM BASIC CONTROL	Changes the UCN's control state to BASIC. The command is executed by selecting the ENTER target.
CANCEL	Clears the HPM FULL CONTROL, HPM BASIC CONTROL, and ENTER command targets from the display.
ENTER	Executes the CONTROL STATES function command.

AUTO CHECKPT target

Selection of the **AUTO CHECKPT** command target on the HPM Status display as shown in the following figure invokes additional targets at the bottom of the display to change the Checkpointing state of the HPM.

Figure 112 HPM Status Display – AUTO CHECKPT Target Selected

```
MAKE SELECTION                              22 Mar   12:57:47   9


HPM AUTO CHECKPNT: INHIBIT    HPM 29 STATUS/UCN 10  HPM CONTROL STATE  :BASIC
IOL PERIODIC SWAP: ENABLE     HPMM 29 P HPMM 30 S   UCN CBL STS HPMM 29: A/B
                                 OK       BACKUP                HPMM 30: A/B
WRITE LOCKOUT : OFF
01   AO     02 HLAI   03 LLAI   04  DO    05 DISOE  06      07      08
     OK        OK        OK        OK        OK

09         10        11        12        13        14      15      16

17         18        19        20        21        22      23      24

25         26        27        28        29        30      31      32

33         34        35        36        37        38      39      40


LOAD/SAVE  CONTROL    AUTO    IOL CABLE    RUN                 SLOT    DETAIL
RESTORE    STATES   CHECKPT  COMMANDS    STATES             SUMMARY   STATUS

HPM CKPT   HPM CKPT                                         CANCEL    ENTER
ENABLE     INHIBIT
```

16 039

AUTO CHECKPT display targets

The command targets at the bottom of the display in Figure 112 perform the functions defined in the following table.

Table 40 HPM Status Display – AUTO CHECKPT Target Selected

Target	Function
HPM CKPT ENABLE	Enables automatic Checkpointing of the HPM. The command is executed by selecting the ENTER target.
HPM CKPT INHIBIT	Disables automatic Checkpointing of the HPM. The command is executed by selecting the ENTER target.
CANCEL	Clears the HPM CKPT ENABLE, HPM CKPT INHIBIT, and ENTER command targets.
ENTER	Executes the AUTO CHECKPT function command.

IOL CABLE COMMANDS target

Selection of the **IOL CABLE COMMANDS** command target on the HPM Status display as shown in the following figure invokes additional targets at the bottom of the display to change the selected IOL cable or enable/disable automatic cable swapping.

Figure 113 HPM Status Display – IOL CABLE COMMANDS

```
MAKE SELECTION                                  22 Mar    12:58:32   9


HPM AUTO CHECKPNT: INHIBIT    HPM 29 STATUS/UCN 10  HPM CONTROL STATE  :BASIC
IOL PERIODIC SWAP: ENABLE     HPMM 29 P HPMM 30 S  UCN CBL STS HPMM 29: B/A
                                  OK      BACKUP              HPMM 30: B/A
WRITE LOCKOUT : OFF                A         A
 01   AO     02 HLAI    03 LLAI    04   DO    05 DISOE   06        07        08
      OK        OK         OK           OK        OK
      A         A          A            A         A
 09        10         11         12         13         14        15        16


 17        18         19         20         21         22        23        24


 25        26         27         28         29         30        31        32


 33        34         35         36         37         38        39        40


 LOAD/SAVE  CONTROL    AUTO     IOL CABLE    RUN                  SLOT     DETAIL
 RESTORE    STATES    CHECKPT   COMMANDS    STATES               SUMMARY   STATUS

 SELECT    SELECT     ENABLE    DISABLE                 ALL     CANCEL    ENTER
 CABLE A   CABLE B     SWAP      SWAP               MODULES
```

16040

IOL CABLE COMMANDS display targets

The command targets at the bottom of the display in Figure 113 perform the functions defined in the following table.

Table 41 HPM Status Display – IOL CABLE COMMANDS

Target	Function
SELECT CABLE A	Activates I/O Link (IOL) cable A. The command is executed by selecting the ENTER target.
SELECT CABLE B	Activates I/O Link (IOL) cable B. The command is executed by selecting the ENTER target.
ENABLE SWAP	Enables periodic swapping of the I/O Link cables. The command is executed by selecting the ENTER target.
DISABLE SWAP	Disables periodic swapping of the I/O Link cables. The command is executed by selecting the ENTER target.
ALL MODULES	Allows both HPMMs and all IOPs to be affected by the cable function command. The command is executed by selecting the ENTER target.
CANCEL	Clears the SELECT CABLE A, SELECT CABLE B, ENABLE SWAP, DISABLE SWAP, ALL MODULES, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen IOL CABLE COMMANDS function to be executed.

RUN STATES target

Selection of the **RUN STATES** command target on the HPM Status display as shown in the following figure invokes additional targets at the bottom of the display to **STARTUP**, **SHUTDOWN**, **IDLE** or **SWAP,** the chosen HPMM or IOP.

Figure 114 HPM Status Display – RUN STATES Target Selected

```
MAKE SELECTION                                       22 Mar     12:59:46   ⁵⁶


HPM AUTO CHECKPNT: INHIBIT      HPM 29 STATUS/UCN 10   HPM CONTROL STATE  :BASIC
IOL PERIODIC SWAP: ENABLE       HPMM 29 P HPMM 30 S    UCN CBL STS HPMM 29: B/A
                                   OK      BACKUP                  HPMM 30: B/A
WRITE LOCKOUT : OFF
┌────────┬────────┬────────┬────────┬────────┬────────┬────────┬────────┐
│01  AO  │02 HLAI │03 LLAI │04  DO  │05 DISOE│06      │07      │08      │
│    OK  │    OK  │    OK  │    OK  │    OK  │        │        │        │
├────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┤
│09      │10      │11      │12      │13      │14      │15      │16      │
│        │        │        │        │        │        │        │        │
├────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┤
│17      │18      │19      │20      │21      │22      │23      │24      │
│        │        │        │        │        │        │        │        │
├────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┤
│25      │26      │27      │28      │29      │30      │31      │32      │
│        │        │        │        │        │        │        │        │
├────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┤
│33      │34      │35      │36      │37      │38      │39      │40      │
│        │        │        │        │        │        │        │        │
└────────┴────────┴────────┴────────┴────────┴────────┴────────┴────────┘

┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐      ┌────────┐┌────────┐
│LOAD/SAVE││CONTROL ││ AUTO   ││IOL CABLE││  RUN   │      │ SLOT   ││ DETAIL │
│RESTORE ││STATES  ││CHECKPT ││COMMANDS ││ STATES │      │SUMMARY ││ STATUS │
└────────┘└────────┘└────────┘└────────┘└────────┘      └────────┘└────────┘
┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐      ┌────────┐┌────────┐
│STARTUP ││ IDLE   ││SHUTDOWN││ SWAP   ││VALIDATE│      │ CANCEL ││ ENTER  │
│        ││        ││        ││PRIMARY ││ IOP DB │      │        ││        │
└────────┘└────────┘└────────┘└────────┘└────────┘      └────────┘└────────┘
```

16041

RUN STATES display targets

The command targets at the bottom of the display in Figure 114 perform the functions defined in the following table.

Table 42 HPM Status Display – RUN STATES Target Selected

Target	Function
STARTUP	Provides COLD and WARM STARTUP targets for starting the HPMM or IOP that was chosen by its status box. Changes the HPMM or IOP chosen from the Idle state to the OK state if it has a valid database, which is indicated. The HPMM or IOP will then begin processing data. The command is executed by selecting the ENTER target.
IDLE	The chosen HPMM or IOP is changed from the OK state to the Idle state. The command is executed by selecting the ENTER target.
SHUTDOWN	Changes the chosen HPMM from the Idle or Fail state to the Alive or OK state, respectively. To place the HPMM back in service after Shutdown, its personality program and database must be reloaded using the LOAD/SAVE RESTORE target. The command is executed by selecting the ENTER target.
SWAP PRIMARY	Swaps the chosen HPMMs or redundant IOPs. The present primary HPMM or IOP becomes the secondary HPMM or IOP, respectively. The command is executed by selecting the ENTER target.
VALIDATE IOP DB	Accepts the existing database for the chosen IOP as the valid database. The command is executed by selecting the ENTER target.
ALL MODULES	Allows all HPMMs and IOPs to be affected by the STARTUP or IDLE target.
CANCEL	Clears the STARTUP, IDLE, SHUTDOWN, SWAP PRIMARY, VALIDATE IOP DB, ALL MODULES, and ENTER command targets from the display.
ENTER	The ENTER target must be selected for the chosen RUN STATES function to be executed.

SLOT SUMMARY target

Selection of the **SLOT SUMMARY** command target on the HPM Status display as shown in the following figure invokes the Slot Summary Menu display from which the point type of interest for the chosen HPMM or IOP is selected. The selection provides a Slot Summary display for the point type that displays the contents (point ID, descriptor, and active/inactive state) of the HPMM or IOP that is chosen.

Figure 115 HPM Status Display – SLOT SUMMARY Target Selected
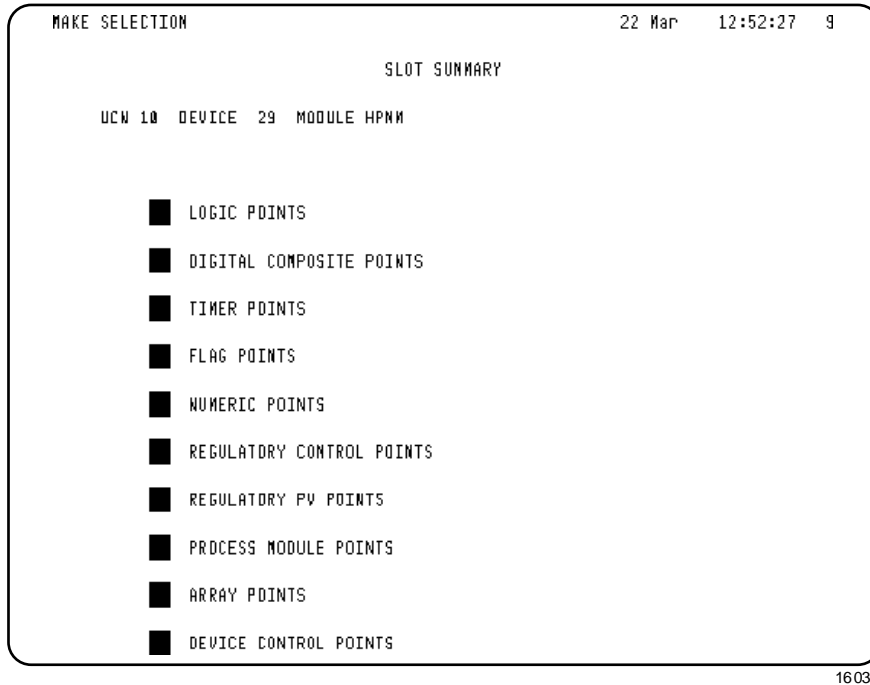
16034

REGULATORY CONTROL POINTS target

An example of this is the Process Module Points display as shown in the following figure. Selecting the **REGULATORY CONTROL POINTS** target on the Slot Summary Menu display invokes the display. The Slot Summary display provides access to commands that active/deactivates slots.

Figure 116 HPM Status Display – REGULATORY CONTROL POINTS Target Selected
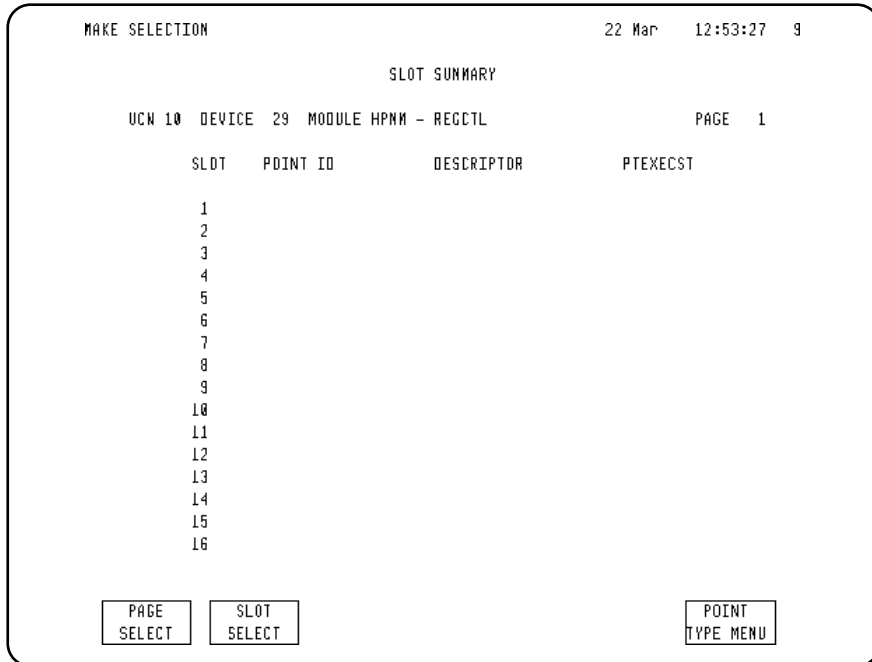
16035

Process Module Points display targets

Three targets are available on the Process Module Points display.

- Selecting the **PAGE SELECT** target produces a **ENTER PAGE NUMBER** response. Enter the page number of interest.

- Selecting the **SLOT SELECT** target produces a **ENTER SLOT NUMBER** response. Enter the slot number of interest.

- The **POINT TYPE MENU** target returns you to the Slot Summary Menu display.

DETAIL STATUS target

Selection of the **DETAIL STATUS** command target on the HPM Status display invokes the Detail Status display of the chosen HPMM or IOP as shown in Figure 120, Figure 121, or Figure 143.

3.6   NIM Detail Status Displays

Selection procedure

The NIM Detail Status displays consist of two displays, the NIM Driver Configuration display and the NIM Local UCN Statistics display. The initial NIM Detail Status display, which is the NIM Driver Configuration display, is selected by invoking the UCN Status display, choosing the NIM of interest on the display grid, and then selecting the **DETAIL STATUS** target.

The NIM Driver Configuration display can also be invoked by selecting the **NIM DVR CONFIG** target on the NIM Local UCN Statistics display.

NIM Driver Configuration display

The NIM Driver Configuration display is shown in the following figure.

Figure 117 NIM Driver Configuration Display

```
MAKE SELECTION                                  22 Mar 95 12:30:12   9




               UCN DRIVER DATA :
  ┌────────┐     PROTOCOL VERSION : 00  PROTOCOL REVISION : 01   MODEM REV : 26
  │  UCN   │       UCN LLC VERSION : 3B   UCN LLC REVISION : 01    TBC REV : 00
  │ STATS  │        DRIVER VERSION : 3B    DRIVER REVISION : 01
  └────────┘
  ┌────────┐
  │NIM DVR │     NUMBER OF EVENT RECEIVERS :   000
  │CONFIG  │
  └────────┘     TOKEN RING MEMBER ?  YES







  ┌────────┐     P/S     PRIMARY  UCN CHANNEL    CHANNELA
  │UCN   10│     STATUS OK          UCN AUTO SWAP ENABLE
  NODE   3
  TYPE NIM
```

NIM Driver Configuration display status

The following table defines the information in the NIM Driver Configuration display.

Table 43 NIM Driver Configuration Display Status

Term	Description
PROTOCOL VERSION	The version of the UCN Communications protocol which exists in the NIM UCN Communications Driver.
PROTOCOL REVISION	The revision of the UCN Communications protocol which exists in the NIM UCN Communications Driver.
UCN LLC VERSION	The version of the Logical Link Control layer which exists in the UCN.
UCN LLC REVISION	The revision of the Logical Link Control layer which exists in the UCN.
DRIVER VERSION	The version of the UCN Communications Driver in the NIM.
DRIVER REVISION	The revision of the UCN Communications Driver in the NIM.
NUMBER OF EVENT RECEIVERS	The number of event receivers currently recognized by the UCN Driver.
TOKEN RING NUMBER ?	Is the NIM currently in the UCN token ring? (YES or NO) There are four possible messages that can appear under the TOKEN RING NUMBER ? text. They are: CHANNEL A ABANDONED DUE TO SILENCE CHANNEL B ABANDONED DUE TO SILENCE CHANNEL A ABANDONED DUE TO NOISE CHANNEL B ABANDONED DUE TO NOISE The CHANNEL A and CHANNEL B messages are exclusive to each other.
MODEM REV	The revision of the NIM UCN Communications Driver
TBC REV	The revision of the Token Bus Controller

UCN Driver statistics (UCN STATS target)

The NIM maintains a set of UCN Driver statistics that are used to evaluate the condition of the UCN as seen by the NIM. These statistics are requested by selection of the **UCN STATS** target. The statistics are presented in the two pages of the NIM Local UCN Statistics display as shown in Figure 118 and Figure 119.

NIM and HPMM display differences

The Local UCN Statistics displays for the NIM and HPMM are similar. The HPMM Local UCN Statistics displays are shown in Figure 118 and Figure 119. The NIM and HPMM Local UCN Statistics displays have the following differences.

- The targets available on the displays are slightly different.
- The HPMM Local UCN Statistics display has a **FILE POS** status.
- The **TYPE** status is different (**HPM** or **NIM**).
- Only the NIM Local UCN Statistics display has Event Receiver statistics.
- The Event Sender statistics error counts on the NIM Local UCN Statistics display are always zero.
- Only the HPMM Local UCN Statistics display has Performance statistics.

Page statistical and status content

Page 1 displays the local statistics for the UCN node, NIM or HPMM, while Page 2 displays UCN Event Sender statistics (HPMM only), UCN Event Receiver statistics (UCN only), Performance statistics (HPMM only), Time Synch status (NIM or HPMM), and Time Synch statistics (NIM or HPMM).

Switching display pages

You can switch between the Page 1 and Page 2 displays by alternately selecting the **STATISTICS PAGE TWO** target on the Page 1 display and the **STATISTICS PAGE ONE** target on the Page 2 display.

NIM Local UCN Statistics display-page 1

Figure 118 NIM Local UCN Statistics Display – Page 1

```
                                          11 Sep 95 11:54:45   1


                            ┌──────┐ ┌──────────┐      ┌──────────┐
                            │ HELP │ │RESET LOCL │      │STATISTICS│
                            └──────┘ │STATISTICS │      │PAGE TWO  │
                                     └──────────┘      └──────────┘
              LOCAL UCN STATISTICS - PAGE 1

              NO COPY BUFFERS          0      TOTAL CABLE SWAPS    5417
              TOKEN ROTATION TIME      1      CABLE A SILENCE         0
              NO SUCCESSOR FOUND       4      CABLE B SILENCE         0
              ASKED WHO FOLLOWS       11      CABLE A NOISE           0
              TOKEN PASSES FAILED     10      CABLE B NOISE           0
    ┌──────┐  NOISE BITS               0      NO-RESPONSE ERRORS  12240
    │ UCN  │  CHECKSUM ERROR           0      UNEXPECTED RESPONSES    0
    │STATS │  REPEATER ERROR           0      ERRORS IN RESPONSES     0
    └──────┘  PARTIAL FRAME            3      AUTO-RECONNECTS         0
    ┌──────┐  RECEIVED FRAME TOO LONG  0
    │NIM DVR│ NO RECEIVE BUFFERS       0      LOCAL MESSAGES       2449
    │CONFIG│  RECEIVE OVERRUN          0      MESSAGES SENT       55043
    └──────┘  DUPLICATE RWR            0      MESSAGES RECEIVED   28860
              NULL RWR (RESYNCH)      19      MESSAGES DISCARDED      0
              TRANSMIT UNDERRUN        0      REPLY TIMEOUTS          1
              TRANSMIT FRAME TOO LONG  0

    ┌──────┐
    │UCN  3│      P/S    PRIMARY  UCN CHANNEL   CHANNELB
    │NODE 1│      STATUS OK       UCN AUTO SWAP ENABLE
    │TYPE NIM
    └──────┘
                                                             15251
```

NIM Local UCN Statistics display-page 2

Figure 119 NIM Local UCN Statistics Display – Page 2

```
                                            11 Sep 95 11:55:32   1

              LOCAL UCN STATISTICS - PAGE 2
                                        ┌──────┐ ┌──────────┐   ┌──────────┐
                                        │ HELP │ │RESET LOCL│   │STATISTICS│
                                        └──────┘ │STATISTICS│   │ PAGE ONE │
                                                 └──────────┘   └──────────┘
                                             EVENT RECEIVER STATISTICS
                                          MESSAGES RECEIVED      27494
                                          MESSAGES NOT ACK'D         0
                                          MESSAGE BUFFER OVERRUN     0
                                              (NAK'D)
                                          MESSAGE DUPLICATE          0
        ┌──────┐                          AT NODE THROTTLE           0
        │ UCN  │                             THRESHOLD
        │STATS │                          AT NODE NAK THRESHOLD      0
        └──────┘                          LOST MESSAGES              0
        ┌──────┐
        │NIM DVR│
        │CONFIG │
        └──────┘    TIME SYNCH STATUS             TIME SYNCH STATISTICS
                  UCN DATE      11 Sep 1995    SYNCH ERRORS            0
                  UCN TIME         11:55:17    LOST MESSAGES           0
                  SYNCHER NODE            1    CLOCK ERRORS            0
                  CURRENT STATE      FAILED    DRIFT THRESHOLD         0
                  DRIFT VALUE             0

    ┌─────────┐
    │UCN    3 │     P/S    PRIMARY  UCN CHANNEL   CHANNELB
    │NODE   1 │     STATUS OK       UCN AUTO SWAP ENABLE
    │TYPE NIM │
    └─────────┘
```
15252

Two pages

The **STATISTICS PAGE TWO** target on the first page display is used to request the second page of statistics. The first page is chosen by selecting the **STATISTICS PAGE ONE** target on the second page display. The **RESET LOCL STATISTICS** target on either page is used to reset the values of all the statistics to zero for diagnostic purposes, not just those on the page being displayed.

Cable noise/silence

Not shown in the figures is a group of four messages pertaining to the detection of noise/silence on the UCN cables. These messages, which appear immediately above the **LOCAL UCN STATISTICS - PAGE 1** or **PAGE 2** heading, can be any combination of the following texts:

- **CABLE A NOISE**
- **CABLE B NOISE**
- **CABLE A SILENCE**
- **CABLE B SILENCE**

Time Sync operation

Normal Time Synch operation is for the Synchronizer NIM, the lowest-address NIM that has an EPNI board and the best LCN clock status, to send hardware recognized Time Synch message, followed by a matching synchtime message containing the exact time of the Time Synch message transmission. This is done at nominal 6 second intervals.

Four second update

The statistics and messages are updated every four seconds.

HELP target

Refer to Figure 118 and Figure 119.

The **HELP** target is used to gain greater insight into each statistical entry on the 2-page Local UCN Statistics display. To use it, you simply select the individual entry that you would like more information about, and then select the **HELP** target. The resultant display provides the following information about the statistical entry you selected.

- Description

- Normal Value

- How the system recovers from the failure

- Probable cause of the failure

- Reference to other statistics for correlation

> **ATTENTION**
>
> For a nonredundant NIM or a redundant NIM whose partner is not available, an increasing "NO-RESPONSE ERRORS" count is normal.

3.7 HPMM Detail Status Displays

HPMM Detail Status display selection

The Primary and Secondary HPMM Detail Status displays are shown in Figure 120 and Figure 121. The primary or secondary display is obtained by choosing the HPM of interest on the UCN Status display, selecting the **DETAIL STATUS** target, choosing the primary or secondary HPMM, and then selecting the **DETAIL STATUS** target.

Primary HPMM Detail Status display

Figure 120 Primary HPMM Detail Status Display


```
MAKE SELECTION                                    22 Mar    13:06:26   9



┌─────────┐
│HPMM IOL │
│  INFO   │
└─────────┘
┌─────────┐
│ IOM IOL │
│  INFO   │
└─────────┘
┌─────────┐
│ VERS/   │
│ REVIS   │
└─────────┘
┌─────────┐
│CONTROL  │              Please Select Target
│CONFIG   │
└─────────┘
┌─────────┐
│  UCN    │
│ STATS   │
└─────────┘
┌─────────┐
│ MAINT   │
│SUPPORT  │
└─────────┘
┌─────────┐
│ SOFT    │
│FAILURE  │
└─────────┘
┌─────────┐
│UCN  010 │   P/S    PRIMARY  UCN CHANNEL   CHANNELA    FILE POS FILE_1
│NODE 029 │   STATUS OK       UCN AUTO SWAP ENABLE
└─────────┘
 TYPE HPM
```
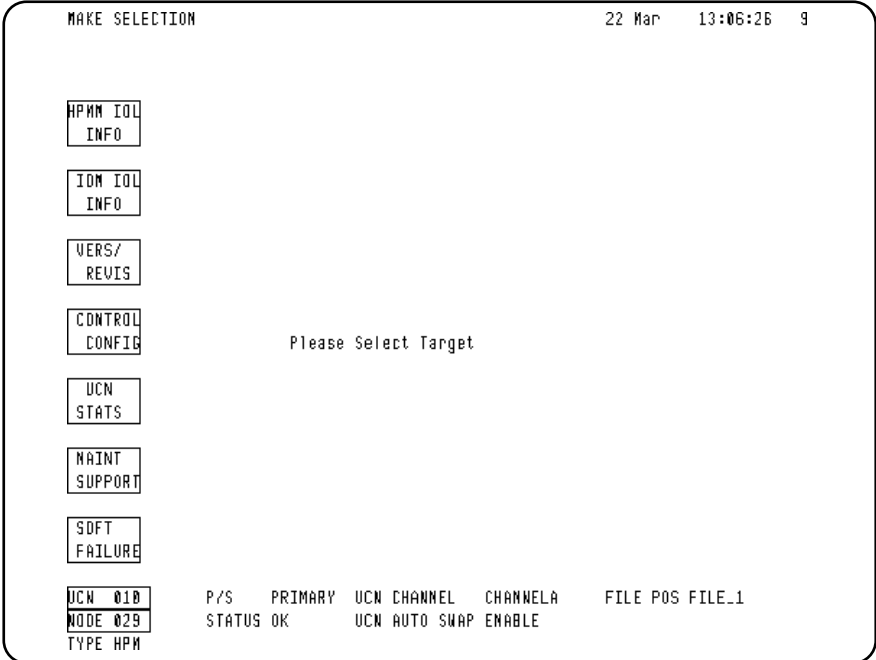
16042

Secondary HPMM Detail Status display

Figure 121 Secondary HPMM Detail Status Display

```
┌─────────────────────────────────────────────────────────────┐
│  MAKE SELECTION                          22 Nov   13:54:31  1 │
│                                                               │
│                                                               │
│  ┌──────┐                                                     │
│  │HPMM IOL                                                    │
│  │ INFO │                                                     │
│  └──────┘                                                     │
│                                                               │
│                                                               │
│  ┌──────┐                                                     │
│  │VERS/ │                                                     │
│  │REVIS │                                                     │
│  └──────┘                                                     │
│                                                               │
│                        Please Select Target                   │
│                                                               │
│  ┌──────┐                                                     │
│  │ UCN  │                                                     │
│  │STATS │                                                     │
│  └──────┘                                                     │
│  ┌──────┐                                                     │
│  │MAINT │                                                     │
│  │SUPPORT                                                     │
│  └──────┘                                                     │
│  ┌──────┐                                                     │
│  │SOFT  │                                                     │
│  │FAILURE                                                     │
│  └──────┘                                                     │
│  ┌──────┐                                                     │
│  │UCN  3│   P/S    SECNDRY  UCN CHANNEL   CHANNELB   FILE POS RIGHT │
│  │NODE 10   STATUS OK       UCN AUTO SWAP ENABLE     │
│  └──────┘   TYPE HPM    PKGOPT REDUN                          │
│                                                               │
└─────────────────────────────────────────────────────────────┘
                                                         16043
```
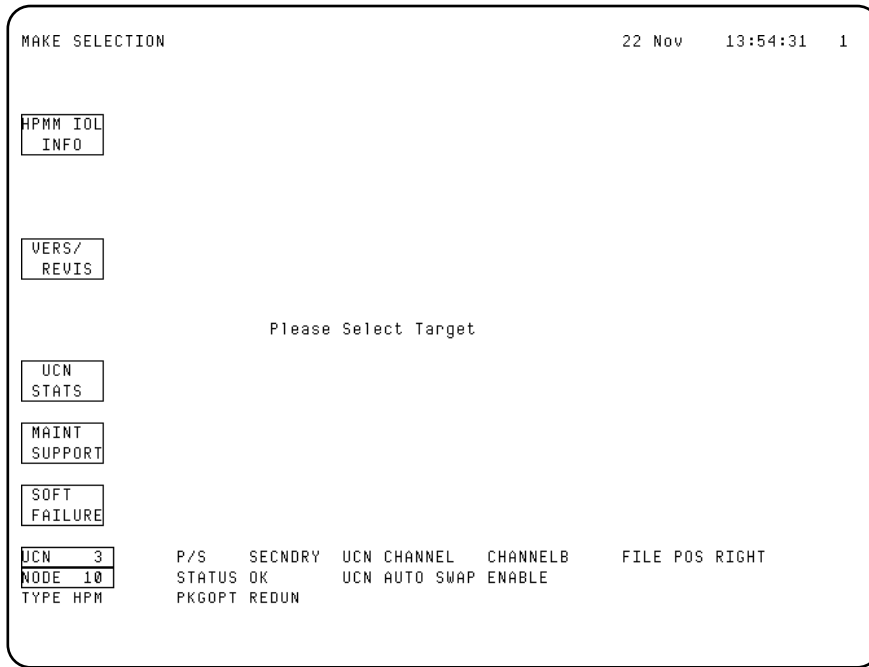
Targets and bottom data fields

The data fields at the bottom of the display and the targets at the left side of the display remain as long as the display is on the console screen.

Bottom data fields defined

The data at the bottom of the display is defined in the following table.

Table 44 HPMM Detail Status Display

Term	Description
UCN	The UCN number
NODE	The node number on the UCN
TYPE	The node type (NIM or HPM)
P/S	The node's current redundancy status (PRIMARY, SECNDRY, or NONREDUN)
STATUS	The current composite status of the node. This is the same as the composite status displayed on the UCN Status display. See the *Process Operations Manual* for responses.
PKGOPT	The configured hardware packaging of the HPMM. REDUN = Nonredundant and redundant 7-Slot HPMM card files REDUN_2F = Nonredundant and redundant 15-Slot HPMM card files
UCN CHANNEL	Current UCN cable active (CHANNEL A or CHANNEL B).
UCN AUTO SWAP	The current UCN cable auto swap status (ENABLE or DISABLE).
FILE POS	The HPMM node's assigned position in the HPM. RIGHT = Right 7-Slot card file LEFT = Left 7-Slot card file FILE_1 = Primary (lower) 15-Slot card file FILE_2 = Secondary (upper) 15-Slot card file.

Four-second update

With the exception of **UCN**, **NODE**, and **TYPE**, the data at the bottom of the display is updated every four seconds.

Target comparison

The targets at the left side of the display are dependent on the node's redundancy status as illustrated by comparison of Figure 120 and Figure 121. Except for the HPMM I/O Information display, the information selected by the set of secondary HPMM targets is identical to those selected by the corresponding target for a primary HPMM.

HPMM I/O Link Information display

Selection of the **HPMM IOL INFO** target on the HPMM Detail Status display invokes the I/O Link Information display as shown in Figure 122. The current status of the HPMM as a node on the I/O Link is displayed, and for the Primary HPMM, it also displays the status of the entire I/O Link as seen by the HPMM Communications processor's I/O Link Supervisor function. As shown in Figure 123, only the top portion of the display, the status of the HPMM as an I/O Link address, is displayed for the Secondary HPMM.

Primary HPMM I/O Link Information display

Figure 122 Primary HPMM I/O Link Information Display

Secondary HPMM I/O Link Information display

Figure 123 Secondary HPMM I/O Link Information Display

```
                                          22 Nov    14:38:21   1

             HPMM IOL COMMUNICATIONS STATUS :

┌────────┐   IOL RECEIVE CHANNEL : CHANNELA
│HPMM IOL│   CABLE A ERRORS :    1  CABLE A SILENCES :     0  ┌─────────┐
│  INFO  │   CABLE B ERRORS :    0  CABLE B SILENCES :     0  │RESET HPMM│
└────────┘                                                    │COMM ERRS│
                                                              └─────────┘
             LAST COMMUNICATION ERROR : INVALERT

┌────────┐
│VERS/   │
│ REVIS  │
└────────┘



┌────────┐
│  UCN   │
│ STATS  │
└────────┘
┌────────┐
│ MAINT  │
│SUPPORT │
└────────┘
┌────────┐                                        ┌─────────┐
│  SOFT  │                                        │RESET IOL│
│FAILURE │                                        │COMM ERRS│
└────────┘                                        └─────────┘
┌────────┐    P/S    SECNDRY  UCN CHANNEL   CHANNELA    FILE POS RIGHT
│UCN   3 │    STATUS OK       UCN AUTO SWAP ENABLE
│NODE 10 │    TYPE HPM        PKGOPT REDUN
└────────┘
                                                              16045
```

Four -second update

With the exception of the **STALL TIME** and the allowed number of errors before the periodic UCN cable swap is disabled (see below), the data in the display is updated every four seconds.

HPMM I/O Link status

The status of the HPMM as an I/O Link node is defined in the following table.

Table 45 HPMM I/O Link Information Display

Term	Description
IOL RECEIVE CHANNEL	The current I/O Link receive channel (CHANNEL A or CHANNEL B) for the HPMM.
CABLE A ERRORS **CABLE B ERRORS** **CABLE A SILENCES** **CABLE B SILENCES**	Running totals are displayed of the errors/silences detected for each I/O Link cable Interface since the startup of the HPMM or the last reset of the error data. For diagnostic purposes, these totals can be reset to zero by selection of the RESET HPMM COMM ERRS target.
LAST COMMUNICATION ERROR	The last I/O Link error detected by the HPMM. This error is set to NONE by selection of the RESET HPMM COMM ERRS target.
IOL PROCESSOR STATUS	The current status of the I/O Link processor (OK or ERROR).
TOKEN PASSING INFORMATION	DROPSThe number of token drops detected by the I/O Link processor. STALL TIME The token stall time (fixed) in microseconds (xxx MICROSECONDS).

Term	Description
IOL SUPERVISOR INFORMATION	PERIODIC SWAP The Enable/Disable status of the periodic swap function (ENABLES or DISABLE).
	COMMAND RQST A display of the last command executed by the IOS to itself and/or the IOPs.
	CHANNEL A STS The current condition of the A I/O Link channel (OK or ERROR).
	CHANNEL B STS The current condition of the A I/O Link channel (OK or ERROR).
	XXX ERRORS Periodic I/O Link cable PER MINUTE swapping will be disabled when BEFORE the "before periodic swap"
	PERIODIC SWAP number of errors detected on DISABLE either I/O Link cable exceeds the displayed value. The value is fixed in the I/O Link Driver.
	TOTAL ERROR Displays the total number of CHN A errors and silences detected by CHN B the IOS for both I/O Link cables
	TOTAL SILENCE for all IOPs and the HPMM.CHN A The values in these fields CHN B should be the sum of the values given in the IOP I/O Link Information display and the errors shown at the top of this display. The values shown can be reset to zero by selection of the RESET IOL COMM ERRS target. Selection of the target resets the communications errors/silences totals in each of the IOPs, and also resets the current I/O Link errors (LAST ERR) to NONE.

HPMM IOM I/O Link Information display

The target that produces the HPMM IOM I/O Link Information display and the accompanying three displays is available only for the primary HPMM. One of the three displays is shown in the following figure.

Figure 124 IOM I/O Link Information Display

```
                                         22 Nov    14:39:28   1


            ┌─────────────┐
            │Refresh Values│
┌───────┐   └─────────────┘
│HPMM IOL│  Select Modules:  ███01..15██  [ 16..30 ]  [ 31..40 ]
│ INFO  │
└───────┘             Primary IOPs                Secondary IOPs
┌───────┐  MD Chn  Errors    Silences  Last Err  Chn  Errors    Silences  Last Err
│IOM IOL│           A    B    A    B                    A    B    A    B
│ INFO  │   1  B  0001 0000 0000 0000 INVALERT
└───────┘   2
┌───────┐   3
│VERS/  │   4
│REVIS  │   5
└───────┘   6
┌───────┐   7
│CONTROL│   8
│CONFIG │   9  B  0000 0000 0000 0000 NONE      B  0000 0000 0000 0000 NONE
└───────┘  10  B  0001 0000 0000 0000 INVALERT
┌───────┐  11
│ UCN   │  12
│STATS  │  13
└───────┘  14
┌───────┐  15
│MAINT  │
│SUPPORT│
└───────┘
┌───────┐
│SOFT   │
│FAILURE│
└───────┘
┌───────┐   P/S    PRIMARY   UCN CHANNEL   CHANNELA    FILE POS LEFT
│UCN   3│   STATUS OK        UCN AUTO SWAP ENABLE
│NODE  9│   TYPE HPM   PKGOPT REDUN
└───────┘
                                                              16046
```

Data tables

The display shows the current I/O Link status for the primary and the secondary (if present) IOP, in the High-Performance Process Manager. Up to 40 IOPs are configurable in the HPM. The information is given in a tabular form. IOPs are arranged in the order of their module number on the I/O Link Interface.

The data table is displayed on three pages. Page 1 displays the data for modules 1-15, page 2 for modules 16-30, and page 3 for modules 31-40. The 01...15, 16...30, or 31...40 target is used to select the desired display. For both the primary and secondary IOP (if it exists), there are seven subcolumns. The subcolumn labels are described in the table that follows. =Data for "configured-but-not responding" IOPs appears in red.

The displayed data is snapshot data that is updated every 4 seconds. The **REFRESH VALUES** target can be used to update the displayed data.

DSA data fields

The DSA data fields for the IOM I/O Link nodes are defined in the following table.

Table 46 IOM I/O Link Information Display

Term	Description
MD	The module number (1-40)
CHN	The current I/O Link receive channel (A or B)
ERRORS A **ERRORS B** **SILENCES A** **SILENCES B**	The total errors/silences detected on the A and B I/O Link cables since the IOP was started or the last reset of the I/O Link errors/silences from the HPMM I/O Link Information display.
LAST ERR	The last I/O Link error detected by the IOP. Reset of the error/silence totals from the HPMM I/O Link Information display sets the error to NONE.

HPMM Version/Revision Display

The selection of the **VER/REVIS** target on the I/O Link Information display invokes the HPMM Version/Revision display shown in the following figure which shows the current version/revision/personality information for the hardware and software present in the HPMM.

Figure 125 HPMM Version/Revision Display

```
                                            22 Nov   14:40:21   1


 HPMM IOL          REVISIONS AND PERSONALITY DATA
  INFO              OVERALL SW  VERS  50  REV  01

 IOM IOL          H/W F/W    IDENTITY        CREATION DATE
  INFO
           COMMUNICATIONS  30   B    NAME HPCMHP    DAY      8
 VERS/                               VERS 50       MONTH     9
  REVIS                              REV  00       YEAR     95
                                 LOADED PERSONALITY: ON-PROCESS
 CONTROL
  CONFIG   CONTROL                    NAME HPCTHP    DAY     13
                                      VERS 50       MONTH    9
  UCN                                 REV  01       YEAR    95
 STATS                           LOADED PERSONALITY: ON-PROCESS

 MAINT     I/O INTERFACE    C         VERS 50       DAY      7
 SUPPORT                              REV  00       MONTH    9
                                                    YEAR    95
 SOFT      UCN INTERFACE    FF
 FAILURE   TBC   REV        I

 UCN    3      P/S   PRIMARY  UCN CHANNEL   CHANNELA    FILE POS LEFT
 NODE   9      STATUS OK      UCN AUTO SWAP ENABLE
 TYPE HPM      PKGOPT REDUN
```

16047

With R684, two new fields are added. The **Node Type** field displays either **HPM** or **EHPM** depending on type of node. The **Media Type** field displays **TBC** for an HPM, or **FTE** for an EHPM.

```
                                            19 May 11 17:39:59    7


HPMM IOL                    REVISIONS AND PERSONALITY DATA
  INFO                        OVERALL SW  VERS  68  REV  85


IOM IOL                   H/W F/W    IDENTITY      CREATION DATE
  INFO
           COMMUNICATIONS    H    C    NAME HPCMHP    DAY      25
VERS/                                  VERS 68       MONTH     5
  REVIS                                REV  80       YEAR      10
                              LOADED PERSONALITY: ON-PROCESS
CONTROL
  CONFIG   CONTROL                     NAME HPCTHP    DAY       2
                                       VERS 68       MONTH     8
  UCN                                  REV  85       YEAR      10
  STATS                       LOADED PERSONALITY: ON-PROCESS

MAINT      I/O INTERFACE     A         VERS 50       DAY       7
SUPPORT                                REV  00       MONTH     9
                                                     YEAR      95
SOFT       UCN INTERFACE     A       ┌─────────────────────┐
FAILURE    TBC   REV         I       │ NODE TYPE: EHPM     │
                                     │ MEDIA TYPE: FTE     │
UCN   14       P/S   PRIMARY UCN CHANNEL   CHANNELA    FILE POS LEFT
NODE  07       STATUS PARTFAIL UCN AUTO SWAP ENABLE
TYPE HPM       PKGOPT REDUN
```

Version and revision data

The information is derived from the hardware boards, firmware ROMs, and the personality data contained in the software. The information is tabular and the column headers are defined in the following table.

Table 47 HPMM Version/Revision Display

Term	Description
OVERALL SW VERS REV	Uniquely ties the Communications and Control component software version and revision together.
H/W	The hardware version/revision of the HPMM cards and the HPM UCN Interface module
F/W	The firmware version/revision for the Communications and Control processors
IDENTITY	The NAME, VERSion, and REVision of the software personalities that are currently hosted by the Communications, Control, and I/O Link processors.
CREATION DATE	The DAY, MONTH, and YEAR of the creation of the software personalities that are currently hosted by the Communications, Control, and I/O Link processors.
LOADED PERSONALITY	The present state of the Communications and Control processor personalities
NODE TYPE	The type of node, either **HPM** or **EHPM**.
MEDIA TYPE	The type of media, either **TBC** for an HPM, or **FTE** for an EHPM.

HPMM Control Configuration Display

Selection of the **CONTROL CONFIG** target on the HPMM Detail Status display invokes the HPMM Control Configuration display for the primary HPMM only. There are two displays associated with the **CONTROL CONFIG** target.

HPMM Write Lockout Control Display

Initial selection of the **CONTROL CONFIG** target produces the HPMM Control Configuration display shown in the following figure. The display has two main sections, Control Configuration and Schedule Overrun Counters.

Figure 126 HPMM Write Lockout Control Display

```
                                               03 Feb 09 22:14:32   8

        CONTROL CONFIGURATION : SCANRATE REG1LOG1  SEQPROC  1_PU

HPMM IOL                    TOTAL  FAST
  INFO      CONTROL SLOTS    100    20      FLAGS      16384
            PV SLOTS         100     0      NUMERICS       0
IOM IOL     LOGIC SLOTS       25     0      TIMERS        64
  INFO      DIGITAL COMPOSITES 100   50     STRINGS        0
            PROCESS MODULES    45   30*     TIMES          0
VERS/       ARRAY SLOTS         0
 REVIS      DEVICE CTL SLOTS  100    20
            ALM NUMERIC SLOTS   0
CONTROL     ARRAY/SI SCAN PERIOD  1.00     TOTAL  SEQUENCE MEM 14750 BLOCKS
CONFIG      * SEMI FAST PM              CONFIG SEQUENCE MEM  2384 BLOCKS

  UCN       NUMBER OF SCAN TABLE ITEMS       0          RESOURCE
 STATS      PEER TO PEER EFFICIENCY     100.0%            INFO
            PEER TO PEER SCAN PERIOD     0.5SEC
 MAINT      SCHEDULE OVERRUN COUNTERS - TOTALS FOR ALL CYCLES :  HPM WRITE
SUPPORT                    CURRENT HOUR    PREVIOUS HOUR  LOCKOUT
            POINT PROCESSOR OVERRUNS     2             2
  SOFT      IO LINK ACCESS OVERRUNS      0             0       SCHEDULE
FAILURE     UCN ACCESS OVERRUNS          0             0         INFO

UCN    1      P/S    PRIMARY  UCN CHANNEL   CHANNELA    FILE POS RIGHT
NODE  29      STATUS PF_IDLE  UCN AUTO SWAP ENABLE
TYPE HPM      PKGOPT REDUN
```

Control Configuration display information

Control Configuration information is found in the following table.

Table 48 HPMM Control Configuration Display

Term	Description
SCANRATE	See the *Process Operations Manual* Section 18, for the displayed states.
SEQPROC	See the *Process Operations Manual*, Section 18, for the displayed states.
TOTAL SEQUENCE MEM	The TOTAL SEQUENCE MEMory available in BLOCKS
CONFIG SEQUENCE MEM	The number of CONFIGuration SEQUENCE MEMory BLOCKS in use
CONTROL SLOTS	Number of regulatory CONTROL SLOTS and the number configured for FAST scan
PV SLOTS	The total number of regulatory PV SLOTS and the number configured for FAST scan
LOGIC SLOTS	Total number of regulatory LOGIC SLOTS and the number configured for FAST scan
DIGITAL COMPOSITES	The total number of regulatory DIGITAL COMPOSITE slots and the number configured for FAST scan
PROCESS MODULES	The total number of PROCESS MODULES **Note:** The Process Module point with * indicates that the point is processed twice a second.
ARRAY SLOTS	The total number of ARRAY SLOTS
DEVICE CTL SLOTS	The total number of regulatory DEVICE CTL (Control) SLOTS and the number configured for FAST scan
FLAGS	The total number of FLAGS
NUMERICS	The total number of NUMERICS
TIMERS	The total number of TIMERS
STRINGS	The total number of STRINGS
TIMES	The total number of TIMES
ARRAY/SI SCAN PERIOD	The ARRAY/SI (Serial Interface) SCAN PERIOD in seconds
NUMBER SCAN TABLE ITEMS	The number of Scan table items
PEER TO PEER EFFICIENCY	The peer to peer efficiency in percentage.
PEER TO PEER SCAN PERIOD	The peer to peer scan period in seconds.

Schedule Overrun Counters

The Schedule Overrun Counters portion of the display shows the total overruns for the previous and the current hour for all eight subcycles of the Control processor scan. On the hour, the **CURRENT HOUR** values become the **PREVIOUS HOUR** values and the **CURRENT HOUR** values are reset. The overruns are defined in the following table.

Table 49 HPMM Schedule Overrun Counters Statistics

Term	Description
POINT PROCESSOR OVERRUN	The number of times that the processing of all points could not be completed in 1 second.
I/O LINK ACCESS OVERRUNS	The number of timeouts that were encountered during data requests from the IOPs.
UCN ACCESS OVERRUNS	The number of timeouts that were encountered during access of data from HPM, APM, PM, or LM peers.

HPM Write Lockout Displays

HPM WRITE LOCKOUT target

Control of HPM Write Lockout can be executed from the HPM Write Lockout Control display. The display is invoked by selecting the **HPM WRITE LOCKOUT** target. The display is shown in the following figure.

Figure 127 HPM Write Lockout Target


```
                                    27 Nov   07:51:35   1




                    HPM WRITE LOCKOUT CONTROL


                WRITE            WRITE
              LOCK ON         LOCK OFF


             Select ENTER to execute command

                       ENTER                        CONTROL
                                                     CONFIG

                                                      HELP



 UCN    3      P/S    PRIMARY  UCN CHANNEL   CHANNELB    FILE POS LEFT
 NODE   9      STATUS OK       UCN AUTO SWAP ENABLE
 TYPE HPM      PKGOPT REDUN
```

16049
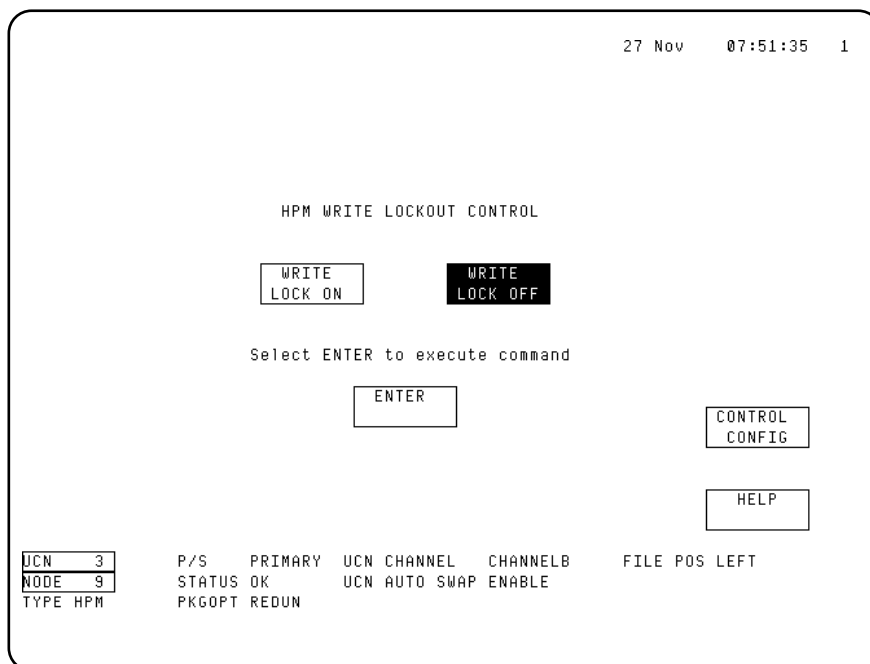
WRITE LOCK ON/OFF target selection

The HPM Write Lockout state can be altered only when the HPMM is in the OK or Soft Failure state and the US keylock is in the **ENGINEER** position.

If the proper conditions exist, selecting the **WRITE LOCK ON** target or **WRITE LOCK OFF** target, whichever is appropriate, followed by selecting the **ENTER** target, executes the command.

US ENGINEER keylock position

Failure to have the US keylock in the ENGINEER position when executing the HPM Write Lockout on/off command results in the HPM Write Lockout Control display shown in the following figure.

Figure 128 HPM Write Lockout Control Display – Improper US Keylock Position

```
                                            22 Nov    14:42:28    1




                        HPM WRITE LOCKOUT CONTROL


                    ┌─────────┐         ┌─────────┐
                    │ WRITE   │         │ WRITE   │
                    │ LOCK ON │         │ LOCK OFF│
                    └─────────┘         └─────────┘

                        Keylock State is not ENGR.
                        HPM Write Lockout Control
                            may not be changed.
                                                    ┌─────────┐
                                                    │ CONTROL │
                                                    │ CONFIG  │
                                                    └─────────┘

                                                    ┌─────────┐
                                                    │  HELP   │
                                                    └─────────┘

 ┌──────────┐
 │UCN     3 │  P/S    PRIMARY  UCN CHANNEL   CHANNELB    FILE POS LEFT
 │NODE    9 │  STATUS OK       UCN AUTO SWAP ENABLE
 └──────────┘
  TYPE HPM     PKGOPT REDUN
```
16050
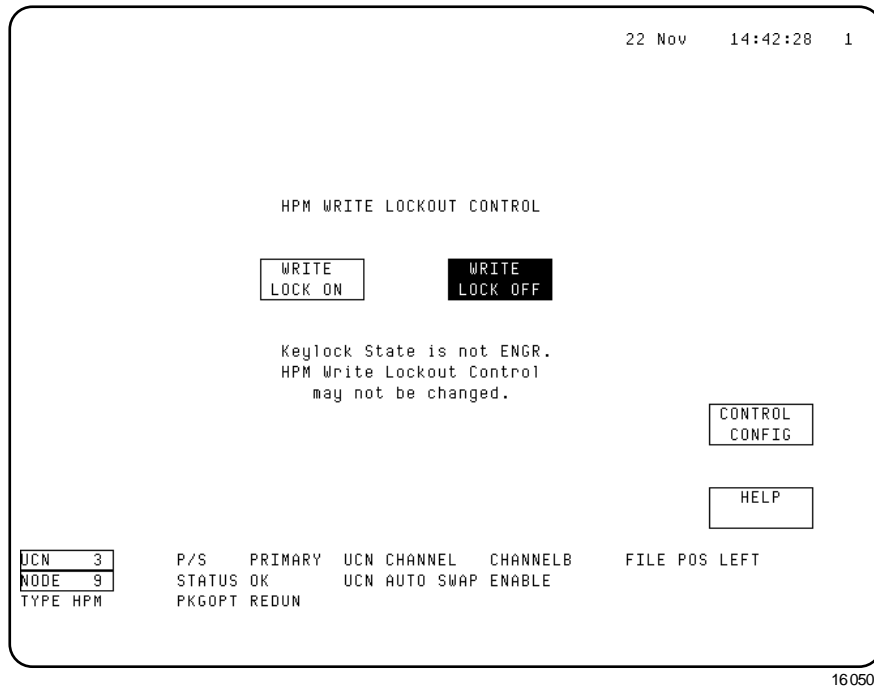
HELP target selection

Selecting the HELP target on the HPM Write Lockout Control display produces the HPM Write Lockout Control Help display shown in the following figure.

Figure 129 HPM Write Lockout Control Help Display

```
                                           22 Mar    13:25:52   9


HPM WRITE LOCKOUT PROVIDES THE USER WITH THE CAPABILITY TO BLOCK THE HPM FROM
ANY CONFIGURATION, SETPOINT OR MODE CHANGES. THE LOCKOUT SETTING CAN BE CHANGED
ONLY FROM THE HPM LOCKOUT CONTROL DISPLAY AND IT IS ENGINEER-KEY LOCKED. THE
HPM MUST BE IN RUN MODE TO CHANGE THE HPM LOCKOUT SETTING.

WHEN HPM LOCKOUT IS OFF, THE HPM HANDLES ALL CONFIGURATION, SETPOINT OR MODE
CHANGES IN THE NORMAL MANNER.

WHEN HPM LOCKOUT IS ON, ALL WRITE OPERATIONS TO THE HPM ARE DISALLOWED. THIS
INCLUDES CONFIGURATION, SETPOINT AND MODE CHANGES (MENTIONED ABOVE), AS WELL AS:

   - CHANGE OF HPM RUN STATES
   - WRITES FROM PEER NODES
   - CL PROGRAM LOAD AND CONFIRMATION OF MESSAGES
   - HOT FAILOVER MIGRATION

EXCEPTION: THE FOLLOWING COMMANDS ARE NOT BLOCKED BY HPM WRITE LOCKOUT AND
           ARE ALLOWED AT ALL TIMES.
   - HPPM & IOP SWAP COMMANDS                        ┌─────────┐
   - UCNC COMMANDS (CABLE SWAP, RESET STATISTICS ETC.)│ CANCEL  │
   - IOL MAINTENANCE COMMANDS (CABLE SWAP ETC.)      └─────────┘
   - CHANGES TO HPM WRITE LOCKOUT SETTING.

   FOR MORE DETAILS, REFER TO THE USER MANUALS.
```

16051

HPMM Schedule Information Display

Target selection

A detailed analysis of the assignment of the Control processor points for the eight subcycles of the Control processor scan is available by selecting the **SCHEDULE INFO** target. This invokes the HPMM Schedule Information display shown in the following figure.

Figure 130 HPMM Schedule Information Display

30 Jan 09 00:03:29

Control Config	Cycle 1		Cycle 2		Cycle 3		Cycle 4	
	1a	1b	2a	2b	3a	3b	4a	4b
	From-To	From-To	From-To	From-To	From-To	From-To	From-To	From-To
PV	100- 68	67- 47	46- 13	12- 1				
Fast PV								
PM				10- 1				
SmFst PM								
Log					50- 16	15- 11		
Fast Log		10- 1		10- 1		10- 1	10- 1	
DV						25- 10	9- 6	
Fast DV		5- 1		5- 1		5- 1	5- 1	
DC							25- 11	
Fast DC		10- 1		10- 1		10- 1	10- 1	
Ctl							50- 38	37- 1
Fast Ctl								
Tim								64- 1
Flg								1024- 1
Num	40- 1	80- 41	120- 81	160- 121				
CrHr PPX	0	0	0	0	0	0	0	0
PrHR PPX	0	0	0	0	0	0	0	0
CrHr IOL		0		0		0		0
PrHr IOL		0		0		0		0

```
UCN    1      P/S    PRIMARY    UCN CHANNEL    CHANNELA     FILE POS FILE_1
NODE  21      STATUS PARTFAIL   UCN AUTO SWAP ENABLE
TYPE HPM      PKGOPT REDUN_2F
```

Four cycles

The Control processor 1-second point-processing scan is divided into four cycles, each of which contains two subcycles. When configuring the Control processor and its associated entities, the user distributes the processing of the various point types among the several subcycles by slot type and slot number. This information is shown in the HPMM Schedule Information display in tabular form, along with the overrun counters for each cycle and subcycle. Inspection of the data in this table enables the user to determine where the assignment of slots is causing overruns and enables correction of the distribution to minimize overloading

Slot indices

Each box in the upper part of the table shows which slot indices of each point type are being processed in a given subcycle of the processing scan. For example, in Figure 130, PV Slots 25 through 9 are being processed during subcycle 1a, Logic Slots 17 through 1 are being processed during subcycle 2b, and so on. This information is fixed as a result of configuration and is not updated in the display.

Overruns

The overruns in the lower portion of the display are updated every 4 seconds. Point Processing Execution (PPX) overruns are computed for each subcycle. I/O Link (IOL) access overruns are computed for each cycle.

HPMM UCN Statistics Displays

Target selection

The displays invoked by selection of the **UCN STATS** target on the HPMM UCN Detail Status display are very similar to the displays described in the "NIM Detail Status display" subsection of "Detail Status Display Selection Procedures" ("UCN Status Displays" section). The HPMM's UCN statistics and status are maintained by the HPMM's UCN Driver. Use the **HELP** target on the display for descriptions of the statistics and status. Performance statistics descriptions, which are unique to the HPMM UCN Statistics display, are found in the following table. The displays are shown in Figure 131 and Figure 132.

Table 50 Performance Statistics

Statistic	Description
Comm Processor CPU Free	Indicates the Communications processor's free time as a percentage of availability.
Control Processor CPU Free	Indicates the Control processor's free time as a percentage of availability.
I/O Link Bandwidth Free	Indicates the I/O Link Communications Channel's free time as a percentage of availability.

HELP target

Refer to Figure 131 and Figure 132.

The **HELP** target is used to gain greater insight into each statistical entry on the 2-page HPMM UCN Statistics display. To use it, simply select the individual entry that you would like more information about, and then select the **HELP** target. The resultant display provides the following information about the statistical entry that you selected.

Description

Normal Value

How the system recovers from a failure

Probable cause of a failure

Reference to other statistics for correlation

> **ATTENTION**
>
> For a nonredundant HPMM or a redundant HPMM whose partner is not available, an increasing "NO-RESPONSE ERRORS" count is normal.

HPMM UCN Statistics display – Page 1

Figure 131 HPMM UCN Statistics Display – Page 1

```
                                                   22 Nov    14:45:40   1


  ┌────────┐                               ┌──────┐┌────────┐   ┌─────────┐
  │HPMM IOL│                               │ HELP ││RESET LOCL│  │STATISTICS│
  │  INFO  │                               └──────┘│STATISTICS│  │PAGE TWO │
  └────────┘       LOCAL UCN STATISTICS - PAGE 1    └────────┘   └─────────┘
  ┌────────┐
  │IOM IOL │       NO COPY BUFFERS           0    TOTAL CABLE SWAPS    4013
  │  INFO  │       TOKEN ROTATION TIME       0    CABLE A SILENCE         0
  └────────┘       NO SUCCESSOR FOUND        0    CABLE B SILENCE         0
  ┌────────┐       ASKED WHO FOLLOWS         0    CABLE A NOISE           0
  │ VERS/  │       TOKEN PASSES FAILED       0    CABLE B NOISE           0
  │ REVIS  │       NOISE BITS                0    NO-RESPONSE ERRORS     14
  └────────┘       CHECKSUM ERROR            0    UNEXPECTED RESPONSES    0
  ┌────────┐       REPEATER ERROR            0    ERRORS IN RESPONSES     0
  │CONTROL │       PARTIAL FRAME             0    AUTO-RECONNECTS         0
  │ CONFIG │       RECEIVED FRAME TOO LONG   0
  └────────┘       NO RECEIVE BUFFERS        0    LOCAL MESSAGES          0
  ┌────────┐       RECEIVE OVERRUN           0    MESSAGES SENT       13386
  │  UCN   │       DUPLICATE RWR             0    MESSAGES RECEIVED   46663
  │ STATS  │       NULL RWR (RESYNCH)        3    MESSAGES DISCARDED      0
  └────────┘       TRANSMIT UNDERRUN         0    REPLY TIMEOUTS          0
  ┌────────┐       TRANSMIT FRAME TOO LONG   0
  │ MAINT  │
  │SUPPORT │
  └────────┘
  ┌────────┐     UCN    3     P/S   PRIMARY  UCN CHANNEL   CHANNELB    FILE POS LEFT
  │  SOFT  │     NODE   9     STATUS OK       UCN AUTO SWAP ENABLE
  │FAILURE │     TYPE HPM     PKGOPT REDUN
  └────────┘
```
16053

HPMM UCN Statistics display – Page 2

Figure 132 HPMM UCN Statistics Display – Page 2

```
                                                   08 Nov    08:01:43   1

                 LOCAL UCN STATISTICS - PAGE 2
  ┌────────┐                               ┌──────┐┌────────┐   ┌─────────┐
  │HPMM IOL│                               │ HELP ││RESET LOCL│  │STATISTICS│
  │  INFO  │                               └──────┘│STATISTICS│  │PAGE ONE │
  └────────┘                                        └────────┘   └─────────┘
  ┌────────┐     EVENT SENDER STATISTICS         PERFORMANCE STATISTICS
  │IOM IOL │
  │  INFO  │     MESSAGES SENT         16066   COMM PROCESSOR CPU FREE  87.0 %
  └────────┘     MESSAGES RETRIED          0   CTRL PROCESSOR CPU FREE  93.4 %
  ┌────────┐     RECEIVER DROPPED          0   I/O LINK BANDWIDTH FREE  99.2 %
  │ VERS/  │     NAKS RECEIVED             0
  │ REVIS  │     THROTTLING REQUESTED      0
  └────────┘     NUMBER OF EVENT RCVRS     1
  ┌────────┐
  │CONTROL │
  │ CONFIG │
  └────────┘
  ┌────────┐        TIME SYNCH STATUS             TIME SYNCH STATISTICS
  │  UCN   │     UCN DATE        08 Nov 1995   SYNCH ERRORS             0
  │ STATS  │     UCN TIME          08:01:32    LOST MESSAGES            0
  └────────┘     SYNCHER NODE             1    CLOCK ERRORS             0
  ┌────────┐     CURRENT STATE        FAILED   DRIFT THRESHOLD          0
  │ MAINT  │     DRIFT VALUE              0
  │SUPPORT │
  └────────┘
  ┌────────┐     UCN    3     P/S   PRIMARY  UCN CHANNEL   CHANNELA    FILE POS RIGHT
  │  SOFT  │     NODE   9     STATUS OK       UCN AUTO SWAP ENABLE
  │FAILURE │     TYPE HPM     PKGOPT REDUN
  └────────┘
```
16054

HPMM Maintenance Support Displays

Target selection

The **MAINT SUPPORT** target provides access to six displays related to software errors, patches, the current state of the HPMM, and manufacturing information. The displays are shown in the following figures:

- Figure 133 HPMM Communications Error Block Display
- Figure 134 HPMM Control Block Display
- Figure 135 HPMM Control Patches Display
- Figure 136 HPMM Communications Patches Display
- Figure 137 HPMM Node Status Information Display
- Figure 138 Manufacturing Information Display

They contain the following six secondary targets:

- **CONTROL ERROR BLK**
- **COMMUNCTN ERROR BLK**
- **CONTROL PATCHES**
- **COMMUNCTN PATCHES**
- **NODE STS INFO**
- **MANUFAC INFO**

Communications Error Block display

The initial display produced by selection of the **MAINT SUPPORT** target is the Communications Error Block display as shown in Figure 133. The display provides the latest error information from the HPMM Communications processor. The error information consists of an error block in LCN error block format and the associated register values.

The Communications software version (**VERS**) and revision (**REV**) is displayed as well as the time of the last failure (**TIME OF FAILURE**).

Error information is not updated while the display is in view. The HPMM Detail Status display must be reselected to view changes in the error data.

Notice the reference to access Hard failure codes in the HPM Service manual. Table 58 Communications and Control Processor Hard Failure Codes is located in the "Fault Isolation" section.

Figure 133 HPMM Communications Error Block Display

```
                                        22 Nov    14:46:37   1


 ┌────────┐ ┌────────┐ ┌████████┐ ┌────────┐ ┌────────┐ ┌────────┐ ┌────────┐
 │HPMM IOL│ │CONTROL │ █COMMUNCTN█ │CONTROL │ │COMMUNCTN│ │NODE STS│ │MANUFAC.│
 │ INFO   │ │ERROR BLK│ █ERROR BLK█ │PATCHES │ │PATCHES │ │ INFO   │ │ INFO   │
 └────────┘ └────────┘ └████████┘ └────────┘ └────────┘ └────────┘ └────────┘
 ┌────────┐      SW VERS 00 REV 00        TIME OF FAILURE:      0 00:00:00
 │IOM IOL │         00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
 │ INFO   │
 └────────┘         BB BB 23 21 0A 0A 00 00 0F 04 39 74 80 11 0C B4
 ┌────────┐
 │VERS/   │         FF FF FF FF 55 55 00 00 00 00 00 00 00 00 FE 0A
 │ REVIS  │
 └────────┘         0A 00 00 00 00 00 00 00 00 00
 ┌────────┐         ----D0----- ----D1----- ----D2----- ----D3-----
 │CONTROL │         00 00 00 02 00 00 00 00 53 54 00 00 53 54 41 4B
 │ CONFIG │         ----D4----- ----D5----- ----D6----- ----D7-----
 └────────┘         53 54 41 4B 53 54 41 01 53 54 41 4B 00 00 00 00
 ┌────────┐         ----A0----- ----A1----- ----A2----- ----A3-----
 │UCN     │         0F 05 6F E0 53 54 41 4B 53 54 41 4B 53 54 41 4B
 │ STATS  │         ----A4----- ----A5----- ----A6----- ----A7-----
 └────────┘         53 54 41 4B 80 11 0C F0 80 11 03 E0 00 00 21 F8
 ┌────────┐
 │MAINT   │
 │SUPPORT │
 └────────┘
 ┌────────┐
 │SOFT    │
 │FAILURE │
 └────────┘
 ┌────────┐
 │UCN    3│      P/S    PRIMARY  UCN CHANNEL   CHANNELB    FILE POS LEFT
 │NODE   9│      STATUS OK       UCN AUTO SWAP ENABLE
 └────────┘      TYPE HPM     PKGOPT REDUN
```

16055

Control Error Block display

The selection of the **CONTROL ERROR BLK** target invokes the Control Error Block display, providing the latest error information from the HPMM Control processor. The error information consists of an error block in LCN error block format and the associated register values as shown in Figure 134. The display is also available by selection of the **CONTROL ERROR BLK** target while in any of the other Maintenance Support displays.

The Control software version (**VERS**) and revision (**REV**) is displayed as well as the time of the last failure (**TIME OF FAILURE**).

Error information is not updated while the display is in view. The HPMM Detail Status display must be reselected to view changes in the error data.

Notice the reference to access Hard failure codes in the HPM Service manual. Table 58 Communications and Control Processor Hard Failure Codes is located in the "Fault Isolation" section.

Figure 134 HPMM Control Block Display
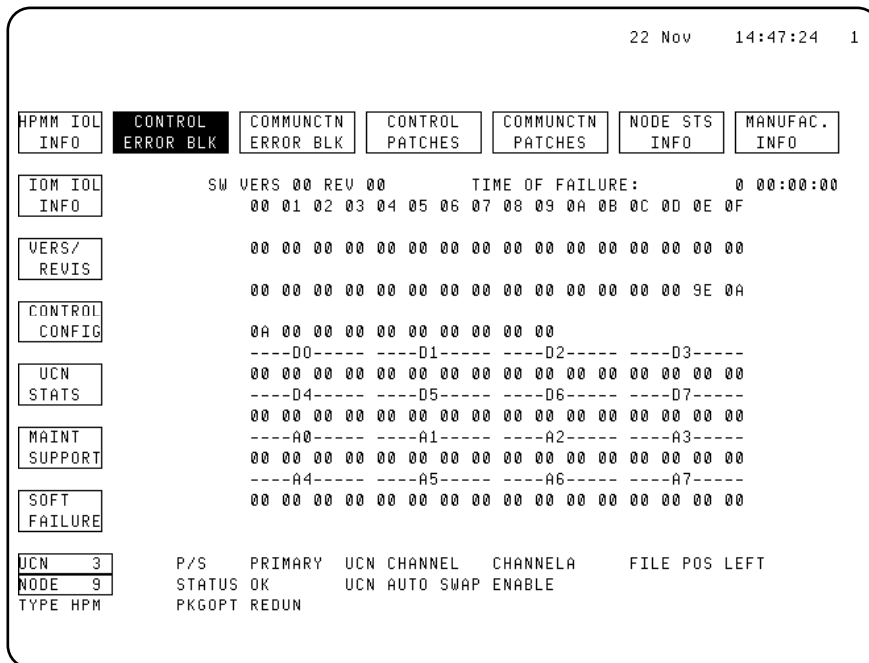
Control Patches display

The HPMM Control processor maintains a 256-word patch area. This area can be displayed by selection of the **CONTROL PATCHES** target. The Control Patches display is composed of four pages showing 64 words per page. Page 1 is shown in the following figure. To page forward in the display, the user selects the **NEXT PAGE** target. Paging backwards is not permitted. The page forward function has a wraparound feature.

Figure 135 HPMM Control Patches Display
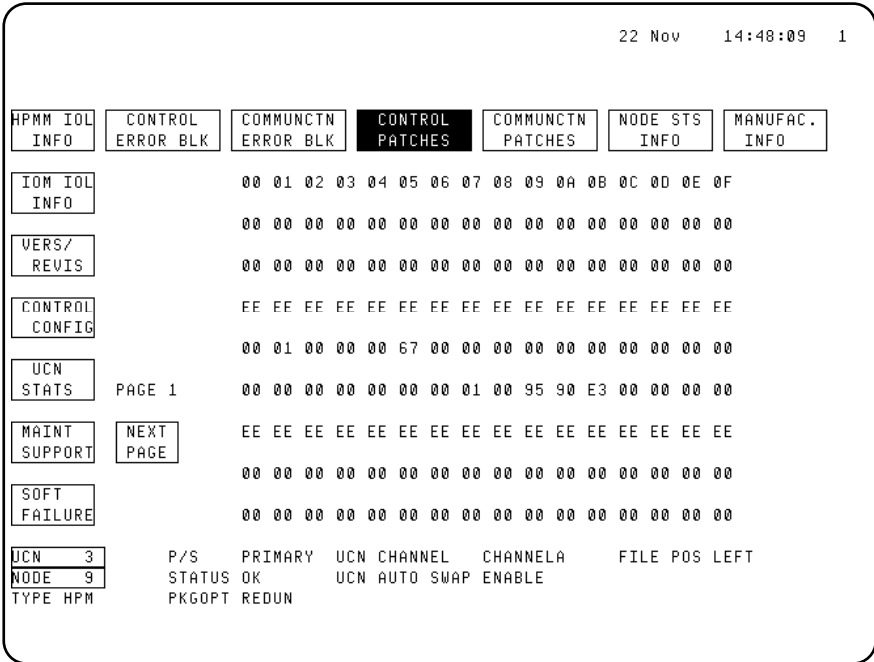
16057

ATTENTION

The Control Patches are used are used for Honeywell maintenance purposes only.

Communications Patches display

The HPMM Communications processor maintains a 256-word patch area. This area can be displayed by selection of the **COMMUNCTN PATCHES** target. The Communications Patches display is composed of four pages showing 64 words per page. Page 1 is shown in the following figure. To page forward in the display, the user selects the **NEXT PAGE** target. Paging backwards is not permitted. The page forward function has a wraparound feature.

Figure 136 HPMM Communications Patches Display
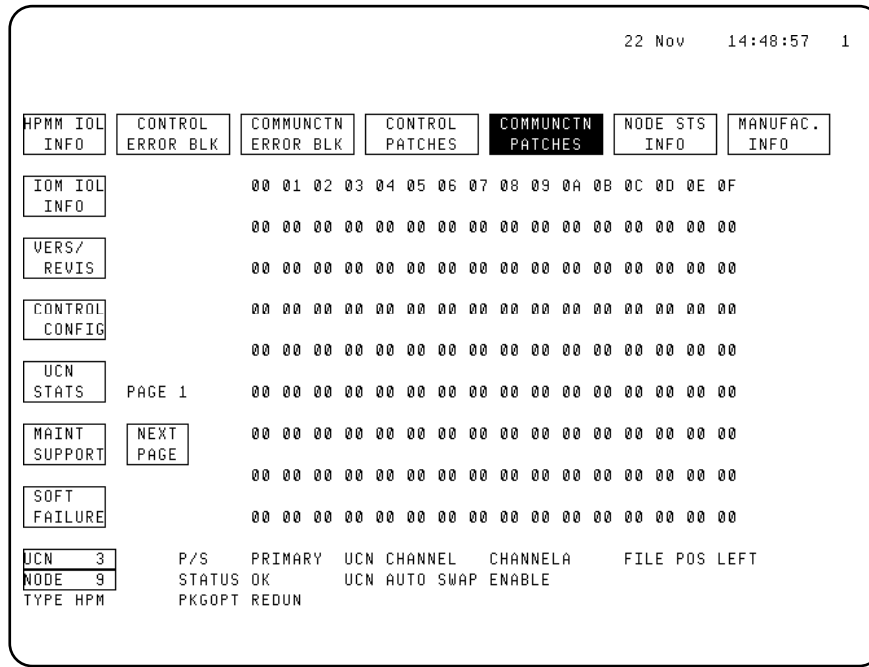
> **ATTENTION**
> The Communications Patches are used are used for Honeywell maintenance purposes only.

HPMM Node Status Information display

The Node Status Information display that is selected by the **NODE STS INFO** target contains miscellaneous information relative to the status of the HPMM. The format of the display is shown in the following figure.

Figure 137 HPMM Node Status Information Display

```
                                          22 Nov    14:49:42   1


 HPMM IOL   CONTROL    COMMUNCTN   CONTROL    COMMUNCTN   NODE STS   MANUFAC.
   INFO    ERROR BLK   ERROR BLK   PATCHES    PATCHES      INFO       INFO

 IOM IOL
   INFO                              CURR IOLP HARD FAIL : UNKNOWN
              PREV CTRL FAILURE : NULL     CURR CTRL HARD FAIL : NULL
 VERS/                               CURR COMM HARD FAIL : NULL
 REVIS
              PREV HPMM  STATUS : ALIVE
CONTROL
 CONFIG   REDUN PARTNER UCN VISIBILITY : VISIBLE
          REDUN PARTNER IOL VISIBILITY : VISIBLE
  UCN
 STATS      NODE LOAD FAILURE INFO :     0
                        LOAD FLAGS :    00
 MAINT        LOAD PACKET NUMBER :   1454
SUPPORT  UCN NODE PERFORMING LOAD :      1

  SOFT       STARTUP/FAILOVER INFO : 03
FAILURE

UCN    3       P/S    PRIMARY   UCN CHANNEL    CHANNELA      FILE POS LEFT
NODE   9       STATUS OK        UCN AUTO SWAP ENABLE
TYPE HPM       PKGOPT REDUN
```

16059

Data fields definitions

The display data fields are defined in the following table. Data is updated every 4 seconds.

Table 51 HPMM Node Status Information Display

Term	Description
PREV CTRL FAILURE	The Hard failure condition that existed prior to the last restart of the HPMM Control processor. The mnemonic in this field serves as an entry to the Table 58 in the "Fault Isolation" section.
CURR IOLP HARD FAIL	The current Hard failure detected by the I/O Link processor. The mnemonic in this field serves as an entry to Table 58 in the "Fault Isolation" section.
CURR CTRL HARD FAIL	The current Hard failure detected by the HPMM Control processor. The mnemonic in this field serves as an entry to Table 58 in the "Fault Isolation" section.
CURR COMM HARD FAIL	The current Hard failure detected by the HPMM Communications processor. The mnemonic in this field serves as an entry into Table 60 in the "Fault Isolation" section.
PREVIOUS HPMM STATUS	The previous status of the HPMM Communications processor. (ALIVE, IDLE, FAIL, OK, POWERON)
REDUN PARTNER UCN VISIBILITY	The redundant HPMM's visibility on the UCN (VISIBLE or NOT VISIBLE).
REDUN PARTNER IOL VISIBILITY	The redundant HPMM's visibility on the I/O Link. (VISIBLE or NOT VISIBLE).
NODE LOAD FAILURE INFO	A code that indicates the reason for the failure of the HPMM load.
LOAD FLAGS	Hexadecimal data that shows the status of the load operation.
LOAD PACKET NUMBER	The current load packet identifier
UCN NODE PERFORMING LOAD	An integer that gives the address of the UCN node performing the load.
STARTUP/FAILOVER INFO	Hexadecimal data that shows the state of the HPMM at startup or failover.

Manufacturing Information display

The Manufacturing Information display that is selected by the **MANUFAC INFO** target contains miscellaneous information that is relative to the manufacturing diagnostic software. The format of the display is shown in the following figure.

Figure 138 Manufacturing Information Display
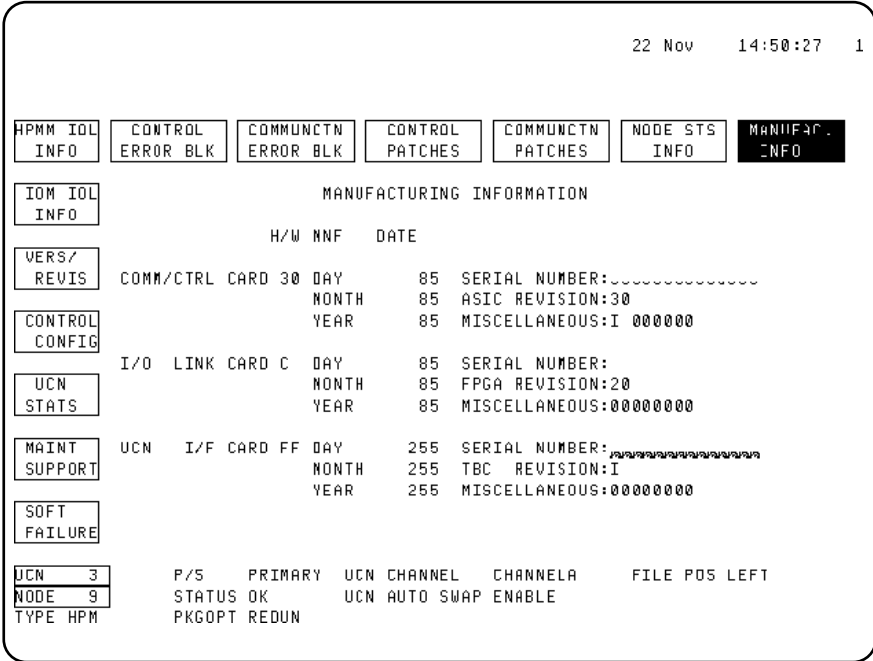
16060

HPMM Soft Failure Displays

Target selection

Selection of the **SOFT FAILURE** target on the HPMM Detail Status display provides access to three displays that show the Soft failures that can exist in the HPMM. Selecting the **SOFT FAILURE** target produces the HPMM Soft Failure display shown in the following figure.

Figure 139 HPMM Soft Failure Display
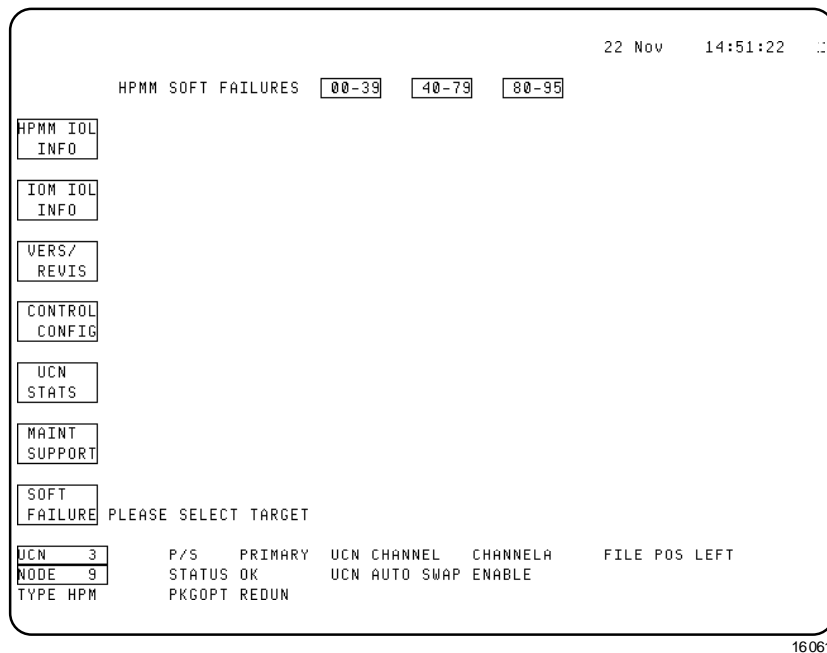
Failure code descriptions

Descriptions of the failure codes and the possible corrective actions can be found in Table 59 Comm/Control Soft Failure Error Codes in the "Fault Isolation" section.

Three targets

Each display consists of three targets, **00-39**, **40-79**, and **80-95**, at the top of the display, and a table of Soft failures below the targets. The Soft failures are displayed in two columns. All possible Soft failures are displayed in half intensity text. The failures that currently exist in the HPMM are highlighted by being shown in reverse video. The operator can step freely through the three displays by selection of the targets at the top of the display.

4-second update

The data is updated every 4 seconds.

HPMM Soft Failure – 00-39 display

The HPMM Soft Failure display for error codes 00 through 39 is shown in the following figure.

Figure 140 HPMM Soft Failure Display – 00-39

```
                                          08 Nov    08:17:53

            HPMM SOFT FAILURES   00-39    40-79    80-95

HPMM IOL   00 CTRL RESET/WDT EXPIRED        20 NO SECNDY UCN COMM TO PRIMARY
   INFO    01 CTRL PROCESSOR FAILURE        21 ----------------------------
           02 COMM PROCESSOR LOAD FAILURE   22 ----------------------------
 IOM IOL   03 ----------------------------  23 PRIM/SECNDY DUPLICATE IOM ADDR
   INFO    04 COMM PROC DIAG INIT TIMEOUT   24 INCOMPATIBLE FIRMWARE
           05 COMM PROC DIAG CYCLE OVERFLOW 25 TIMESYNCH CLOCK ERROR/DRIFT
 VERS/     06 GLOBAL RAM EDAC CIRCUITRY     26 IOL TIMESYNCH FAILURE
  REVIS    07 COM DETECT IOL RAM PARITY CKT 27 TIMESYNCH IOL #1 LATCH ERROR
           08 COM LOCAL RAM PARITY CIRCUITRY 28 TIMESYNCH UCN LATCH ERROR
 CONTROL   09 UCN ADDRESS CHANGE DETECTED   29 COMM PROC STACK LIMIT OVERFLOW
  CONFIG   10 TRANSIENT POWER DOWN DETECTED 30 COMM DETECTED LRM PERR HI-RATE
           11 COMM DETECTED IOL PERR HI-RATE 31 CTRL DETECTED LRM PERR HI-RATE
  UCN      12 ----------------------------  32 ----------------------------
  STATS    13 PRIVATE RAM PARITY CIRCUITRY  33 CTRL IOL OVERRUNS
           14 NO RESPONSE FROM IOL #1       34 CTRL UCN OVERRUNS
 MAINT     15 IOL MAX COMM ERRORS EXCEEDED  35 CTRL POINT PROCESSOR OVERRUNS
 SUPPORT   16 IOL CABLE A FAILURE           36 CTRL PROC DIAG INIT TIMEOUT
           17 IOL CABLE B FAILURE           37 CTRL PROC DIAG CYCLE OVERFLOW
 SOFT      18 NO PRIMARY IOL1 COMM TO SECNDY 38 CTRL LOCAL RAM PARITY CIRCUITRY
 FAILURE   19 NO PRIMARY UCN COMM TO SECNDY 39 CTRL REDUN DATA TRANSFER ERR

UCN    3      P/S    PRIMARY  UCN CHANNEL   CHANNELA    FILE POS RIGHT
NODE   9      STATUS OK       UCN AUTO SWAP ENABLE
TYPE HPM      PKGOPT REDUN
                                                              16062
```

HPMM Soft Failure – 40-79 display

The HPMM Soft Failure display for error codes 40 through 79 is shown in the following figure.

Figure 141 HPMM Soft Failure Display – 40-79

```
                                          08 Nov    08:20:07

            HPMM SOFT FAILURES   00-39    40-79    80-95

HPMM IOL   40 CTRL REDUN DATA TRACKING ERR 60 ----------------------------
   INFO    41 COMM WATCH DOG TIMER EXPIRED  61 ----------------------------
           42 ----------------------------  62 CTRL PROC STACK LIMIT OVERFLOW
 IOM IOL   43 ----------------------------  63 ----------------------------
   INFO    44 ----------------------------  64 ----------------------------
           45 REDUN PRIVATE PATH INIT ERROR 65 IOL PROC STC OVERRUN
 VERS/     46 ----------------------------  66 IOL PROC TASK REQUEST OVERFLOW
  REVIS    47 ----------------------------  67 IOL PROC RESUME NON-WAIT TASK
           48 ----------------------------  68 IOL PROC DIAG INIT TIMEOUT
 CONTROL   49 ----------------------------  69 IOL PROC DIAG CYCLE OVERFLOW
  CONFIG   50 ----------------------------  70 ----------------------------
           51 EXCESSIVE COM CPU LOAD        71 IOL CABLE 1A FAILURE
  UCN      52 EXCESSIVE CTL CPU LOAD        72 IOL CABLE 1B FAILURE
  STATS    53 EXCESSIVE I/O LINK LOAD       73 IOL CABLE 2A FAILURE
           54 UCN CABLE SWITCH HW FAULT     74 IOL CABLE 2B FAILURE
 MAINT     55 ----------------------------  75 NO RESPONSE FROM IOL #2
 SUPPORT   56 ----------------------------  76 IOL #2 WATCH DOG TIMER EXPIRED
           57 ----------------------------  77 TIMESYNCH IOL #2 LATCH ERROR
 SOFT      58 ----------------------------  78 NO PRIMARY IOL2 COMM TO SECNDY
 FAILURE   59 ----------------------------  79 ----------------------------

UCN    3      P/S    PRIMARY  UCN CHANNEL   CHANNELA    FILE POS RIGHT
NODE   9      STATUS OK       UCN AUTO SWAP ENABLE
TYPE HPM      PKGOPT REDUN
                                                              16063
```

HPMM Soft Failure – 80-95 display

The HPMM Soft Failure display for error codes 40 through 79 is shown in the following figure.

Figure 142 HPMM Soft Failure Display – 80-95

```
                                              27 Dec 13 12:21:01  10

              HPMM SOFT FAILURES   00-39    40-79    80-95

HPMM IOL     80 ------------------------------
  INFO       81 ------------------------------
             82 HIGH POWER SUPPLY MARGINING
IOM IOL      83 LOW POWER SUPPLY MARGINING
  INFO       84 IOL DETECTED IOL PERR HI-RATE
             85 IOL DETECT IOL RAM PARITY CKT
VERS/        86 UART ACCESSIBILITY ERROR
  REVIS      87 BATTERY BACKUP CIRCUITRY FAIL
             88 IOL PROC STACK LIMIT OVERFLOW
CONTROL      89 EHPM REDUN PORT NOT CONNECTED
 CONFIG      90 ------------------------------
             91 WATCH DOG TIMER DISABLED
  UCN        92 NO TOG FROM CTRL PROCESSOR
 STATS       93 GLOBAL DRAM EDAC SBE HI-RATE
             94 CTRL CONSOLE EMULATOR UNLOCKED
 MAINT       95 COMM CONSOLE EMULATOR UNLOCKED
SUPPORT


 SOFT
FAILURE


UCN   10       P/S    PRIMARY  UCN CHANNEL   CHANNELA    FILE POS FILE_1
NODE  57       STATUS PARTFAIL UCN AUTO SWAP ENABLE
TYPE HPM       PKGOPT REDUN_2F
```

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3.8   IOP Detail Status Displays

Overview

The IOP Detail Status displays consist of the initial display called the Input/Output Processor (IOP) Detail Status display, and several displays associated with Soft failures. The IOP Detail Status display provides information that is dependent on the IOP type. The following figure shows the IOP display for a primary High Level Analog Input (HLAI) IOP.

Figure 143 HLAI IOP Detail Status Display

```
MAKE SELECTION                                   22 Mar    12:34:37    9


              HLAI     Non-redundant ........
  UCN  10   HPM  29   MODULE   2 PHYS ADDR 131 FILE   1 CARD    4
 STS OK        ACTUAL TYPE HLAI     FTA Connect CONN_A
 Status:
 HARDWARE REV 59  FIRMWARE REV 5.0   LAST HARD FAILURE UNKNOWN

 ACTIVE CABLE  CHANNELA CHN A ERR :    0 CHN A SIL :    0    RESET MODULE
 LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0    COMM ERRORS

 FTA PRESENT               NO STANDBY MANUAL
 COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE
      Box Soft             Slot Soft            Slots with Soft
      Failures             Failures                Failures

 CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE STATE




                                                                    16065
```

Top portion of display

The top portion of the IOP Detail Status display contains the following information.

- The IOP configuration
- Hardware/firmware revisions and the last Hard failure
- I/O Link cable status and statistics
- Status messages
- **PRIMARY** or **SECONDARY IOP STATUS** targets, if redundant
- **SOFT FAILURE** targets

Primary and secondary IOP displays

Switching between the primary and secondary IOP Detail Status displays is provided by the **SECONDARY IOP STATUS** target on the primary display and the **PRIMARY IOP STATUS** target on the secondary display.

> **ATTENTION**
> In some scenarios, Description in the IOP details status display does not appear.

Bottom of display

The information at the bottom of the IOP Detail Status display varies. It is dependent on the IOP type. For example, in Figure 143, "**CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE**" appears for the HLAI IOP.

IOP configuration

The first line of the display indicates the IOP type (**HLAI**, **LLAI**, **DI**, etc.), primary or secondary HPMM (**PRIMARY** or **SECONDARY**) or **Non-redundant**, and whether the IOP is configured as A or B (**IOM_A** or **IOM_B**).

The remaining information in this area is defined in the following table. The status in this area is updated every 4 seconds.

Table 52 IOP Detail Status Display – IOP Configuration

Term	Description
UCN	The network number.
HPM	The HPM address on the UCN.
MODULE	The "soft" (logical) address of the IOP in the HPM configuration (1-40).
PHYS ADDR	The hardware address of the IOP on the I/O Link.
FILE	The card file position of the IOP in the HPM.
CARD	The slot position of the IOP in the card file.
STS	The current status of the IOP (SOFTFAIL, OK, IDLE, IDLESF, NR).
ACTUAL TYPE	The IOP type read from the IOP (HLAI, LLAI, DI, DO, DO_32, LLMux, RHMUX, STIM, STI, PI, SDI, SI, AO, or AO_32).
FTA CONNECT	The connector on the FTA that is in use (CONN_A or CONN_B).
WITH BIAS	Is the acting primary IOP the preferred IOP (YES or NO)?
HARDWARE REV	A hexadecimal byte that shows the current revision of the IOP hardware.
FIRMWARE REV	Two hexadecimal digits in the form "x.x" that shows the current firmware revision.
LAST HARD FAILURE	The last Hard failure detected by the IOP. The mnemonic in this field serves as an entry into Table 61 in the "Fault Isolation" section.
DESCRIPTION	If the IOP is a "High Density" IOP, such as a model MU-PDIY22 IOP, a description of the associated FTA will be included. Two types of FTA can be connected to the IOP (24 V or 240 V).

I/O Link cable status and statistics

The data in this area is defined in the following table.

The data is updated every four seconds. The area also contains the **RESET MODULE COMM ERRORS** target, selection of which resets the error/silence totals for the IOP, and resets the **LAST COMM ERR** field to **NONE**.

Table 53 IOP Detail Status Display – I/O Link Cable Status/Statistics

Term	Description
ACTIVE CABLE	The current I/O Link receive channel (CHANNEL A or CHANNEL B)
LAST COMM ERR	The last I/O Link communications error detected by the IOP
CHN A ERR	The total channel A errors detected by the IOP since startup or the last reset of the cable statistics
CHN B ERR	The total channel B errors detected by the IOP since startup or the last reset of the cable statistics
CHN A SIL	The total channel A silences detected by the IOP since startup or the last reset of the cable statistics
CHN B SIL	The total channel B silences detected by the IOP since startup or the last reset of the cable statistics

Status messages

This area contains status messages that are determined by status bits that are resident in the IOP. The messages are in pairs as defined in the following table. The first message of each pair is the message that is displayed if the status bit is on. The status bits can be considered to be independent of one another, so the message pairs can appear in any combination.

Table 54 IOP Detail Status Display – I/O Link Cable Status Messages

Term	Description
FTA PRESENT/NO FTA	The presence or absence of a Field Termination Assembly (FTA) attached to the IOP
WARM START LAST EXECUTED/COLD START EXECUTED	The nature of the last IOP startup. A warm startup means that the IOP's database has been preserved. A cold startup means that the IOP has a default database.
STANDBY MANUAL ENABLED/NO STANDBY MANUAL	The presence or absence of a Standby Manual device
SWITCHED ACTIVE/NO SWITCHED ACTIVE	The presence or absence of a switched active device

Loss of communications

If the data for the above messages is unavailable due to the loss of communication with the IOP, a message in the form, "**<message data> UNAVAIL**," will appear.

4-second data update

The data is updated every 4 seconds.

IOP Box Soft Failures Displays

SOFT FAILURE targets

Three Soft failure targets on the IOP display provide access to IOP Soft failure displays. The three targets are:

- **BOX SOFT FAILURES**
- **SLOT SOFT FAILURES**
- **SLOTS WITH SOFT FAILURES**

Targets on each display provide the ability to move between the three types of Soft failure displays and the IOP Detail Status display easily.

Target selection

The initial Box Soft Failures display, invoked by selection of the **BOX SOFT FAILURES** target on the IOP Detail Status display, is shown in the following figure. The Box Soft Failures displays consist of five pages as shown in the following figures:

Figure 145 IOP Box Soft Failures Display – Page 1

Figure 146 IOP Box Soft Failures Display – Page 2

Figure 147 IOP Box Soft Failures Display – Page 3

Figure 148 IOP Box Soft Failures Display – Page 4

Figure 149 IOP Box Soft Failures Display – Page 5

Each failure is described, and when the failure is active, an arrow appears pointing to the failure. Table 61 IOP Hard Failure Error Codes, ("Fault Isolation" section) lists the errors and the suggested corrective actions.

Figure 144 IOP Box Soft Failures Display

IOP Box Soft Failures display – Page 1

Page 1 of the IOP Box Soft Failures displays is shown in the following figure.

Figure 145 IOP Box Soft Failures Display – Page 1

```
                                       11 Sep    09:29:31   1


                    ┌─────────┐ ┌─────────┐
                    │ UCN 003 │ │ HPM 009 │  MODULE 001
                    └─────────┘ └─────────┘
                    ┌─────┐  ┌─────┐  ┌─────┐  ┌──────────────┐
                    │  1  │  │  2  │  │  3  │  │ Module  Display │
Select Page:        └─────┘  └─────┘  └─────┘  │ Slot Failures   │
                    ┌─────┐  ┌─────┐           │ Slots w/Failures│
                    │  4  │  │  5  │           └──────────────┘
                    └─────┘  └─────┘

         00 Null soft failure - not used
         01 Sample time clock overrun of greater than twice its period
         02 IOP task request overflow - indicates excessive IOL activity
         03 IOP EXEC resumed a non-waiting task - software bug indicated
         04 Diagnostics have not run in at least 5 sec - possible overload
         05 Entire diagnostic cycle overran the two minute allocated time
         06 FTA is missing or, if LLMUX, power adaptor is missing
         07 EEPROM checksum error - IOP probably not calibrated
         08 EEPROM counter error - too many writes or unformatted EEPROM
         09 EEPROM flag error - incomplete write or uncalibrated IOP
         10 Switched signal error - possible FTA problem
         11 ADP private RAM contents error (LLAI only) - no conversions
         12 ADP private RAM address error (LLAI only) - no conversions
         13 LLAI shared RAM contents failure - no AI conversions
         14 LLAI shared RAM address error - no AI conversions
         15 LLAI shared RAM checksum error - no AI conversions

                    Box Soft Failures - Page 1
```
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IOP Box Soft Failures display – Page 2

Page 2 of the IOP Box Soft Failures displays is shown in the following figure.

Figure 146 IOP Box Soft Failures Display – Page 2

```
                                       11 Sep    09:30:26   1


                    ┌─────────┐ ┌─────────┐
                    │ UCN 003 │ │ HPM 009 │  MODULE 001
                    └─────────┘ └─────────┘
                    ┌─────┐  ┌─────┐  ┌─────┐  ┌──────────────┐
                    │  1  │  │  2  │  │  3  │  │ Module  Display │
Select Page:        └─────┘  └─────┘  └─────┘  │ Slot Failures   │
                    ┌─────┐  ┌─────┐           │ Slots w/Failures│
                    │  4  │  │  5  │           └──────────────┘
                    └─────┘  └─────┘

         16 ADP ROM checksum failure - no AI conversions (LLAI only)
         17 ADP has failed in communications with IOLP (recoverable)
         18 ADP failed on IOP startup - it will not recover
         19 Input module scan overrun, excessive IOL activity to this IOP
         20 Input module scan underrun
         21 *** Slot soft failure only (input failure) ***
         22 DOM secondary regulator is not working
         23 *** This bit is a slot soft failure only ***
         24 8051 stack usage is dangerously close to its limit
         25 *** Spare ***
         26 Input/output loopback failure
         27 No IOLP access to shared RAM
         28 No external AC line in the LLAI; input conversions continue
         29 *** This bit is a slot soft failure only ***
         30 Test voltage reference >5% out of range - PVAUTOs to MAN
         31 *** This bit is a slot soft failure only ***

                    Box Soft Failures - Page 2
```
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N

IOP Box Soft Failures display – Page 3

Page 3 of the IOP Box Soft Failures displays is shown in the following figure.

Figure 147 IOP Box Soft Failures Display – Page 3

```
                                        11 Sep    09:31:19   1


                      UCN 003   HPM 009   MODULE 001

              ┌─────┐   ┌─────┐   ┌─────┐   ┌──────────────┐
              │  1  │   │  2  │   │  3  │   │ Module  Display│
Select Page:  └─────┘   └─────┘   └─────┘   │ Slot Failures │
              ┌─────┐   ┌─────┐             │Slots w/Failures│
              │  4  │   │  5  │             └──────────────┘
              └─────┘   └─────┘

           32 Zero reference voltage out of range
           33 Reference junction value bad
           34 LLAI bad ADP branch taken; software bug
           35 *** This bit is a slot soft failure only ***
           36 FTA #1 has a soft failure
           37 FTA #2 has a soft failure
           38 Calibration of a module has aborted due to a failure
           39 Calibration voltage out of range during a calibration
           40 EEPROM store failed – calibration data may be lost
           41 Reference voltage out of range
           42 Analog to digital conversion underflow (HLAI only)
           43 HLAI A/D out of calibration by more than +/- 3%
           44 AO module failure selection register is bad
           45 Secondary latch failure
           46 Output disable buffer failure
           47 Calibration reference voltage out of range

              Box Soft Failures – Page 3
```

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IOP Box Soft Failures display – Page 4

Page 4 of the IOP Box Soft Failures displays is shown in the following figure.

Figure 148 IOP Box Soft Failures Display – Page 4

```
                                        11 Sep    09:31:58   1


                      UCN 003   HPM 009   MODULE 001

              ┌─────┐   ┌─────┐   ┌─────┐   ┌──────────────┐
              │  1  │   │  2  │   │  3  │   │ Module  Display│
Select Page:  └─────┘   └─────┘   └─────┘   │ Slot Failures │
              ┌─────┐   ┌─────┐             │Slots w/Failures│
              │  4  │   │  5  │             └──────────────┘
              └─────┘   └─────┘

           48 LLMUX: FTA1 not calib./SI: FTA1 write buffer overflow
           49 LLMUX: FTA2 not calib./SI: FTA2 write buffer overflow
           50 FTA 1 communication failure
           51 FTA 2 communication failure
           52 FTA 1 identification error
           53 FTA 2 identification error
           54 FTA 1 reference voltage failure
           55 FTA 2 reference voltage failure
           56 FTA 1 calibration failure
           57 FTA 2 calibration failure
           58 IOP lost synchronization with its primary
           59 AO/DO write enable protection failure
           60 Multiple input failure detected
           61 Redundancy hardware diagnostic failure
           62 Data bus failure
           63 IO redundancy configured on non-supportive hardware rev

              Box Soft Failures – Page 4
```

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IOP Box Soft Failures display – Page 5

Page 5 of the IOP Box Soft Failures displays is shown in the following figure.

Figure 149 IOP Box Soft Failures Display – Page 5

```
                                        11 Sep    09:32:38   1


                  UCN 003   HPM 009   MODULE 001

                  1        2        3     Module  Display
Select Page:                                Slot Failures
                  4        5              Slots w/Failures

        64 Hardware FIFO diagnostic failed – PVs set BAD – replace IOP
        65 Private RAM diagnostic failed   – PVs set BAD – replace IOP
        66 SOE clock failed                – PVs set BAD – replace IOP
        67 PV validation diagnostic failed – PVs set BAD – replace IOP
        68 SOE counter diagnostic failed   – PVs will be valid
        69 Data path failure               –
        70 Data path time out              –
        71 State machine diagnostic failure– PVs set BAD – replace IOP









              Box Soft Failures – Page 5


                                                              16071
```

IOP Slot Soft Failures Displays

Target selection

The initial IOP Slot Soft Failures display, invoked by selection of the **SLOT SOFT FAILURES** target on the IOP Detail Status display, is shown in the following figure. The display consists of three pages as shown in the following figures:

- Figure 151 IOP Slot Soft Failures Display – Page 1
- Figure 152 IOP Slot Soft Failures Display – Page 2
- Figure 153 IOP Slot Soft Failures Display – Page 3

Each failure is described, and when the failure is active, an arrow appears pointing to the failure. Table 62 IOP Box Soft Failure Error Codes ("Fault Isolation" section) lists the errors and the suggested corrective actions.

Figure 150 IOP Slot Soft Failures Display

IOP Slot Soft Failures display – Page 1

Page 1 of the IOP Slot Soft Failures displays is shown in the following figure.

Figure 151 IOP Slot Soft Failures Display – Page 1

```
                                    11 Sep     09:33:19    1



                  UCN 003   HPM 009  MODULE 001

                                        Module Display
Select Page:      1       2       3     Box Failures
                                        Slots w/Failures

          00 Null soft failure - not used
          01 *** Box soft failure only ***
          02 *** Box soft failure only ***
          03 *** Box soft failure only ***
          04 *** Box soft failure only ***
          05 *** Box soft failure only ***
          06 *** Box soft failure only ***
          07 EEPROM checksum error OR IOP not calibrated
          08 EEPROM counter error - too many writes or unformatted EEPROM
          09 *** Box soft failure only ***
          10 *** Box soft failure only ***
          11 *** Box soft failure only ***
          12 *** Box soft failure only ***
          13 *** Box soft failure only ***
          14 *** Box soft failure only ***
          15 *** Box soft failure only ***

              Slot Soft Failures - Page 1
```

16073

IOP Slot Soft Failures display – Page 2

Page 2 of the IOP Slot Soft Failures displays is shown in the following figure.

Figure 152 IOP Slot Soft Failures Display – Page 2

```
                                    11 Sep     09:33:55    1



                  UCN 003   HPM 009  MODULE 001

                                        Module Display
Select Page:      1       2       3     Box Failures
                                        Slots w/Failures

          16 *** Box soft failure only ***
          17 *** Box soft failure only ***
          18 *** Box soft failure only ***
          19 *** Box soft failure only ***
          20 *** Box soft failure only ***
          21 Input point failed diagnostic
          22 *** Box soft failure only ***
          23 Failure in output circuitry detected by AO or DO
          24 *** Box soft failure only ***
          25 *** Box soft failure only ***
          26 Input/output loopback failure for this slot
          27 *** Box soft failure only ***
          28 *** Box soft failure only ***
          29 Bad input or bad FTA plug-in module
          30 *** Box soft failure only ***
          31 FTA type mismatch with slot configuration

              Slot Soft Failures - Page 2
```

16074

IOP Slot Soft Failures display – Page 3

Page 3 of the IOP Slot Soft Failures displays is shown in the following figure.

Figure 153 IOP Slot Soft Failures Display – Page 3

```
                                         11 Sep     09:34:31   1



                      ┌─────────┐  ┌─────────┐
                      │ UCN 003 │  │ HPM 009 │  MODULE 001
                      └─────────┘  └─────────┘
                                              ┌──────────────────┐
                                              │  Module Display  │
   Select Page:      ┌───────┐  ┌───────┐  ┌───────┐ Box Failures   │
                     │   1   │  │   2   │  │   3   │ Slots w/Failures│
                     └───────┘  └───────┘  └───────┘└──────────────────┘

           32 *** Box soft failure only ***
           33 *** Box soft failure only ***
           34 *** Box soft failure only ***
           35 Illegal internal zero configuration attempted on this channel
           36 *** Spare failure indicator ***
           37 *** Spare failure indicator ***
           38 Calibration of this slot has aborted
           39 *** Box soft failure only ***
           40 *** Box soft failure only ***
           41 *** Box soft failure only ***
           42 A/D slot conversion on AIM slot underflowed min allowed count
           43 *** Box soft failure only ***
           44 *** Box soft failure only ***
           45 *** Box soft failure only ***
           46 *** Box soft failure only ***
           47 *** Box soft failure only ***

                  Slot Soft Failures - Page 3
```

16075

IOP Slots with Soft Failures Display

Target selection

The Slots with Soft Failures display, invoked by selection of the **SLOTS WITH SOFT FAILURES** target on the IOP detail Status display, is a single display as shown in the following figure. No failure is displayed as the response **NONE** indicates.

Figure 154 IOP Slots with Soft Failures Display
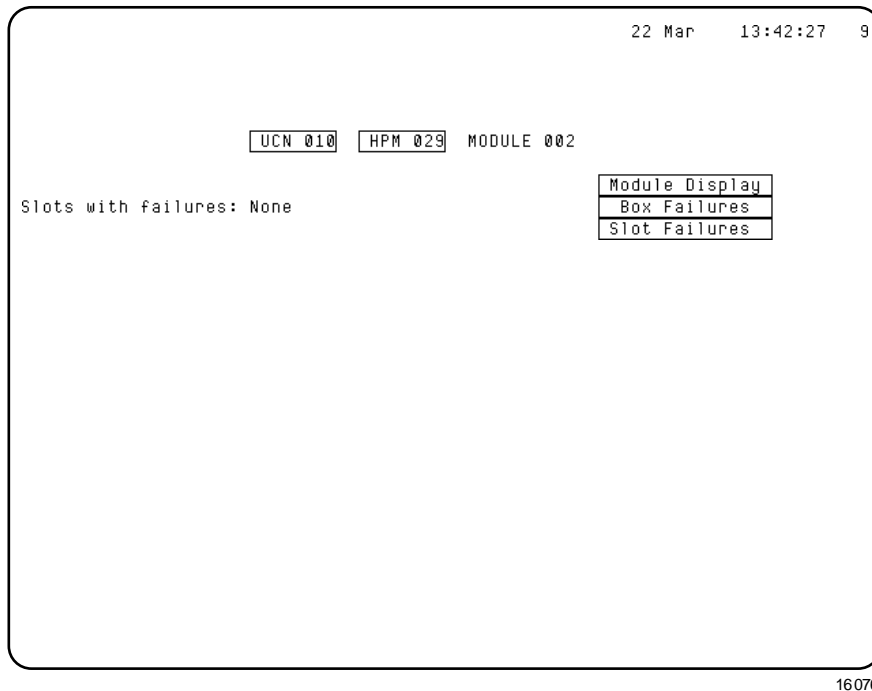
```
                                           22 Mar    13:42:27   9



                        ┌─────────┐ ┌─────────┐
                        │ UCN 010 │ │ HPM 029 │  MODULE 002
                        └─────────┘ └─────────┘
                                              ┌──────────────────┐
                                              │  Module Display  │
        Slots with failures: None            ├──────────────────┤
                                              │   Box Failures   │
                                              ├──────────────────┤
                                              │   Slot Failures  │
                                              └──────────────────┘
```

16076

HLAI IOP Detail Status Display

IOP calibration

The HLAI IOP Detail Status display can be used for calibration of the IOP's A/D converters. Targets are provided to enable/disable the calibration procedure. The calibration procedures are found in "IOP Calibration Procedures" section.

HLAI IOP calibration

The HLAI IOP Detail Status display, as shown in Figure 143, is typical of the display for an IOP that is not in the **IDLE** or **IDLESF** (Idle or Idle/Soft Failure) state. Calibration is permitted in only the **IDLE** or **IDLESF** states, as indicated by the "**CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE**" message at the bottom of the display.

ENABLE CALIBRATN target

When the IOP is in the Idle or Idle/Soft Failure state, and not being calibrated, as indicated by a calibration bit resident in the IOP, an **ENABLE CALIBRATN** target appears, indicating that calibration can be initiated as shown in the following figure.

Figure 155 High Level Analog Input IOP Detail Status Display – ENABLE CALIBRATN Target Selected

```
MAKE SELECTION                                   22 Mar   13:50:02   9


            HLAI      Non-redundant ........
  ┌─────┐ ┌─────────┐
  │ UCN  10│ │ HPM  29│  MODULE   2 PHYS ADDR 131 FILE   1 CARD   4
  └─────┘ └─────────┘
  STS IDLE     ACTUAL TYPE HLAI     FTA Connect CONN_A
  Status:
  HARDWARE REV 59  FIRMWARE REV 5.0   LAST HARD FAILURE UNKNOWN

                                                          ┌──────────────┐
  ACTIVE CABLE  CHANNELA CHN A ERR :    0 CHN A SIL :   0 │ RESET MODULE │
  LAST COMM ERR NONE      CHN B ERR :    0 CHN B SIL :   0 │ COMM ERRORS  │
                                                          └──────────────┘
  FTA PRESENT                 NO STANDBY MANUAL
  COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

  ┌───────────────┐     ┌───────────────┐     ┌──────────────────┐
  │   Box Soft    │     │  Slot Soft    │     │  Slots with Soft │
  │   Failures    │     │  Failures     │     │    Failures      │
  └───────────────┘     └───────────────┘     └──────────────────┘
  ┌───────────────┐
  │    ENABLE     │
  │  CALIBRATN    │
  └───────────────┘
```

16077

DISABLE CALIBRATN target

Selection of the **ENABLE CALIBRATN** target sets the calibration bit in the IOP and results in the display that is shown in the following figure. The **DISABLE CALIBRATN** target indicates that calibration is in progress, and that the calibration bit in the IOP can be reset by the operator selecting the **DISABLE CALIBRATN** target.

Figure 156 High Level Analog Input IOP Detail Status Display – DISABLE CALIBRATN Target Selected

```
MAKE SELECTION                                       22 Mar    13:50:32    9



               HLAI     Non-redundant ........
  UCN  10    HPM  29   MODULE   2 PHYS ADDR 131 FILE   1 CARD   4
STS IDLE      ACTUAL TYPE HLAI      FTA Connect CONN_A
Status:
HARDWARE REV 59  FIRMWARE REV 5.0   LAST HARD FAILURE UNKNOWN

ACTIVE CABLE  CHANNELA CHN A ERR :    0 CHN A SIL :    0    RESET MODULE
LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0    COMM ERRORS

FTA PRESENT                  NO STANDBY MANUAL
COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

      Box Soft          Slot Soft           Slots with Soft
      Failures          Failures               Failures

      DISABLE
      CALIBRTN




                                                               16078
```

Calibration bit

The calibration bit can also be reset at the IOP when calibration is complete. Either action will return the IOP to the state that is shown in Figure 155.

LLAI IOP Detail Status Display

IOP calibration

The LLAI IOP Detail Status display can be used for calibration of the IOP's A/D converters. Targets are provided to enable/disable the calibration procedure. The calibration procedures are found in the "IOP Calibration Procedures" section.

LLAI IOP calibration

There are two types of calibrations possible for the LLAI IOP, A/D Converter calibration and Reference Junction calibration. Figure 157, Figure 158 and Figure 159 show the calibration targets available for calibration of the LLAI IOP.

ENABLE CALIBRATN and ENABLE RJ CALIBR Targets

The following figure shows the Low Level Analog Input IOP Detail Status display with the ENABLE CALIBRATN and ENABLE RJ CALIBR targets.

Figure 157 Low Level Analog Input IOP Detail Status Display –ENABLE CALIBRATN and

ENABLE RJ CALIBR Targets

```
MAKE SELECTION                                  22 Mar    13:52:17    !9


              LLAI     Non-redundant ........
┌─────┐  ┌────────┐
│UCN 10│  │HPM  29│ MODULE   3 PHYS ADDR 132 FILE   1 CARD   5
└─────┘  └────────┘
STS IDLE      ACTUAL TYPE LLAI     FTA Connect CONN_A
Status:
HARDWARE REV 26  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

ACTIVE CABLE  CHANNELA CHN A ERR :    0 CHN A SIL :    0   ┌─────────────┐
LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0   │RESET MODULE │
                                                          │COMM ERRORS  │
                                                          └─────────────┘
FTA PRESENT               NO STANDBY MANUAL
WARM POWERUP LAST EXECUTED  SWITCHED ACTIVE

┌──────────────┐    ┌──────────────┐    ┌─────────────────┐
│  Box Soft    │    │  Slot Soft   │    │  Slots with Soft│
│  Failures    │    │  Failures    │    │  Failures       │
└──────────────┘    └──────────────┘    └─────────────────┘

    LINE PERIOD   16668                      OPEN SENSOR DETEC⌐
    RJ RAW COUNTS -----                         ┌──────┐
    RJ Temp : ---------                         │  ON  │
                                                ├──────┤
┌──────────────┐                                │ OFF  │
│ ENABLE       │                                └──────┘
│ CALIBRATN    │
└──────────────┘                            LINE FREQUENCY
┌──────────────┐                                ┌──────┐
│ ENABLE       │                                │ 50 HZ│
│ RJ CALIBR    │                                ├──────┤
└──────────────┘                                │ 60 HZ│
                                                └──────┘
```

16079

Calibration messages

When either type of calibration is in progress, the message "**MODULE IN CALIBRATION**" or "**RJ IN CALIBRATION**" is displayed to the right of the **LINE PERIOD** data, as shown in Figure 158 and Figure 159 respectively.

DISABLE CALIBRATN target

Figure 158 Low Level Analog Input IOP Detail Status Display – DISABLE CALIBRATN Target Selected

```
MAKE SELECTION                                    22 Mar   13:52:46   (


             LLAI     Non-redundant ........
   UCN  10   HPM  29  MODULE   3 PHYS ADDR 132 FILE   1 CARD   5
   STS IDLE     ACTUAL TYPE LLAI     FTA Connect CONN_A
   Status:
   HARDWARE REV 26  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN


   ACTIVE CABLE  CHANNELB CHN A ERR :    0 CHN A SIL :    0   RESET MODULE
   LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0   COMM ERRORS

   FTA PRESENT                 NO STANDBY MANUAL
   WARM POWERUP LAST EXECUTED   SWITCHED ACTIVE

      Box Soft          Slot Soft          Slots with Soft
      Failures          Failures             Failures

      LINE PERIOD   16667   MODULE IN CALIBRATION      OPEN SENSOR DETEC
      RJ RAW COUNTS -----                                   ON
      RJ Temp : ---------                                  OFF

      DISABLE
      CALIBRTN                                       LINE FREQUENCY
                                                        50 HZ
      ENABLE                                            60 HZ
      RJ CALIBR
```
16080

DISABLE RJ CALIBR target

Figure 159 Low Level Analog Input IOP Detail Status Display – DISABLE RJ CALIBR Target Selected

```
MAKE SELECTION                                22 Mar    13:53:40   !S


            LLAI      Non-redundant ........
 UCN  10   HPM  29  MODULE   3 PHYS ADDR 132 FILE   1 CARD   5
STS IDLE     ACTUAL TYPE LLAI    FTA Connect CONN_A
Status:
HARDWARE REV 26  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

ACTIVE CABLE  CHANNELB CHN A ERR :     0 CHN A SIL :     0   RESET MODULE
LAST COMM ERR NONE      CHN B ERR :     0 CHN B SIL :     0   COMM ERRORS

FTA PRESENT               NO STANDBY MANUAL
WARM POWERUP LAST EXECUTED  SWITCHED ACTIVE

   Box Soft          Slot Soft          Slots with Soft
   Failures          Failures             Failures

   LINE PERIOD   16671                      OPEN SENSOR DETEC¨
   RJ RAW COUNTS -----   RJ IN CALIBRATION       ON
   RJ Temp : ---------                            OFF

   ENABLE
   CALIBRATN                                 LINE FREQUENCY
                                               50 HZ
   DISABLE                                     60 HZ
   RJ CALIBR
                                                           16081
```

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definitions that follow provide information that is unique to the LLAI IOP Detail Status display.

REQUEST OTD STATUS and LINE FREQUENCY targets

The unique portion of the LLAI IOP Detail Status display data and the **REQUEST OTD STATUS** and **LINE FREQUENCY** targets are shown in the following figure.

Figure 160 Low Level Analog Input IOP Detail Status Display

```
MAKE SELECTION                                15 May 91 12:57:18  2


                LLAI      Non-redundant ........
     ┌───────┐┌───────┐
     │UCN 007││APM 003│  MODULE 002 PHYS ADDR 139 FILE 001 CARD 012
     └───────┘└───────┘
     STS OK       ACTUAL TYPE LLAI    FTA Connect CONN_A
     Status:
     HARDWARE REV 04  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

     ACTIVE CABLE  CHANNELB CHN A ERR : 00000 CHN A SIL : 00000   ┌──────────────┐
     LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000   │RESET MODULE  │
                                                                  │COMM ERRORS   │
                                                                  └──────────────┘
     FTA PRESENT             NO STANDBY MANUAL
     COLD START LAST EXECUTED  SWITCHED ACTIVE

     ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
     │  Box Soft    │   │  Slot Soft   │   │ Slots with Soft│
     │  Failures    │   │  Failures    │   │  Failures    │
     └──────────────┘   └──────────────┘   └──────────────┘

      LINE PERIOD   16671
      RJ RAW COUNTS 4.E05                                ┌──────────────┐
      RJ Temp :    029.05                                │REQUEST OTD   │
                                                         │STATUS        │
                                                         └──────────────┘
     CALIBRATION NOT PERMITTED - MODULE NOT IN IDLE STATE
                                                        LINE FREQUENCY
                                                        ┌──────────────┐
                                                        │   50 HZ      │
     RJ CALIBRATION NOT PERMITTED - MODULE NOT IN IDLE STATE │ 60 HZ │
                                                        └──────────────┘


                                6627
```

LLAI IOP Detail Status display definitions

The LLAI IOP Detail Status display information and the **REQUEST OTD STATUS** and **LINE FREQUENCY** targets are defined in the following table.

Table 55 Low Level Analog Input IOP Detail Status Display

Term	Description
LINE PERIOD	The ac line period in microseconds
RJ RAW COUNTS	The Reference Junction raw count
RJ TEMP	The Reference Junction temperature in degrees centigrade
REQUEST OTD STATUS	When selected, the REQUEST OTD STATUS target, displays the current state of the IOP's Open Thermocouple Detection (OTD) option. If the target is selected, it is replaced with two targets showing the possible OTD states, ON or OFF, with the current state shown in reverse video. If the IOP is in the Idle state, and the Universal Station (US) keyswitch is in the ENGineer position, the state may be changed by selecting the desired target. Any other IOP state or any other keyswitch position will result in an error message.
LINE FREQUENCY	The LINE FREQUENCY target permits selection of 50 Hz or 60 Hz operation. The selection is identified by reverse video.

AO IOP Detail Status Display

There are two types of Analog Output IOPs and each type accommodates only certain FTA models. Generally, the main difference in the types of AO IOPs is the number of FTA channels that the IOP supports, either 8 or 16 channels. The "High Density" 16-channel IOP display is identified by the term **AO_16** in the first line at the top of the display and after **ACTUAL TYPE** in the third line of the display. The 8-channel IOP display is identified by the term **AO**.

8-channel AO IOP display

The following figure is an illustration of the 8-channel Analog Output IOP display.

Figure 161 8-Channel -Analog Output IOP Detail Status Display

```
MAKE SELECTION                                 22 Mar    14:01:32   9



             AO      Non-redundant ........
  UCN  10   HPM  29  MODULE   1 PHYS ADDR 130 FILE   1 CARD   3
  STS OK      ACTUAL TYPE AO      FTA Connect CONN_A
  Status:
  HARDWARE REV 56  FIRMWARE REV 4.3   LAST HARD FAILURE UNKNOWN

  ACTIVE CABLE  CHANNELB CHN A ERR :    0 CHN A SIL :    0   RESET MODULE
  LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0   COMM ERRORS

  FTA PRESENT              NO STANDBY MANUAL
  COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

     Box Soft          Slot Soft          Slots with Soft
     Failures          Failures             Failures

  CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE STATE  REQUEST
                                                       FAILOPT
```

16082

16-channel AO IOP display

The following figure is an illustration of the 16-channel Analog Output IOP display.

Figure 162 16-Channel Analog Output IOP Detail Status Display

```
MAKE SELECTION                                   13 Apr    08:02:02   3



              AO_16     Non-redundant ........
 ┌───────┐  ┌───────┐
 │UCN 010│  │APM 023│  MODULE 008 PHYS ADDR 152 FILE 002 CARD 009
 └───────┘  └───────┘
 STS OK       ACTUAL TYPE AO_16    FTA Connect CONN_A
 Status: ** IOP in Simulation **
 HARDWARE REV 00  FIRMWARE REV 5.0   LAST HARD FAILURE POWERDWN

 ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000  ┌─────────────┐
 LAST COMM ERR -------- CHN B ERR : 00000 CHN B SIL : 00000  │RESET MODULE │
                                                             │COMM ERRORS  │
                                                             └─────────────┘
 FTA PRESENT               NO STANDBY MANUAL
 COLD POWERUP LAST EXECUTED  NO SWITCHED ACTIVE

 ┌─────────────┐   ┌─────────────┐   ┌──────────────┐
 │  Box Soft   │   │  Slot Soft  │   │ Slots with Soft│
 │  Failures   │   │  Failures   │   │   Failures   │
 └─────────────┘   └─────────────┘   └──────────────┘

 CALIBRATION NOT PERMITTED, MODULE NOT IN IDLE   ┌──────────┐
                                                 │ REQUEST  │
                                                 │ FAILOPT  │
                                                 └──────────┘




                                                            33 346
```

REQUEST FAILOPT target

Selection of the **REQUEST FAILOPT** target, as shown in Figure 161 and Figure 162, causes the display to access the current state of the IOP's failure option, parameter **FAILOPT**.

NULL, HOLD, and UNPOWER targets

When the target is selected, it is replaced with three targets showing the possible failure option states, **NULL**, **HOLD** and **UNPOWER**, with the current state in reverse video. If the Universal Station keyswitch is in the **ENG**ineer position, the state may be changed to **HOLD** or **UNPOWER**, by selecting the desired target. Any other IOP state, or any other keyswitch position, or selection of the **NULL** target will result in an error message.

Idle or OK state

If the IOP is in the Idle or OK state and the Universal Station keyswitch is in the **ENG**ineer position, the failure option can be changed to **HOLD** or **UNPOWER**, by selecting the appropriate target. Any other IOP state, any other keyswitch position, or selection of the **NULL** target will result in an error message.

NULL target

The **NULL** failure option can be selected only by placing the IOP in the Idle state, reconstituting the HPM box configuration, selecting the **NULL** failure state, and then reloading.

PRIMARY IOP STATUS and SECONDARY IOP STATUS targets

The AO IOP can exist as a redundant configuration.The **SECONDARY IOP STATUS** and **PRIMARY IOP STATUS** targets provide a means of selecting either the primary or secondary IOP displays. Each display has a unique message. The primary display can display the message "**CALIBRATION NOT PERMITTED**, **MODULE NOT IN IDLE**." The secondary display has the message "**SECONDARY IOP**, **CALIBRATION NOT PERMITTED**."

IOP calibration

The AO IOP Detail Status display can be used for calibration of the IOP's D/A converters. Targets are provided to enable/disable the calibration procedure. The calibration procedures are found in the "IOP Calibration Procedures" section.

AO IOP calibration

Figure 163 and Figure 164 show the targets available for calibration of the Analog Output (AO) IOP. Selecting the **ENABLE CALIBRATN** target initiates the calibration procedure, while selecting the **DISABLE CALIBRATN** target terminates the procedure.

Figure 163 Analog Output IOP Detail Status Display – ENABLE CALIBRATN Target Selected

```
MAKE SELECTION                                     22 Mar    13:54:43   9


             AO       Non-redundant ........
 UCN  10   HPM  29  MODULE   1 PHYS ADDR 130 FILE   1 CARD   3
 STS IDLE     ACTUAL TYPE AO       FTA Connect CONN_A
 Status:
 HARDWARE REV 56  FIRMWARE REV 4.3   LAST HARD FAILURE UNKNOWN

 ACTIVE CABLE  CHANNELA CHN A ERR :     0 CHN A SIL :    0    RESET MODULE
 LAST COMM ERR NONE     CHN B ERR :     0 CHN B SIL :    0    COMM ERRORS

 FTA PRESENT               NO STANDBY MANUAL
 COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE
     Box Soft            Slot Soft           Slots with Soft
     Failures            Failures              Failures

    ENABLE                                 REQUEST
    CALIBRATN                              FAILOPT
```

16083

DISABLE CALIBRATN target

Figure 164 Analog Output IOP Detail Status Display – DISABLE CALIBRATN Target Selected

```
MAKE SELECTION                                    22 Mar    13:55:15   9



            AO       Non-redundant ........
 UCN  10   HPM  29  MODULE   1 PHYS ADDR 130 FILE   1 CARD   3
 STS IDLE    ACTUAL TYPE AO       FTA Connect CONN_A
 Status:
 HARDWARE REV 56  FIRMWARE REV 4.3   LAST HARD FAILURE UNKNOWN

 ACTIVE CABLE  CHANNELB CHN A ERR :    0 CHN A SIL :    0     RESET MODULE
 LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0     COMM ERRORS

 FTA PRESENT                 NO STANDBY MANUAL
 COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

      Box Soft           Slot Soft          Slots with Soft
      Failures            Failures             Failures

      DISABLE                                 REQUEST
      CALIBRTN                                FAILOPT




                                                                   16084
```

LLMux IOP Detail Status Display

IOP calibration

The Low Level Multiplexer (LLMux) IOP Detail Status display can be used for calibration of the LLMux A/D converters. Targets are provided to enable/disable the calibration procedure. The calibration procedures are found in the "IOP Calibration Procedures" section.

LLMux IOP calibration

Figure 165 and Figure 166 show the targets available for calibration of the Low Level Multiplexer (LLMux) IOP. Selecting either the **ENABLE CAL ON FTA1** or **ENABLE CAL ON FTA2** target initiates the calibration procedure, while selecting the **DISABLE CAL ON FTA1** or **DISABLE CAL ON FTA2** target terminates the procedure.

Figure 165 Low Level Multiplexer IOP Detail Status Display–ENABLE CAL ON Target Selected

```
MAKE SELECTION                                  20 May 91 12:19:49  2



               LLMUX    Non-redundant .......
  UCN 009   APM 003   MODULE 005 PHYS ADDR 160 FILE 003 CARD 001
STS IDLE      ACTUAL TYPE LLMUX   FTA Connect CONN_A
Status:
HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

ACTIVE CABLE   CHANNELB CHN A ERR : 00000 CHN A SIL : 00000    RESET MODULE
LAST COMM ERR NONE      CHN B ERR : 00000 CHN B SIL : 00000    COMM ERRORS

FTA PRESENT              NO STANDBY MANUAL
COLD START LAST EXECUTED  NO SWITCHED ACTIVE

    Box Soft            Slot Soft           Slots with Soft
    Failures            Failures              Failures


  REQUEST FTA                              LINE FREQUENCY
    TYPES                                     50 HZ
                                              60 HZ
  ENABLE CAL
   ON FTA1

  ENABLE CAL
   ON FTA2

                                                          6625
```

DISABLE CALIBRATN target

Figure 166 Low Level Multiplexer IOP Detail Status Display–DISABLE CALIBRATN Target Selected

```
MAKE SELECTION                                  20 May 91 12:19:49  2



               LLMUX    Non-redundant .......
  UCN 009   APM 003   MODULE 005 PHYS ADDR 160 FILE 003 CARD 001
STS IDLE      ACTUAL TYPE LLMUX   FTA Connect CONN_A
Status:
HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

ACTIVE CABLE   CHANNELB CHN A ERR : 00000 CHN A SIL : 00000    RESET MODULE
LAST COMM ERR NONE      CHN B ERR : 00000 CHN B SIL : 00000    COMM ERRORS

FTA PRESENT              NO STANDBY MANUAL
COLD START LAST EXECUTED  NO SWITCHED ACTIVE

    Box Soft            Slot Soft           Slots with Soft
    Failures            Failures              Failures


  REQUEST FTA                              LINE FREQUENCY
    TYPES                                     50 HZ
                                              60 HZ
  DISABLE CAL
   ON FTA1

  ENABLE CAL
   ON FTA2

                                                          6626
```

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definitions that follow provide information that is unique to the LLMux IOP Detail Status display.

Unique LLMux IOP Detail Status targets

The LLMux IOP Detail Status display has unique data and targets as shown in the following figure. The **REQUEST FTA TYPE** target provides a means of identifying the type of FTA, a thermocouple (TC) or Resistive Temperature Device (RTD) FTA, that is attached to each Power Adapter channel. Selecting the target produces status displayed as **FTA 1 TYPE** and **FTA 2 TYPE** with the type of FTA attached to each channel.

Another target is the **LINE FREQUENCY** target which permits selection of 50 Hz or 60 Hz operation. The selection is identified by reverse video.

Figure 167 Low Level Multiplexer IOP Detail Status Display

```
MAKE SELECTION                              15 May 91 13:10:31  2



                LLMUX    Non-redundant ........ SF
       UCN 009    APM 003   MODULE 021 PHYS ADDR 160 FILE 003 CARD 001
       STS SOFTFAIL ACTUAL TYPE LLMUX    FTA Connect CONN_A
       Status:
       HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

       ACTIVE CABLE  CHANNELB CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
       LAST COMM ERR NONE      CHN B ERR : 00000 CHN B SIL : 00000  COMM ERRORS

       FTA PRESENT               NO STANDBY MANUAL
       COLD START LAST EXECUTED   NO SWITCHED ACTIVE

          Box Soft           Slot Soft           Slots with Soft
          Failures           Failures              Failures


         REQUEST FTA                         LINE FREQUENCY
            TYPES                                50 HZ
                                                 60 HZ
          FTA    1 CALIBRATION NOT PERMITTED - MODULE NOT IN IDLE STATE


          FTA 2 CALIBRATION NOT PERMITTED -     MODULE NOT IN IDLE STATE




                                                          6631
```

RHMUX IOP Detail Status Display

IOP calibration

The Remote Hardened Multiplexer (RHMUX) IOP Detail Status display can be used for calibration of the IOP's A/D converters. Targets are provided to enable/disable the calibration procedure. The calibration procedures are found in the "IOP Calibration Procedures" section.

RHMUX IOP calibration

Figure 168 and Figure 169 show the targets available for calibration of the Remote Hardened Multiplexer (RHMUX) IOP. Selecting either the **ENABLE CAL ON FTA1** or **ENABLE CAL ON FTA2** target initiates the calibration procedure, while selecting the **DISABLE CAL ON FTA1** or **DISABLE CAL ON FTA2** target terminates the procedure.

Figure 168 Remote Hardened Multiplexer IOP Detail Status Display – ENABLE CAL ON Target Selected

```
MAKE SELECTION                                    15 May 91 13:10:31  2



            LLMUX     Non-redundant ........ SF
 UCN 009   HPM  003  MODULE 021 PHYS ADDR 160 FILE 003 CARD 001
STS SOFTFAIL ACTUAL TYPE RHMUX    FTA Connect CONN_A
Status:
HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

ACTIVE CABLE  CHANNELB CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS

FTA PRESENT              NO STANDBY MANUAL
COLD START LAST EXECUTED  NO SWITCHED ACTIVE

    Box Soft            Slot Soft            Slots with Soft
    Failures            Failures               Failures


   REQUEST FTA                          LINE FREQUENCY
     TYPES                                 50 HZ
                                           60 HZ
   FTA    1 CALIBRATION NOT PERMITTED - MODULE NOT IN IDLE STATE


   FTA 2 CALIBRATION NOT PERMITTED -    MODULE NOT IN IDLE STATE     16662
```

DISABLE CALIBRATN target

Figure 169 Remote Hardened Multiplexer IOP Detail Status Display – DISABLE CALIBRATN Target Selected

```
MAKE SELECTION                                    15 May 91 13:10:31  2



             LLMUX    Non-redundant ........ SF
   UCN 009  HPM  003  MODULE 021 PHYS ADDR 160 FILE 003 CARD 001
   STS SOFTFAIL ACTUAL TYPE RHMUX    FTA Connect CONN_A
   Status:
   HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN

   ACTIVE CABLE  CHANNELB CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
   LAST COMM ERR NONE      CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS

   FTA PRESENT               NO STANDBY MANUAL
   COLD START LAST EXECUTED   NO SWITCHED ACTIVE

    Box Soft              Slot Soft             Slots with Soft
    Failures              Failures                 Failures


     REQUEST FTA                        LINE FREQUENCY
       TYPES                              50 HZ
                                          60 HZ
     FTA    1 CALIBRATION NOT PERMITTED – MODULE NOT IN IDLE STATE


     FTA 2 CALIBRATION NOT PERMITTED –    MODULE NOT IN IDLE STATE      16662
```

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definitions that follow provide information that is unique to the RHMUX IOP Detail Status display.

Unique RHMUX IOP Detail Status targets

The RHMUX IOP Detail Status display has unique data and targets as shown in the following figure. The **REQUEST FTA TYPE** target provides a means of identifying the type of FTA, presently a thermocouple (TC) FTA, that is connected to each Power Adapter channel. Selecting the target produces status displayed as **FTA 1 TYPE** and **FTA 2 TYPE** with the type of FTA attached to each channel.

Another target is the **LINE FREQUENCY** target that permits selection of 50 Hz or 60 Hz operation. The selection is identified by reverse video.

Figure 170 Remote Hardened Multiplexer IOP Detail Status Display

```
MAKE SELECTION                                    15 May 91 13:10:31  2



                 LLMUX      Non-redundant ........ SF
        UCN 009   HPM  003   MODULE 021 PHYS ADDR 160 FILE 003 CARD 001
        STS SOFTFAIL ACTUAL TYPE RHMUX      FTA Connect CONN_A
        Status:
        HARDWARE REV 01  FIRMWARE REV 3.7   LAST HARD FAILURE POWERDWN


        ACTIVE CABLE  CHANNELB CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
        LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS


        FTA PRESENT             NO STANDBY MANUAL
        COLD START LAST EXECUTED  NO SWITCHED ACTIVE


          Box Soft              Slot Soft             Slots with Soft
          Failures              Failures                 Failures



          REQUEST FTA                              LINE FREQUENCY
            TYPES                                      50 HZ
                                                       60 HZ
          FTA    1 CALIBRATION NOT PERMITTED - MODULE NOT IN IDLE STATE



          FTA 2 CALIBRATION NOT PERMITTED -    MODULE NOT IN IDLE STATE    16663
```

DI IOP Detail Status Display

Overview

There are two types of Digital Input IOPs and each type accommodates only certain FTA models. Both types of DI IOPs support 32 FTA channels. The "High Density" 32-channel IOP display is identified by the term **DI24V** in the first line at the top of the display and after **ACTUAL TYPE** in the third line of the display. The other 32-channel IOP display is identified by the term **DI**.

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definition that follows provides information that is unique to the DI IOP Detail Status display.

DI IOP Detail Status display

As shown in the following figure, the Digital Input IOP Detail Status display has one unique status.

The **CURRENT DIGITAL INPUT STATUS** data is represented by two hexadecimal words showing the current state of the 32 digital inputs. Input slot 1 is the high order bit in the left-hand word of the data pair.

Figure 171 Digital Input IOP Detail Status Display

```
MAKE SELECTION                                          07 Sep 91 10:02:51  1



                DI      Non-redundant ........
┌────────┐ ┌────────┐
│UCN 003 │ │APM 005 │  MODULE 005 PHYS ADDR 148 FILE 002 CARD 005
└────────┘ └────────┘
STS OK        ACTUAL TYPE DI        FTA Connect CONN_A
Status:
HARDWARE REV 00  FIRMWARE REV 3.3   LAST HARD FAILURE POWERDWN

ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000  ┌─────────────┐
LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000  │RESET MODULE │
                                                            │COMM ERRORS  │
                                                            └─────────────┘
FTA PRESENT                    NO STANDBY MANUAL
WARM POWERUP LAST EXECUTED  SWITCHED ACTIVE

┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│   Box Soft   │   │  Slot Soft   │   │ Slots with Soft │
│   Failures   │   │  Failures    │   │   Failures   │
└──────────────┘   └──────────────┘   └──────────────┘

CURRENT DIGITAL INPUT STATUS :   0000 0000

                                                              6629
```

DO IOP Detail Status Display

Overview

There are two types of Digital Output IOPs and each type accommodates only certain FTA models. Generally, the main difference in the types of DO IOPs is the number of FTA channels that the IOP supports, either 16 or 32 channels. The "High Density" 32-channel IOP display is identified by the term **DO_32** in the first line at the top of the display and after **ACTUAL TYPE** in the third line of the display. The 16-channel IOP display is identified by the term **DO**.

16-channel DO IOP display

The following figure is an illustration of the 16-channel Digital Output IOP display.

Figure 172 16-Channel Digital Output IOP Detail Status Display

```
MAKE SELECTION                               22 Mar   14:03:35   9



             DO       Non-redundant ........
  UCN  10    HPM  29   MODULE   4 PHYS ADDR 133 FILE   1 CARD   6
  STS OK        ACTUAL TYPE DO       FTA Connect CONN_A
  Status:
  HARDWARE REV 07  FIRMWARE REV 3.6   LAST HARD FAILURE MLTOUTFL

  ACTIVE CABLE  CHANNELB CHN A ERR :    0 CHN A SIL :    0   RESET MODULE
  LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0   COMM ERRORS

  FTA PRESENT                 NO STANDBY MANUAL
  COLD POWERUP LAST EXECUTED  NO SWITCHED ACTIVE
       Box Soft            Slot Soft           Slots with Soft
       Failures            Failures              Failures
```

16085

32-channel DO IOP display

The 32-channel Digital Output IOP display also has an additional display line, the sixth line. The line contains a description of the type of Digital Output FTA that is associated with the IOP. After **IOP DESCRIPTION**, either the term **24V** or **240V** will be displayed. The term **24V** indicates a model MU-TDOY22/62 FTA is connected to the IOP, and the term **240V** indicates a model MU-TDOY22/62 FTA is connected.

The following figure is an illustration of the 32-channel Digital Output IOP display.

Figure 173 32-Channel Digital Output IOP Detail Status Display
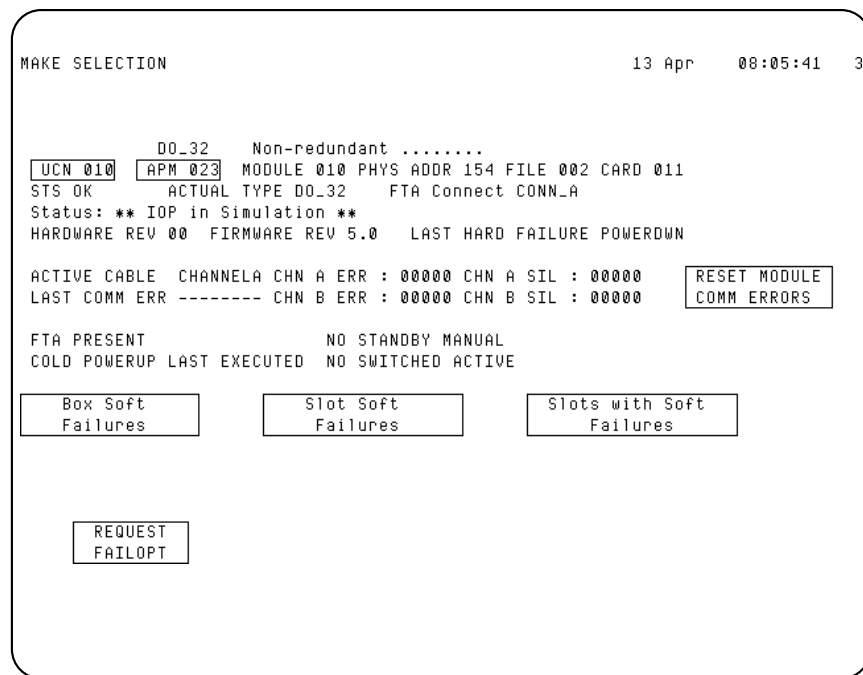
Similar to AO IOP display

The Detail Status display for the Digital Output IOP is similar to the display shown for the Analog Output IOP. See the Analog Output IOP display discussion for details.

STI/STIM IOP Detail Status Display

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definition that follows provides information that is unique to the STI/STIM IOP Detail Status display.

STIM IOP Detail Status display

The unique data on the Smart Transmitter Interface IOP Detail Status display consists of a single target as shown in the following figure.

The **LINE FREQUENCY** target permits selection of 50 Hz or 60 Hz operation. The selection is identified by reverse video.

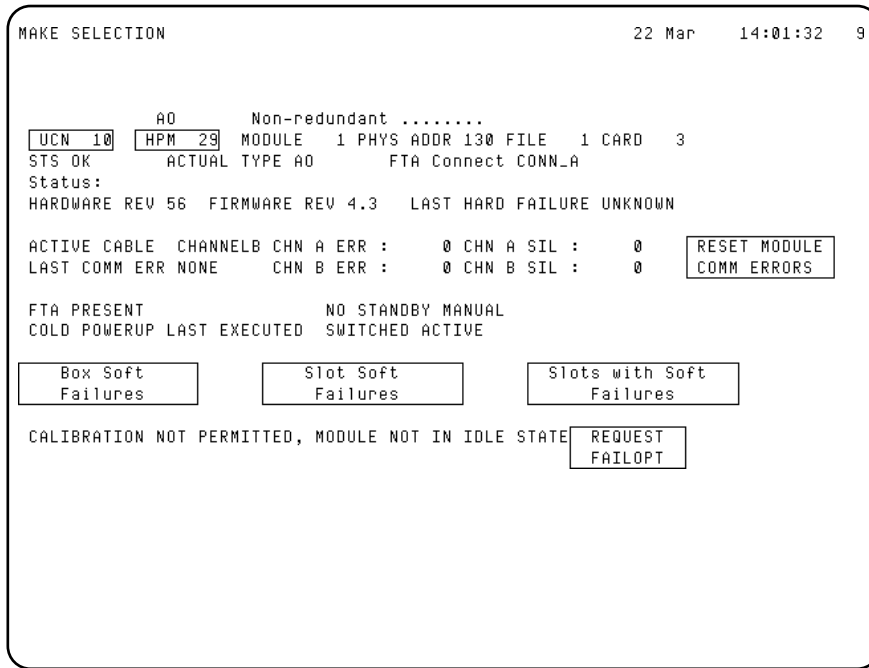**Figure 174 Smart Transmitter Interface IOP Detail Status Display**

```
MAKE SELECTION                                 07 Sep 91 10:04:44  1



                 STIM    Non-redundant ........
   UCN 003    APM 005   MODULE 006 PHYS ADDR 149 FILE 002 CARD 006
  STS IDLE      ACTUAL TYPE STIM     FTA Connect CONN_A
  Status:
  HARDWARE REV 02  FIRMWARE REV 3.9   LAST HARD FAILURE POWERDWN

  ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
  LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS

  FTA PRESENT                 NO STANDBY MANUAL
  COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

     Box Soft            Slot Soft           Slots with Soft
     Failures            Failures              Failures



        LINE FREQUENCY
          50 HZ
          60 HZ
                                              6632
```

PI IOP Detail Status Display

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP.

PI IOP Detail Status display

As shown in the following figure, the Pulse Input IOP Detail Status display has no unique status information or targets.

Figure 175 Pulse Input IOP Detail Status Display

```
MAKE SELECTION                                      07 Jul 92 07:34:16  1



              PI        Non-redundant ........
 UCN 001   APM 013   MODULE 003 PHYS ADDR 135 FILE 001 CARD 008
STS OK       ACTUAL TYPE PI      FTA Connect CONN_A
Status:
HARDWARE REV 22  FIRMWARE REV 3.3   LAST HARD FAILURE POWERDWN

ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000     RESET MODULE
LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000     COMM ERRORS

FTA PRESENT               NO STANDBY MANUAL
WARM POWERUP LAST EXECUTED  NO SWITCHED ACTIVE

   Box Soft            Slot Soft            Slots with Soft
   Failures            Failures             Failures

Unsupported module type
                                                             6633
```

SDI IOP Detail Status Display

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definitions that follow provide information that is unique to the SDI IOP Detail Status display.

SDI IOP Detail Status display

As shown in the following figure, the unique portion of the Serial Device Interface IOP Detail Status display consists of a single target. Its purpose is the same as the Smart Transmitter Interface IOP Detail Status display.

The **LINE FREQUENCY** target permits selection of **50 HZ** or **60 HZ** operation. The selection is identified by reverse video.

Figure 176 Serial Device Interface IOP Detail Status Display

```
MAKE SELECTION                                 07 Sep 91 10:04:44  1



                STIM      Non-redundant ........
     UCN 003   APM 005   MODULE 006 PHYS ADDR 149 FILE 002 CARD 006
     STS IDLE     ACTUAL TYPE STIM      FTA Connect CONN_A
     Status:
     HARDWARE REV 02  FIRMWARE REV 3.9   LAST HARD FAILURE POWERDOWN

     ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
     LAST COMM ERR NONE     CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS

     FTA PRESENT              NO STANDBY MANUAL
     COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

       Box Soft          Slot Soft         Slots with Soft
       Failures          Failures             Failures



           LINE FREQUENCY
             50 HZ
             60 HZ

                                                        6632
```

SI IOP Detail Status Display

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definitions that follow provide information that is unique to the SI IOP Detail Status display.

SI IOP Detail Status display

As shown in the following figure, the unique portion of the Serial Interface IOP Detail Status display consists of **FTA 1** and **FTA 2** status information.

Figure 177 Serial Interface IOP Detail Status Display

```
MAKE SELECTION                                    19 Sep    14:20:08  1



              SI        Non-redundant ........
   UCN 012   APM 063  MODULE 007 PHYS ADDR 139 FILE 001 CARD 012
   STS OK       ACTUAL TYPE SI       FTA Connect CONN_A
   Status:
   HARDWARE REV 04  FIRMWARE REV 4.1   LAST HARD FAILURE SPARE255

   ACTIVE CABLE  CHANNELA CHN A ERR : 00000 CHN A SIL : 00000   RESET MODULE
   LAST COMM ERR NONE      CHN B ERR : 00000 CHN B SIL : 00000   COMM ERRORS

   FTA PRESENT              NO STANDBY MANUAL
   COLD POWERUP LAST EXECUTED  SWITCHED ACTIVE

     Box Soft            Slot Soft          Slots with Soft
     Failures            Failures             Failures



   FTA 1:   Modbus - Rev D  RS232, 19.2 K Baud, Even Parity, Modem Control Off

   FTA 2:

                                                             9326
```

DISOE IOP Detail Status Display

Unique display information

Some of the information provided by an IOP Detail Status display is unique for the type of IOP. The definition that follows provides information that is unique to the DISOE IOP Detail Status display.

DISOE IOP Detail Status display

As shown in the following figure, the Digital Input Sequence of Events IOP Detail Status display has one unique status. The display represents the Model MU/MC-PDIS12 DISOE IOP that supports IOP redundancy.

The **CURRENT DIGITAL INPUT STATUS** data is represented by two hexadecimal words showing the current state of the 32 digital inputs. Input slot 1 is the high order bit in the left-hand word of the data pair.

Figure 178 Digital Input Sequence of Events IOP Detail Status Display

```
MAKE SELECTION                                   22 Mar   14:02:50   9



            DISOE   PRIMARY IOP A
 UCN  10   HPM  29   MODULE   5 PHYS ADDR 134 FILE   1 CARD   7
 STS OK       ACTUAL TYPE DISOE    FTA Connect CONN_A    With Bias  Yes
 Status:
 HARDWARE REV 70  FIRMWARE REV 4.5    LAST HARD FAILURE POWERDWN
 DESCRIPTION: DISOE
 ACTIVE CABLE  CHANNELB CHN A ERR :    0 CHN A SIL :    0   RESET MODULE
 LAST COMM ERR NONE     CHN B ERR :    0 CHN B SIL :    0   COMM ERRORS

 FTA PRESENT              NO STANDBY MANUAL       Secondary
 WARM POWERUP LAST EXECUTED  SWITCHED ACTIVE       Status

   Box Soft            Slot Soft           Slots with Soft
   Failures            Failures              Failures

 CURRENT DIGITAL INPUT STATUS :   0000 0000
```

16086-A

Status indicator

The **Status** indicator on the model MU/MC-PDIS12 IOP is green when the IOP is the primary IOP and orange when the IOP is the secondary IOP.

IOP PI Loading Information display

This display shows the data that was loaded the last time the personality was loaded.

Figure 179 IOP PI Loading Information Display

The IOP PI Loading Information display information and targets are defined in the following table.

Table 56 IOP PI Loading Information Display

Term	Description
UCN	Displays the UCN address on the LCN. Also, a target to return to the UCN Status display.
HPM	Displays the HPM address on the UCN. Also, a target to return to the HPM Status display.
IOM	Displays the IOP address in the HPM. Also, a target to return to the Fieldbus IOP Detail Status display.
PERSONALITY LOCK	Lock code, which is a combination of a Universal key code and a unique code specific to Fieldbus IOP. This would be expanded in the future for other Field Programmable IOPs. Appropriate key is send down during the PI Load, which is verified against this lock before Programming the PI.
CURRENT PI FILE NAME	This is the name of the file that is currently loaded in the Fieldbus IOP.
NEXT PI FILE NAME	This is the name of the file that is being loaded in the Fieldbus IOP.
STATUS	Status of the PI Load. Shows Initial, Transient as well as Final states.
LOADING NODE	UCN Node Number of the NIM that has locked the current IOP for PI Loading.
PACKET NUMBER	Current packet number during the load and total number of packets after the load is complete.
IDENTIFIER	Unique description for the Fieldbus IOP
KEY	Code embedded in the first packet that comes down during Program Load. This key code is verified against the Personality Lock and the Program Load continues only with the right key-lock combination. A universal key could be send down which would override any lock.
VERSION	Software Version Number of the current PI in the IOP.
REVISION	Software Revision Number of the current PI in the IOP.

4. Fault Isolation

4.1 Overview

CAUTION	The yellow-colored "Voltage Margin" jumper plug that is located in the area behind the bezel door at the front of the High-Performance I/O Link card must always be in the **Normal** (+5 vdc) position during normal operation. The jumper plug must never be removed or moved to the **Low Margin** or **High Margin** position while on-control. An HPMM Soft failure will be reported if it is not in the **Normal** position.

Purpose

This section provides the information required for HPM fault isolation (troubleshooting). It includes a troubleshooting flow chart that guides the user through isolating faults in the HPM It also provides the user with fault code tables, which include a description of the fault and the recommended corrective action(s) to resolve the problem.

Release 500 software displays

The displays shown in this section are reproductions of console screens created by Release 500 software.

4.2 Failure Types

Two types of failures

There are two general types of failures that can occur in the High-Performance Process Manager, "Hard failures" and "Soft failures."

Hard failure

A Hard failure causes an HPMM or IOP to enter a predefined failure state. While in this failed state, the module cannot perform its normal functions and will be in a reset condition (IOPs) or executing a "failure" program (HPMM).

Soft failure

A Soft failure allows a card to continue operating in its current state (OK or Idle), but its operation is degraded. The level of degraded operation could be insignificant or significant, depending on the nature of the Soft failure. Some Soft failures can automatically clear (clearing is done by the HPMM or IOP without intervention), other Soft failures require manual intervention for resolution.

Hard and Soft failures

Both the Hard and Soft failure types are described below.

HPM failure

An HPM failure indicates that a HPMM Hard failure, as described below, has occurred in an HPM. The HPMM cannot control the process or act as a redundant partner because of the nature of the fault in the HPMM. The four types of Hard failures that cause the HPMM to fail are indicated by a status of **FAIL** in the HPM Box (grid) on the UCN Status display.

HPMM Hard failure

An HPMM Hard failure forces the HPMM into the **FAIL** state. In this state, the HPMM executes only from its failure executive and acts only as a responder on the UCN. Note that if there is a fault in the High-Performance Comm/Control or the High-Performance I/O Link card in the primary HPMM, and the HPMM is redundant, the faulty HPMM enters the **FAIL** state and the HPM operations switch to the redundant partner HPMM.

If an HPMM does not have a redundant partner and a Hard failure occurs in the control processor on the High-Performance Comm/Control card, the communications processor on the High-Performance Comm/Control card annunciates the appropriate Hard failure code, and the HPMM degrades to the Soft failure state. In this case, no control execution is being performed, but the LCN/UCN view to the IOPs is maintained.

An HPMM Hard failure is indicated by a **FAIL** status on the HPMM Detail Status display. It is also visible as a **Fxxx** state in the HPMM alphanumeric display window. HPMM Hard failure error codes are indicated on the HPMM Detail Status displays for the High-Performance Comm/Control and High-Performance I/O Link card processors. These same Hard failure error codes are also available through the appropriate use of the HPMM alphanumeric display and its associated display switch behind the bezel door at the front of the High-Performance Comm/Control card.

HPM Partial failure

In most cases, an HPM Partial failure indicates that a minor fault has been detected in an HPM, and the HPM continues to control the process. A Partial failure can be caused by an HPMM Soft failure, IOP Hard failure, or an IOP Soft failure as described below. The HPMM Partial failure is indicated by a status of **PARTFAIL**, **PF_IDLE**, **PF_IOIDL**, or **BKUP_PF** on the UCN Status display. The **PF_IDLE** and **PF_IOIDL** Partial failures indicate that a Partial failure was detected while the HPMM, or at least one of the IOPs, is in the idle condition. Some Partial failures may cause failover between redundant HPMMs, while others can cause redundant IOP failover.

HPMM Soft failure

In most cases, an HPMM Soft failure indicates that a minor fault, such as a timeout or overflow condition, has been detected in the internal diagnostics or that a parity checker has failed. The HPMM Soft failures appear in system event messages and on the HPMM Detail Status display. More detailed information is available when the **SOFT FAILURE** target on the HPMM Maintenance Support display is selected. Note that a Control processor Hard failure on the High-Performance Comm/Control card in a nonredundant HPMM appears as a **SOFTFAIL** on the display, even though this is a major failure and control is interrupted.

IOP Hard failure

An IOP Hard failure indicates that a Hard failure has occurred in an IOP card. The background (embedded in the operating personality) internal diagnostics in an IOP card are used to test the card's functions and report the status of the IOP, using Hard and Soft failure error codes. When a Hard failure occurs, the IOP card fails (stops operations), and its status becomes **NR** (No Response).

The only possible recovery from this type of failure is to recycle power on the failed IOP by unlocking and lifting/lowering the upper card lever. If the failure still exists, the IOP will fail again.

Restart of an output IOP after a power loss (or manual power recycle) results in analog output channels going to a nonpowered state, and digital output channels are set to off. Reloading of the IOP data base is then required.

IOP Soft failure

An IOP Soft failure indicates that a Soft failure, such as an single slot/channel input/output failure, has been detected in an IOP card by the IOP's internal diagnostics. The IOP Soft failures appear in system event messages and on the IOP Detail Status display.

IOP Soft failures are grouped into two categories. IOP Box Soft failures are failures that affect all slots/channels in the IOP. IOP Slot Soft failures are failures that affect one or more but not all slots/channels in the IOP.

4.3   Fault Isolation Concepts

Introduction

The first step in fault isolation is to determine whether the fault exists in a field device, or in the High-Performance Process Manager. After it has been determined that the fault is in the High-Performance Process Manager, you can begin isolating the fault by using the information provided in this section.

Troubleshooting flowcharts

A flowchart to assist you in isolating off-process and on-process faults to specific High-Performance Process Manager components is shown in Figure 180 through Figure 185. The flowcharts encourage the following troubleshooting philosophy.

- Use the flowchart to lead you through the available High-Performance Process Manager status and alphanumeric displays so you can identify the type of fault and the associated error code. This is the next step in fault isolation.

- The flowchart will point you to a table in this section that lists and describes the error codes, along with the recommended corrective action(s).

- The recommended corrective action usually identifies the most likely cause of the error condition. In some cases more than one corrective action is given. In these cases, the action listed first is the most probable fix. The remaining actions should be attempted in sequence if the problem is not resolved. If the fault is not eliminated by the recommended corrective action(s), then you should pursue other causes, such as checking for faulty cabling, improper or faulty FTA connections, improper system installation (especially power and grounding), and potential harmful transient conditions, such as Electrostatic Discharge (ESD) or Radio Frequency Interference (RFI).

Recommendations for Operators and Service Technicians

The flowchart shown in the following figures have been developed for use by both a Universal Station (US) Operator and the Service Technician.

- Figure 180 HPM Fault Isolation Flowchart (Sheet 1 of 6)
- Figure 181 HPM Fault Isolation Flowchart (Sheet 2 of 6)
- Figure 182 HPM Fault Isolation Flowchart (Sheet 3 of 6)
- Figure 183 HPM Fault Isolation Flowchart (Sheet 4 of 6)
- Figure 184 HPM Fault Isolation Flowchart (Sheet 5 of 6)
- Figure 185 HPM Fault Isolation Flowchart (Sheet 6 of 6)

The flowchart shows the Operator how to use the displays to locate the error code. When the error code is identified, the Service Technician can begin to further define/resolve the fault by using the error code tables and associated corrective action recommendations.

After a fault has been isolated to a particular High-Performance Process Manager subassembly, refer to the "IOP Calibration Procedures" section for the applicable removal and replacement procedures.

Troubleshooting table usage

Use the following tables in this section in conjunction with the troubleshooting activities guided by the HPM troubleshooting flow chart. There will be specific references (exit points) to these tables given in the troubleshooting flowchart.

- Table 57 HPMM Corrective Actions
- Table 58 Communications and Control Processor Hard Failure Codes (covers both HMPP Communications and Control processor Hard failures).
- Table 59 Comm/Control Soft Failure Error Codes
- Table 60 I/O Link Hard Failure Error Codes
- Table 61 IOP Hard Failure Error Codes
- Table 62 IOP Box Soft Failure Error Codes
- Table 63 IOP Slot Soft Failure Error Codes
- Table 64 HPMM Card and Module Indicators
- Table 68 Alphanumeric Display for a Normal Startup Sequence
- Table 69 Alphanumeric Display for Startup/Factory Test Mode Sequence
- Table 70 Alphanumeric Display for HPMM Cold Startup Failure Sequence
- Table 71 Alphanumeric Display for Load Sequence
-
- Table 72 Communications/I/O Link Processor Failure Display Sequence
- Table 73 Control Processor Failure Display Sequence
- Table 74 RAM Retention Startup Display Sequence
- Table 75 Alphanumeric Display for HPMM Swapping Sequence (Detailed Display Mode)
- Table 76 Alphanumeric Display for HPMM Swapping Sequence (Non-Detailed Display Mode)
- Table 77 Alphanumeric Display for Failover HPMM Swapping Sequence (Detailed Display Mode)
- Table 78 Alphanumeric Display for Failover HPMM Swapping Sequence (Non-Detailed Display Mode)
- Table 79 HPMM Diagnostic Test List
- Table 80 IOP Card Indicators

- Table 81 IOP Multicolor Status Indicator
- Table 82 FTA Indicators

Troubleshooting Flow Chart

Fault isolation flowchart (Sheet 1 of 6)

Figure 180 HPM Fault Isolation Flowchart (Sheet 1 of 6)

Check:
- The Indicators on the cards in the HPMM and IOP card files. Refer to "FTA indicator functions " for indicator functions. Replace the cards as necessary.
- The Power System dc voltages.
- The ac input voltage and the input wiring at the Power System.
- The dc power cables to the HPMM and IOP card files, and connectors at the individual card files.
- The voltages at the backplanes of the card files.
- Reinitialize the HPM .

STOP

Start → Fault during initial power-up of the HPM as seen on HPMM Status & Alphanumeric Displays? — Yes

No

Note:

This sheet assumes that a fault was detected in the HPM before it was placed on-process.

HPMM appears as ALIVE on UCN Status Display and responds to operator commands after initial power on? — No

Yes

Check:

The Power and Status indicators on the Comm/Ctrl card, I/O Link card, and the UCN Interface module. Reference Table 4-8. Also check the alphanumeric display on the Comm/Ctrl card. Reference Tables 4-9 to 4-21. Replace the cards as necessary.
- The UCN drop cable connections at the HPMM card file(s).
- The UCN drop cables.
- The UCN taps.
- The UCN trunk cables.
- Refer to the *UCN Site Planning & Installation High-Performance Process Manager Checkout* testing the UCN.

Note:
If any other HPMs on the same UCN do not respond to operator commands, check the UCN cable connections to the NIM.

After the fault has been corrected, test the UCN using the UCN Exerciser. Refer to "UCN Exerciser" Section for a description of this test

Reinitialize the HPM.

STOP

1

Go to Sheet 2

Figure 181 HPM Fault Isolation Flowchart (Sheet 2 of 6)

From Sheet 1

1

The status of the HPM is the combined status of the HPMM(s) and the IOPs.

The Operator selects the UCN Status display to determine the status of the HPM.

Hard and Soft failures are indicated by an HPM status of FAIL, PARTFAIL, PF_IDLE, BKUP_PF, or PF_UMIDL.

The Operator selects the HPM Detail Status display by selecting the HPMM # and the DETAIL STATUS target.

Note:
The remaining sheets of this flowchart assume that a fault has occurred while the HPM is on-process.

```
MAKE SELECTION                              24 Aug   12:30:35  1

UCN CABLE STATUS: OK            UCN 03 STATUS    UCN CONTROL STATE: BASIC
                                                 UCN AUTO CHECKPNT: INHIBIT
                                                 NIM AUTO CHECKPNT: ENABLE
 01 NIM   09 HPM 10
    OK       OK
             FAIL




LOAD/SAVE CONTROL  AUTO    UCN CABLE  RUN              SLOT    DETAIL
RESTORE   STATES  CHECKPT  STATUS     STATES           SUMMARY STATUS
```

UCN Status Display

```
MAKE SELECTION                              24 Aug   12:31:11  1

HPM AUTO CHECKPNT: INHIBIT   HPM 09 STATUS/UCN 03  HPM CONTROL STATE   :BASIC
IOL PERIODIC SWAP: ENABLE    HPMM 09 P HPMM 10 S   UCN CBL STS HPMM 09: B/A
                                 OK       FAIL                 HPMM 10: B/A
WRITE LOCKOUT : OFF
 01 HLAI  02      03       04      05       06      07       08
    OK

 09  AO   10  AO  11       12      13       14      15       16
    OK       OK

 17  DI   18      19  DO   20      21       22      23       24
    OK          OK

 25       26      27       28      29       30      31       32

 33       34      35       36      37       38      39       40

LOAD/SAVE CONTROL  AUTO    IOL CABLE  RUN              SLOT    DETAIL
RESTORE   STATES  CHECKPT  COMMANDS   STATES           SUMMARY STATUS
```

HPM Detail Status Display

HPM Detail Status display indicates that the HPMM has a Hard or Soft failure?

No →
4 IOP Hard Failure (Sheet 5)
5 IOP Box Soft Failure (Sheet 6)
6 IOP Slot Soft Failure (Sheet 6)

Yes →
2 HPMM Hard or Soft Failure (Sheet 3)

HPMM Hard Failure = FAIL
HPMM Soft Failure = IDLESF or SOFTFAIL (if in RUN)

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Fault isolation flowchart (Sheet 3 of 6)

Figure 182 HPM Fault Isolation Flowchart (Sheet 3 of 6)

AAAA = Current Hard Failure Code in Words 4 & 5

BBBB = Previous Hard Failure Code in Words 4 & 5

0000 = No Hard Failure since Power On

Hard Failure Code See Comm/Control Hard Failure Codes Table 4-2 in this manual.

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Fault isolation flowchart (Sheet 4 of 6)

Figure 183 HPM Fault Isolation Flowchart (Sheet 4 of 6)

From Sheet 3
HPMM Soft Failures
HPM status = IDLESF or SOFTFAIL

3

Note:
This sheet shows the path for HPMM Soft failures.

The Operator selects the

SOFT FAILURE target on the

the HPMM Detail Status display. The HPMM soft failure error codes and the code descriptions appear on the display after selecting one of the three yellow error displays. Any active soft failure is highlighted on the display. Refer to Table 4-3 for descriptions of the error codes and the recommended corrective action.

STOP

HPMM Soft Failure (0-39) Display

MAKE SELECTION   01 Sep 94 10:02:59 1

HPMM SOFT FAILURES   00 - 39   40 - 79   80 - 95

HPMM IOL INFO	00 CTRL RESET/WDT EXPIRED	20 NO SECNDY UCN COMM TO PRIMARY
	01 CTRL PROCESSOR FAILURE	21 ————————
IOM IOL INFO	02 COMM PROCESSOR LOAD FAILURE	22 ————————
	03 ————————	23 PRIM/SECNDY DUPLICATE IOM ADDR
	04 COMM PRC DIAG INIT TIMEOUT	24 INCOMPATIBLE FIRMWARE
VERS/ REVIS	05 COMM PRC DIAG CYCLE OVERFLOW	25 TIMESYNC CLOCK ERROR DRIFT
	06 GLOBAL RAM PARITY CHECKER FAIL	26 IOL TIMESYNC FAILURE
	07 COM DETECT IOL RAM PARITY CKT	27 TIMESYNC IOL #1 LATCH ERROR
CONTROL CONFIG	08 COMM LOCAL RAM PARITY CIRCUITRY	28 TIMESYNC UCN LATCH ERROR
	09 UCN ADDRESS CHANGE DETECTED	29 COMM PROC STACK LIMIT OVERFLOW
UCN STATS	10 TRANSIENT POWER DOWN DETECTED	30 COMM DETECTED LRM PERR HI-RATE
	11 COMM DETECTED IOL PERR HI-RATE	31 CTRL DETECTED LRM PERR HI-RATE
	12 ————————	32 ————————
	13 PRIVATE RAM PARITY CIRCUITRY	33 CTRL IOL OVERRUNS
MAINT SUPPORT	14 NO RESPONSE FROM IOL #1	34 CTRL UCN OVERRUNS
	15 IOL MAX COMM ERRS EXCEEDED	35 CTRL POINT PROCESSOR OVERRUNS
SOFT FAILURE	16 IOL CABLE A FAILURE	36 CTRL PROC DIAG INIT TIMEOUT
	17 IOL CABLE B FAILURE	37 CTRL PROC DIAG CYCLE OVERFLOW
	18 NO PRIMARY IOL1 COMM TO SECNDY	38 CTRL LOCAL RAM PARITY CIRCUITRY
	19 NO PRIMARY UCN COMM TO SECNDY	39 CTRL REDUN DATA TRANSFER ERR

UCN   10   P/S   PRIMARY   UCN CHANNEL   CHANNEL A   FILE POS LEFT
NODE 8   STATUS   OK   UCN AUTO SWAP   ENABLE
TYPE HPM   PKGOPT   REDUN

HPMM Soft Failure Codes

Code Descriptions

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Fault isolation flowchart (Sheet 5 of 6)

Figure 184 HPM Fault Isolation Flowchart (Sheet 5 of 6)
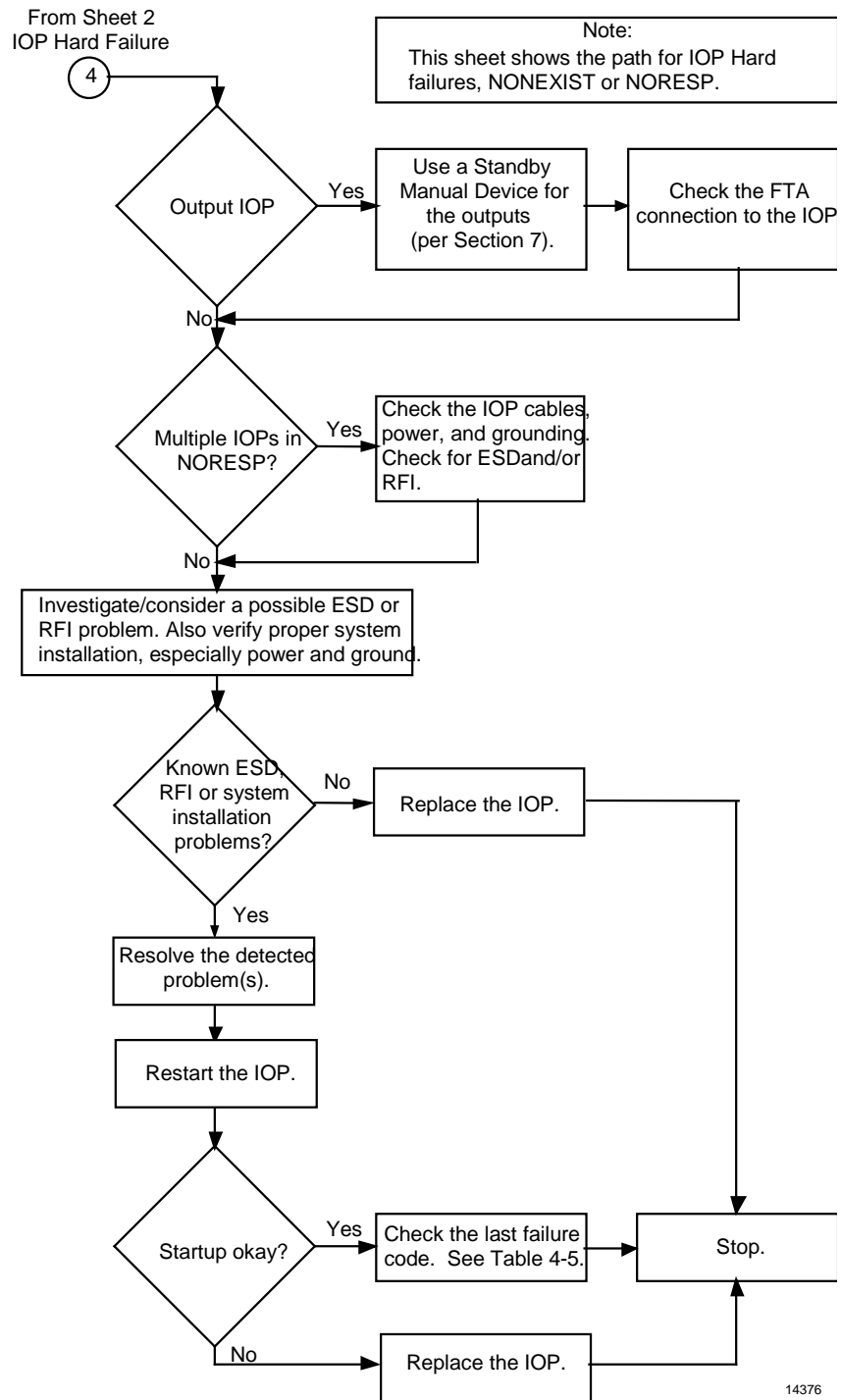
Fault isolation flowchart (Sheet 6 of 6)

Figure 185 HPM Fault Isolation Flowchart (Sheet 6 of 6)

From Sheet 2
IOP Box Soft Failures

(5)

Note:
This sheet shows the paths for IOP Box Soft Failures and IOP Slot Soft Failures.
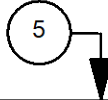
The Operator selects the

BOX SOFT FAILURES

target on the IOP Detailed Status display, and then selects one of five display pages. The Box Soft Failures display appears, showing the box soft failure highlighted. Refer to Table 50 for descriptions of the error codes and the recommended corrective action.

STOP

Box Soft Failures Display

```
                                          16 May    18:52:00   1

             UCN 010   HPM 025   MODULE 015

                                              Module  Display
Select Page:   ▓▓▓      2         3           Slot Failures
                                              Slots w/Failures
               4         5

        00 Null soft failure – not used
        01 Sample time clock overrun of greater than twice its period
        02 IOP task request overflow – indicates excessive IOL activity
        03 IOP EXEC resumed a non-waiting task – software bug indicated
        04 Diagnostics have not run in at least 5 sec – possible overload
        05 Entire diagnostic cycle overran the two minute allocated time
→       06 FTA is missing or, if LLMUX, power adaptor is missing
        07 EEPROM checksum error – IOP probably not calibrated
        08 EEPROM counter error – too many writes or unformatted EEPROM
        09 EEPROM flag error – incomplete write or uncalibrated IOP
        10 Switched signal error – possible FTA problem
        11 ADP private RAM contents error (LLAI only) – no conversions
        12 ADP private RAM address error (LLAI only) – no conversions
        13 LLAI shared RAM contents failure – no AI conversions
        14 LLAI shared RAM address error – no AI conversions
        15 LLAI shared RAM checksum error – no AI conversions

             Box Soft Failures – Page 1
```

From Sheet 2
IOP Slot Soft Failures

(6)
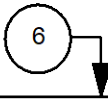
The Operator selects the

SLOT SOFT FAILURES

target on the IOP Detail Status display, and then selects one of three display pages. The Slot Soft Failures display appears, showing the failure with an arrow pointing to the failure message. Refer to Table 4-7 for descriptions of the error codes and recommended corrective action.

STOP

Slot Soft Failures Display

```
                                          17 May    09:57:57   1

             UCN 010   HPM 025   MODULE 015

                                              Module Display
Select Page:   ▓▓▓      2         3           Box Failures
                                              Slots w/Failures

        00 Null soft failure – not used
        01 *** Box soft failure only ***
        02 *** Box soft failure only ***
        03 *** Box soft failure only ***
        04 *** Box soft failure only ***
        05 *** Box soft failure only ***
        06 *** Box soft failure only ***
        07 EEPROM checksum error OR IOP not calibrated
        08 EEPROM counter error – too many writes or unformatted EEPROM
        09 *** Box soft failure only ***
        10 *** Box soft failure only ***
        11 *** Box soft failure only ***
        12 *** Box soft failure only ***
        13 *** Box soft failure only ***
        14 *** Box soft failure only ***
        15 *** Box soft failure only ***

             Slot Soft Failures – Page 1
```

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HPMM Corrective Actions

Table 57 HPMM Corrective Actions

Number	Corrective Action Description
1	Call GTAC for assistance.
2	Reload/restart the HPMM.
3	Check the UCN cables.
4	Check the UCN address and parity jumpers.
5	Check the card file's address and parity jumpers.
6	Replace the High-Performance Comm/Control card.
7	Replace the High-Performance I/O Link card.
8	Replace the HPM UCN Interface module.
9	Check/Replace the redundancy private-path cable or EHPM redundancy cable.
10	Check/Replace the I/O Link Interface cables.
11	Replace the card file backpanel.
12	Replace the Power Supply Module.
13	Ensure the High-Performance I/O Link card Voltage Margin jumper is in the **Normal** position.
14	Check the Control error block.
15	Check the Communications error block.
16	Check for excessive loading of the xPMM (peer-to-peer, heavy event load, large parameter access load from Universal Stations, etc.).
17	Ensure the Console Emulator serial port is secured by issuing the LK command. (Engineering and Factory Test only)
18	Alternate Private Path cable is connected between HPMMs.
19	Reduce the I/O Link Interface traffic used by the Control processor to recover from the I/O Link Interface overruns.
20	Connect the redundancy cable between the third port on the primary and secondary EHPM FTE I/O card.
21	Indicates that the events are generated at a rate higher than the threshold limit of HPM. If this soft failure appears briefly during engineering operations or failover, it can be safely ignored. However, if it appears repeatedly during normal operations or stays for more than 5 minutes, further investigations are required. This condition, if persistent, may cause delay in process alarm/event reporting. Chattering alarms could be one of the reasons for this behavior.

22	If the EHPM firmware image (also known as the Application Image) fails, the front-panel LEDs on the EHPM Comm/Ctrl card will be shown as all black, and the primary EHPM will failover to the secondary (if a secondary EHPM is running as BACKUP).
	To recover:
	1. Restart the failed EHPM by performing a Ram Retention Restart.
	2. Reload the EHPM from the ALIVE state.
	3. After reloading, the new COMM failure code of 0A22 can then be confirmed from viewing the "MAINT SUPPORT" target from the "COMMUNCTN ERROR BLK" section of the specific EHPM's detail display.
	Note: A regular restart (that is, a full power re-cycle) will lose the 0A22 error code indication – only a Ram Retention Restart will maintain the 0A22 error code.
23	As part of the software logic enhancement for PAR **REUCN-2285** (which is the subject of PN2021-18x), the behavior of HPM/EHPM Soft Fail 33 (CTRL IOL OVERRUNS) is now changed from being a Soft Fail to being a Hard Fail condition, however the Soft Fail 33 is still indicated.
	For a redundant and properly synchronized HPM/EHPM, if the conditions which make the CTRL IOL OVERRUNS occur, the primary HPM/EHPM will now failover to the backup node. This occurs at four (4) seconds of experiencing CTRL IOL OVERRUNS. In this case, there is a new control processor failure code of FFDE. This FFDE failure code means "Control IOL Overrun Conditions for more than 4 seconds".
	<u>Note:</u> A non-redundant HPM/EHPM or an HPM/EHPM without a synchronized backup will not fail on the conditions which make the Soft Fail 33 appear.
	Recovery:
	For a redundant HPM/EHPM, after failover:
	If the (Soft Fail 33) overload condition no longer exists, the recovery is to select the failed HPM/EHPM and then select RUN STATES > RECOVER target to return the HPM/EHPM to the ALIVE state and then reload.
	If the (Soft Fail 33) overload condition still remains (after failover), the at the new primary, the Soft Fail 33 (CTRL IOL OVERRUNS) will be present and indicated on the Soft Failures screen off of the HPM Detailed Status Display, but the new primary HPM/EHPM will not fail. The user is encouraged to find the source of the CTRL IOL OVERRUNS and lower the load, and the Soft Fail 33 indication will disappear. This may take several minutes once the load is reduced.
	For a non-redundant HPM/EHPM, if Soft Fail 33 overload conditions exist, the Soft Fail 33 (CTRL IOL OVERRUNS) will be indicated on the Soft Failures screen off of the HPM Detailed Status Display, but the HPM/EHPM will not fail. The user is encouraged to find the source of the CTRL IOL OVERRUNS and lower the load, and the Soft Fail 33 indication will disappear. This may take several minutes once the load is reduced.
	Workaround: If for any reason you experience a sustained CTRL IOL OVERRUN condition, followed by a failure with the failure code of FFDE, make a note of your I/O Link Bandwidth Free percentage. It should always be greater than 20%, otherwise your I/O Link is overloaded, and you may experience further undesired failures.
	You can also look at the $NMxxByy.CRIOLORN(0) parameter, which is an indication if are currently seeing any counts of CTRL IOL Overruns. It may also be good to trend this parameter (it resets every hour) to see if you are ever getting any counts over a 24-hour period. Having Any counts in this parameter should be considered an overloaded IOL and should be studied closer.
	Contact GTAC if you need help in raising the I/O Link Bandwidth Free percentage, as well as if you need help in lowering CRIOLORN(0) counts.

24	If the 0057 COMM failure causes both Primary and Secondary EHPMs to fail, the D0 Data Register on the MAINT SUPPORT page contains 00 00 FF FF and the Recover/Reload attempts fail, then refer to the D5 Data Register on the MAINT SUPPORT page when the node is in a failed state. In such cases, the value in the D5 Data Register indicates the IO Module Number which may be generating bad messages on the IO Link. For example, 00 00 00 27, where 27 is the IO Module Number.
	Workaround: Perform the following procedure to recover the failed nodes.
	1. Select the failed nodes and click **RECOVER** target.
	2. Remove the IOP identified from the D5 Data Register.
	3. Reload the nodes.
	4. When both the nodes are in OK/Backup state (synched), re-insert the IOP, restore the IOP database, validate the IOP database, and perform a start-up.

I/O Link overruns

The use of AI PV scanning in the HPM improves the utilization of I/O Link resources. However, an HPM can still encounter I/O Link overruns. Continuous I/O Link overruns will result in the generation of an I/O Link overrun Soft failure.

In most cases, an I/O Link overrun indicates that the I/O Link Interface cannot handle the requested amount of traffic. In order to alleviate the I/O Link overrun situation, changes must be made to the database to reduce or redistribute usage of the I/O Link for non-scan data during the offending cycle(s). I/O Link overrun counters are maintained and displayed for each 1/4 second cycle on the Schedule Information display.

Note: See Note #23 in Table 57 above for more information on changes to the CTRL IOL OVERRUNS Soft Failure behavior.

I/O Link overruns corrective actions

Depending upon the application, one or more of the following actions may be appropriate.

- Avoid using IOP resident parameters other than:
    - Analog Input scan parameters PV and PVSTS.
    - all alarm flags such as BADPVFL, PVHHFL, PVHIFL, PVLOFL, PVLLFL, PVROCPTP and PVROCNTP.
    - Digital Input scan parameters PVFL and BADPVFL.
    - Digital Output scan parameters SO and INITREQ.
- Change the point mix or scan rate to redistribute or slow down points that read multiple non-scan I/O Link parameters.
- Use Logic points for non-scan I/O input connections that are used by more than one point.
- Delete inactive or non-essential points and non-scan input connections that are used by more than one point.

Contact the Honeywell Technical Assistance Center for additional help if the above recovery actions are not useful.

Comm/Control Hard failure codes

The following the following table defines the Hard failure codes for both the HPMM Communications and the Control processors. This table spans numerous pages. Some codes are used for both the Communications and Control processors where others are unique to an individual processor. The CPU column in the table indicates Both, Comm, or Control to make the distinction.

Corrective actions are identified by number. The corrective actions are listed in Table 57 HPMM Corrective Actions.

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0000	Both	NULL	Unknown Error	2
0001	Both	PWRDWN	Power Down Detected	2
0002	Both	LR_PAR	Local RAM parity error	2, 6
0003	Both	LR_LRAM	Unused on HPM Platform	1
0004	Both	LR_CK	Unused on HPM Platform	1
0005	Both	LR_EXC	Unused on HPM Platform	1
0006	Both	LR_HREV		
0007	Both	MM_HREV		
0008	Both	LR_TMR		
0009	Both	LR_PTRN	Local RAM pattern test failure	6
000A	Both	LR_BYTE	Unused on HPM Platform	1
000B	Both	LR_ADCD		
000C	Both	LR_ADDL		
000D	Both	LR_CLRR	Local RAM initialization test failure	6

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
000E	Both	SPARE20	Unused on HPM Platform	1
000F	Both	SR_PAR		
0010	Both	SR_PTRN		
0011	Both	SR_ADCD		
0012	Both	SR_ADDL		
0013	Both	GR_PAR		
0014	Comm	GR_PTRN	Global RAM pattern test failure	6
0015	Both	GR_BYTE	Unused on HPM platform	1
0016	Both	GR ADCD	Unused on HPM platform	1
0017	Both	GR_ADDL	Global RAM EDAC circuitry test failure	6
0018	Comm	GR_CLRR	Global RAM initialization test failure	6
0019	Both	31_NR	Unused on HPM Platform	1
001 A	Both	31_ALIV		
001 B	Both	31 _ILTN		
001 C	Both	NMI_UNK		
001 D	Comm	BADUCNN	Bad UCN address/parity jumper setting	4, 6, 11
001 E	Both	NR	No response from other processor	2, 6
001 F	Both	MRFT	Memory reference table build failure	6
0020	Both	NOMTOS	Unused on HPM Platform	1
0021	Comrn	LLC_COMM	UCN LLC communication error	8, 6, 11
0022	Comm	UCNDRV	UCN Driver error	2, 6
0023	Both	RD_HREV	Unused on HPM Platform	1
0024	Both	SW_ERROR		
0025	Both	MD_HREV		
0026	Both	DA_PTRN		
0027	Both	DA_BYTE		
0028	Both	DA ADCD		
0029	Both	DA_ADDL		
002A	Both	DA_CLRR		
002B	Both	RD_SNPS		

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
002C	Both	RD_BSLK		
002D	Comm	TB_CMTO	UTBC command timeout	8, 6
002E	Comm	TB_IF	UTBC interface test failure	6
002F	Comm	TB_LPBK	UTBC internal loopback test failure	6
0030	Comm	TB_RXI	UTBC RX internal loopback test failure	6
0031	Comm	TB_TXI	UTBC TX internal loopback test failure	6
0032	Comm	TB_RXE	UTBC RX external loopback test failure	8, 6, 11
0033	Comm	TB_TXE	UTBC TX external loopback test failure	8, 6, 11
0034	Comm	TB_MDFL	Modem failure or command timeout	8, 6, 11
0035	Comm	TB_INT	UTBC interrupt test failure	6
0036	Comm	TB_LSS	UTBC line switch & silence detect	8, 6, 11
0037	Comm	TB_TBCR	UTBC minimum revision test failure	6
0038	Comm	TB_TCLK	UTBC timesynch clock test failure	6
0039	Comm	TB_MJBR	Modem jabber test failure	8, 6, 11
003A	Comm	TB_MDCD	UTBC message decoder test failure	6
003B	Comm	TB_UM51	UM51 auxiliary latch test failure	7, 6
003C	Comm	ROM_CKS	ROM checksum comparison failure	6
003D	Both	FACTMOD	Unused on HPM Platform	1
003E	Both	ASIC_REG	ASIC Register accessibility test failure	6
003F	Both	FV_EXC	Force and verify exception test failure	6
0040	Comm	PR_PCHK	UTBC Private RAM parity circuitry test failure	6
0041	Comm	PR_PTRN	UTBC Private RAM pattern test failure	6
0042	Comm	PR_BW	UTBC Private RAM byte/word decode failure	6
0043	Comm	GR_BWL	Global RAM byte/word/long decode failure	6
0044	Both	LR_PCHK	Local RAM parity circuitry test failure	6
0045	Both	LR_BWL	Local RAM byte/word/long decode failure	6
0046	Comm	GB_PCHK	Global Bus parity circuitry test failure	7, 6, 11

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0047	Comm	IOL_BWL	IOL RAM byte/word/long decode failure	7
0048	Comm	IOL_PTRN	IOL RAM pattern test failure	7
0049	Comm	IOL_CLRR	IOL RAM initialization test failure	7
004A	Both	PRC_TYPE	Incorrect processor type	6
004B	Control	TRKRAM	Tracking mechanism test	6
004C	Both	TIMER	Timer comparison failure	6
004D	Comm	FLASH	Flash ROM read/write test failure	6
004E	Both	BE_EMBE	BERR - EDAC multiple bit error	6
004F	Both	BE_GLBP	BERR - Global Bus parity error	7, 6, 11
0050	Both	BE_OPTB	BERR - Option Card Bus Error	7, 6
0051	Both	BE_GLBT	BERR - Global Bus timeout	7, 6, 11
0052	Both	BE_ILLD	BERR - ASIC register data error	6
0053	Both	BE_ILLA	BERR - ASIC register illegal address error	2, 6
0054	Comm	ROM_WRT	BERR - Write to ROM	2, 6, 1
0055	Comm	PR_PAR	BERR - UTBC Private RAM parity error	2, 6, 1
0056	Both	CRASH	Software invoked crash	2, 6, 1
0057	Both	BAD_EXC	Bad or unexpected exception	2, 6, 1
0058	Both	WDT_TMO	Watchdog timer timeout	2, 6, 1
0059	Both	DMA_EXC	Unexpected DMA Channel interrupt	2, 6
005A	Both	CTL_EXC	Unexpected Control-to-Comm interrupt	2, 6
005B	Both	FRC_EXC	Unexpected FRC compare interrupt	2, 6
005C	Both	COM_PER	Unexpected Comm periodic interrupt	2, 6
005D	Both	CTL_PER	Unexpected Control periodic interrupt	2, 6
005E	Both	COM_EXC	Unexpected Comm-to-Control interrupt	2, 6
005F	Both	TRK_OVF	Unexpected tracking overflow interrupt	2, 6
0060	Both	RDN_TBC	Unexpected RTBC interrupt	2, 6
0061	Both	UCN_TBC	Unexpected UTBC interrupt	2, 6
0062	Both	COM_UART	Unexpected Comm UART interrupt	2, 6
0063	Both	CTL_UART	Unexpected Control UART interrupt	2, 6

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0064	Both	OPT_EXC	Unexpected I/O Link card interrupt	7, 6,11, 1
0065	Comm	PR_CLRR	UTBC Private RAM initialization test failure	6
0066	Comm	BADFILE	Bad File address/parity jumper setting	5, 6, 11
0067	Comm	BADSLOT	Bad Slot address/parity setting	6, 11
0068	Comm	IOL_PCHK	I/O Link RAM parity circuitry test failure	7, 6, 1
0069	Comm	IOL_ITMO	I/O Link timeout during transition to Idle	7, 6, 1
006A	Comm	IOL_IDLE	I/O Link failed to transition to Idle	7, 6, 1
006B	Comm	OL_RTMO	I/O Link timeout during transition to Run	7, 6, 1
006C	Comm	IOL_RUN	I/O Link failed to transition to Run	7, 6, 1
006D	Both	REFRESH	Global DRAM refresh circuitry failure	6, 1
006E	Both	PI_CKSM	Bad software personality checksum	2, 6, 1
006F	Both	BE_UNKN	Access to non-existent memory error	2, 6, 1
0070	Both	BERR_SRC	Unacknowledged BERR Source bits set	2, 6, 1
0071	Comm	EE_COM	Comm/Control serial EEPROM write test failure	6
0072	Comm	EE_IOL	I/O Link card serial EEPROM write test failure	7, 6, 11
0073	Comm	EE_UCN	UCN I/F card serial EEPROM write test failure	8, 6, 11
0074	Control	RT_IF	RTBC host interface test failure	6, 1
0075	Control	RT_LPBK	RTBC internal loopback test failure	9, 6, 1
0076	Control	RT_RXI	RTBC RX internal loopback test failure	9, 6, 1
0077	Control	RT_TXI	RTBC TX internal loopback test failure	9, 6, 1
0078	Control	RT_INT	RTBC interrupt test failure	6, 1
0079	Control	RT_UNRN	Unused on HPM Platform	1
007A	Control	RT_BERR	RTBC bus/address error	2, 6, 1
007B	Control	RT_FD	RTBC corrupted frame descriptor	2, 1
007C	Control	RT_OVRN	RTBC overrun error	2, 6, 1
007D	Control	RT_BDPE	RTBC Buffer Descriptor pool empty	2, 1
007E	Control	RT_FDPE	RTBC Frame Descriptor pool empty	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
007F	Comm	CHGFILE	File address/parity jumpers have changed	5, 6, 11, 1
0080	Comm	CHGSLOT	Slot address/parity has changed	6, 11, 1
0081	Both	RSTCTL	Unused on HPM Platform	1
0082	Comm	FI_COM	Fault insertion Comm crash	1
0083	Control	FI_CTL	Fault insertion Control crash	1
0084	Control	FI_PTRN	Fault insertion pattern comparison failure	1
0085	Both	UART_ACC	UART access error	2, 6
0086	Both	NO_HB	The other processor (Communications or Control) has no heartbeat.	2,6
0087 to 00FF	Both	Undefined	Reserved for future Hard failure codes.	1
0100 to 01FF	Comm	CRASH	UCN Token Bus Controller command timeout. These errors occur if the UTBC does not complete a non-modem related command.	6,1
0200 to 02FF	Comm	CRASH	Physical/MAC command to UTBC timeout. These errors occur if the UTBC does not complete a modem related command.	8, 6, 11, 1
0300	Comm	CRASH	Modem A failed to ACK reset in initialization	8, 6, 11, 1
0301	Comm	CRASH	Modem B failed to ACK reset in initialization	8, 6, 11, 1
0302	Comm	CRASH	Modem A failed to ACK reset in jabber test	8, 6, 11, 1
0303	Comm	CRASH	Modem B failed to ACK reset in jabber test	8, 6, 11, 1
0304	Comm	CRASH	Corrupted TX counter	2, 1
0305	Comm	CRASH	No free FD for TX to test	2, 1
0306	Comm	CRASH	No free FD for TX for resynch	2, 1
0307	Comm	CRASH	No free FD for TX for message	2, 1
0308	Comm	CRASH	Modem failed to ACK Enable Channel A command	8, 6, 11, 1
0309	Comm	CRASH	Modem failed to ACK Enable Channel B command	8, 6, 11, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
030A	Comm	CRASH	Modem A failed to ACK in on-line command	8, 6, 11, 1
030B	Comm	CRASH	Modem B failed to ACK in on-line command	8, 6, 11, 1
030C	Comm	CRASH	Modem A failed to ACK in off-line command	8, 6, 11, 1
030D	Comm	CRASH	Modem B failed to ACK in off-line command	8, 6, 11, 1
030E	Comm	CRASH	UTBC bus/address error	2, 6, 1
030F	Comm	CRASH	UTBC faulty transmitter	6, 8, 1
0310	Comm	CRASH	Unexpected frame 6 (was expecting a response but received something else addressed to it).	4, 3, 2, 1
0311	Comm	CRASH	Unexpected frame 10 (was soliciting a new successor and heard another node transmit; this may be a duplicate token problem).	4,3,2,1
0312	Comm	CRASH	UTBC double bus/address error	2, 6, 1
0313	Comm	CRASH	Duplicate UCN node address	4, 1
0314	Comm	CRASH	Modem A error (jabber)	8, 6, 11, 1
0315	Comm	CRASH	Modem B error (jabber)	8, 6, 11, 1
0316	Comm	CRASH	UCN transmit hang	2, 8, 6,1
0317	Comm	CRASH	Unimplemented LLC transmit operation (Means IOCB address in FD was 0.)	2, 1
0318	Comm	CRASH	Bad immediate response FD address in RIOCB	2, 1
0319	Comm	CRASH	No FD for RDR	2, 1
031A	Comm	CRASH	No BD in FD on RDR SAP update	2, 1
031B	Comm	CRASH	Bad RDR FD pointer on close SAP	2, 1
031C	Comm	CRASH	Bad link to BD	2, 1
031D to 03FF	Comm	CRASH	Reserved for future LLC crash codes	1
0400	Comm	CRASH	Null error	2, 1
0401	Comm	CRASH	Failed self-test	8, 6, 11, 1
0402	Comm	CRASH	Unused on HPM Platform	1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0403	Comm	CRASH	Unused on HPM Platform	1
0404	Comm	CRASH	Illogical operational status	2, 1
0405	Comm	CRASH	Command register incorrectly busy	2, 1
0406	Comm	CRASH	Unused on HPM Platform	1
0407	Comm	CRASH	Unused on HPM Platform	1
0408	Comm	CRASH	Unused on HPM Platform	1
0409	Comm	CRASH	Command queue full	2, 1
040A	Comm	CRASH	Unused on HPM Platform	1
040B	Comm	CRASH	Illegal command	2, 1
040C	Comm	CRASH	Unused on HPM Platform	1
040D	Comm	CRASH	IOCB format error	2, 1
040E	Comm	CRASH	Unused on HPM Platform	1
040F	Comm	CRASH	Unused on HPM Platform	1
0410	Comm	CRASH	Unused on HPM Platform	1
0411	Comm	CRASH	Unexpected IOCB chain stop complete	2, 1
0412	Comm	CRASH	Unexpected end of IOCB chain	2, 1
0413 to 041B	Comrn	CRASH	Unused on HPM Platform	1
041C	Comm	CRASH	Remove reply list error (not found).	2, 1
041D	Comm	CRASH	Unused on HPM Platform	1
041E	Comm	CRASH	Write Tx buffer pointer FIFO full	2, 1
041F	Comm	CRASH	LLC returned zero pointer as valid	2, 1
0420	Comm	CRASH	Unused on HPM Platform	1
0421	Comm	CRASH	Put to channel - already in chain.	2, 1
0422	Comm	CRASH	Attempt to double unblock Type 3 node.	2, 1
0423	Comm	CRASH	Test switch was set.	2, 1
0424	Comm	CRASH	Reserved	1
0425	Comm	CRASH	Reserved	1
0426	Comm	CRASH	Duplicate network address error	4, 1
0427	Comm	CRASH	STUN command from network	2, 8, 6, 1
0428	Comm	CRASH	Transmit hang	2, 8, 6, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0429	Comm	CRASH	Configure timeout/Transmit hang	2, 8, 6, 1
042A	Comm	CRASH	Unused on HPM Platform	1
042B	Comm	CRASH	Not enough task channels available.	2, 1
042C	Comm	CRASH	Unused on HPM Platform	1
042D	Comm	CRASH	RX buffer already assigned	2, 1
042E	Comm	CRASH	RX buffer was not assigned	2, 1
042F	Comm	CRASH	Reply-mask/request type mismatch	2, 1
0430	Comm	CRASH	Error in assignment to driver	2, 1
0431	Comm	CRASH	Unexpected channel not open; not result of bad network message	2, 1
0432	Comm	CRASH	Unused on HPM Platform	1
0433	Comm	CRASH	Unused on HPM Platform	1
0434	Comm	CRASH	Unused on HPM Platform	1
0435	Comm	CRASH	Unused on HPM Platform	1
0436	Comm	CRASH	LLC detected jabber	2, 8, 6, 1
0437	Comm	CRASH	LLC detected faulty transmitter	2, 3, 8, 6, 1
0438	Comm	CRASH	LLC called COMM_FAIL routine	2, 8, 6, 1
0439	Comm	CRASH	Unrecoverable IOCB error	2, 1
043A	Comm	CRASH	Timesynch stuck in diagnostic mode	2, 6, 1
043B	Comm	CRASH	Timesynch clock stopped	2, 6, 1
043C to 04FF	Comm	CRASH	Reserved for future UCNC driver crash codes.	1
0500	Comm	CRASH	Event Distributor returned bad MTOS status waiting for its LEF to be set.	2, 1
0501	Comm	CRASH	Event Distributor returned bad MTOS status resetting its LEF.	2, 1
0502	Comm	CRASH	Illogical PN$Add_MMS_Request return status to Event Distributor.	2, 1
0503	Comm	CRASH	Event Distributor encountered illegal event record.	2, 1
0504	Comm	CRASH	MTOS error, could not change priority of given event producer task.	2, 1
0505	Comm	CRASH	Bad event packet detected.	2, 1
0506	Comm	CRASH	MTOS error, could not return event producer task to its inherent priority.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0507	Comm	CRASH	Collector task did not correctly schedule a timed resetting of timesynch timer LEF.	2, 1
0508	Comm	CRASH	MTOS error, could not set LEF of Event Distributor task.	2, 1
0509	Comm	CRASH	MTOS error, could not resume Event Distributor task.	2, 1
050A	Comm	CRASH	Resource error on UM$SEND_IOL call that initiates collection of given SIOM ECL.	2, 1
050B	Comm	CRASH	Collector task could not reset its own LEF.	2, 1
050C	Comm	CRASH	Collector task did not correctly schedule a timed resetting of its own LEF.	2, 1
050D	Comm	CRASH	Collector task did not correctly wait for setting of its own LEF.	2, 1
050E	Comm	CRASH	Could not raise Event Collector task's priority to that above IOL I/F task.	2, 1
050F	Comm	CRASH	Did not receive a resume from IOL I/F task in 30 seconds for completion of collection on at least one IOM ECL.	2, 1
0510	Comm	CRASH	Could not return Event Collector task to its inherent priority.	2, 1
0511	Comm	CRASH	Resource error on UM$SEND_IOL call for collection of SIOM ECL summary bytes.	2, 1
0512	Comm	CRASH	Illogical condition, could not find corresponding collection status connection record.	2, 1
0513	Comm	CRASH	Invalid SIOM Point/System bracket event	2, 1
0514	Comm	CRASH	Invalid SIOM Recovery bracket event	2, 1
0515	Comm	CRASH	Invalid PROCESS ALARM event from AIM module	2, 1
0516	Comm	CRASH	Invalid SIOM STATE CHANGE event	2, 1
0517	Comm	CRASH	Invalid SIOM event type	2, 1
0518	Comm	CRASH	Resource error on UM$SEND_IOL call for update of SIOM ECL remove pointer	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0519	Comm	CRASH	Could not change Event Collector task's priority.	2, 1
051A	Comm	CRASH	Did not receive a resume from IOL I/F task within 30 seconds for completion of SIOM ECL Summary byte collection.	2, 1
051B	Comm	CRASH	Could not return Event Collector task to its inherent priority.	2, 1
051C	Comm	CRASH	Illogical condition, received an OK IOL message but response has unexpected internal size.	2, 1
051D	Comm	CRASH	Resource error on UM$SEND_IOL call for initiation of collection of next SIOM ECL.	2,1
051E	Comm	CRASH	Illegal return status on LEF reset.	2, 1
051F	Comm	CRASH	Illegal system event.	2, 1
0520	Comm	CRASH	Illegal SIOM state.	2, 1
0521	Comm	CRASH	Illegal SIOM state change event.	2, 1
0522	Comm	CRASH	Illegal SIOM bracket event.	2, 1
0523	Comm	CRASH	Illegal UM or IOM event in system event.	2, 1
0524	Comm	CRASH	Illegal HPN event type.	2, 1
0525	Comm	CRASH	Bad resume on recovery task.	2, 1
0526	Comm	CRASH	Bad failover run resume.	2, 1
0527	Comm	CRASH	Bad resume on event tasks.	2, 1
0528	Comm	CRASH	Request to Control failed.	2, 1
0529	Comm	CRASH	SIOM recovery failed.	2, 1
052A	Comm	CRASH	Changing priority failed.	2, 1
052B	Comm	CRASH	Improper resume.	2, 1
052C	Comm	CRASH	Improper copy of event flags.	2, 1
052D	Comm	CRASH	Improper resetting of event flags.	2, 1
052E	Comm	CRASH	Improper timed event setting.	2, 1
052F	Comm	CRASH	Distributor COPY flags failure.	2, 1
0530	Comm	CRASH	Recover SIOM failure.	2, 1
0531	Comm	CRASH	IOL return failure.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0532	Comm	CRASH	Collector task did not correctly schedule a timed resetting of timesynch SCS timer LEF.	2, 1
0533	Comm	CRASH	Bad resume on Recovery Task.	2, 1
0534	Comm	CRASH	Collector task did not correctly reset Num_evt_LEF.	2, 1
0535	Comm	CRASH	Collector task did not correctly perform timed setting of Num_evt_LEF.	2, 1
0536	Comm	CRASH	Collector task did not correctly perform timed set of Coll_TOG_Timer_LEF to 2 seconds.	2, 1
0537 to 05FF	Comm	CRASH	Reserved for future Event Subsystem crash codes.	1
0600	Comm	CRASH	Message size < 0 or > maximum size	2, 1
0601	Comm	CRASH	Received already released message block from DBIF.	2, 1
0602	Comm	CRASH	Error status message (2 words) can not fit into empty send buffer on error return.	2, 1
0603	Comm	CRASH	Error status message (2 words) can not fit into empty send buffer on normal return.	2, 1
0604	Comm	CRASH	DBIF resources will be lost forever.	2, 1
0605	Comm	CRASH	Received already released send-receive block from HPN.	2, 1
0606	Comm	CRASH	Reply buffer size too small.	2, 1
0607	Comm	CRASH	Could not get MTOS semaphore (stack handling 1).	2, 1
0608	Comm	CRASH	Could not release MTOS semaphore (stack handling 1).	2, 1
0609	Comm	CRASH	Could not get MTOS semaphore (stack handling 2).	2, 1
060A	Comm	CRASH	Can not add to full stack.	2, 1
060B	Comm	CRASH	Could not release MTOS semaphore (stack handling 2).	2, 1
060C	Comm	CRASH	Can not add to full list.	2, 1
060D	Comm	CRASH	List corrupted.	2, 1
060E	Comm	CRASH	Can not add to full FIFO.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
060F	Comm	CRASH	Trouble waiting on MTOS Event Flag 1.	2, 1
0610	Comm	CRASH	Trouble resetting MTOS Event Flag 1.	2, 1
0611	Comm	CRASH	Trouble resetting MTOS Event Flag 2.	2, 1
0612	Comm	CRASH	Trouble waiting on MTOS Event Flag 2.	2, 1
0613	Comm	CRASH	Trouble resetting MTOS Event Flag 3.	2, 1
0614	Comm	CRASH	Trouble resetting MTOS Event Flag 4.	2, 1
0615	Comm	CRASH	Size of a write request buffer is > 504 words.	2, 1
0616 to 067F	Comm	CRASH	Reserved for future HPI Subsystem crash codes.	1
0680	Comm	CRASH	Memory allocated for EVT and HPI DB is too small.	1
0681	Comm	CRASH	Structured constant security check fail 1.	2, 1
0682	Comm	CRASH	Structured constant security check fail 2.	2, 1
0683	Comm	CRASH	Structured constant security check fail 3.	2, 1
0684	Comm	CRASH	Structured constant security check fail 4.	2, 1
0685	Comm	CRASH	Structured constant security check fail 5.	2, 1
0686	Comm	CRASH	Structured constant security check fail 6	2, 1
0687	Comm	CRASH	Buffer Allocated for Data Base handling is too small.	1
0688	Comm	CRASH	Control, I/O Link, or Remote processor timeout.	2, 6, 7, 1
0689	Comm	CRASH	Change Task Priority fail 1.	2, 1
068A	Comm	CRASH	Change Task Priority fail 2.	2, 1
068B	Comm	CRASH	Change Task Priority fail 3.	2, 1
068C	Comm	CRASH	General Data record size has changed.	1
068D	Comm	CRASH	Set/Reset Swap event flag failed.	2, 1
068E	Comm	CRASH	Wait for Swap event flag failed.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
068F	Comm	CRASH	Timed event flag failed.	2, 1
068C to 06BF	Comm	CRASH	Reserved for future GBL Subsystem crash codes.	1
06C0 to 06C2	Both	CRASH	Unused on HPM Platform.	1
06C3	Both	CRASH	Comm to Control interrupt failure.	2, 6, 1
06C4	Both	CRASH	Control to Comm interrupt failure.	2, 6, 1
06C5	Comm	CRASH	I/O Link code in wrong location.	1
06C6	Comm	CRASH	I/O Link code wrong size.	1
06C7 to 06DC	Comm	CRASH	Reserved for future miscellaneous crash codes.	1
06DD	Comm	CRASH	Control processor startup failure.	6, 1
06DE	Comm	CRASH	I/O Link processor(s) startup failure.	7, 6, 1
06DF	Comm	CRASH	Bad common memory signature.	1
06E0	Comm	CRASH	CPU Free change priority fail #1.	2, 1
06E1	Comm	CRASH	CPU Free change priority fail #2.	2, 1
06E2	Comm	CRASH	CPU Free pause fail.	2, 1
06E3	Comm	CRASH	Could not set CPU Free LEF.	2, 1
06E4	Comm	CRASH	Could not reset CPU Free LEF.	2, 1
06E5	Comm	CRASH	Could not reset Timer Comparison LEF.	2, 1
06E6	Comm	CRASH	Could not set Timer Comparison LEF.	2, 1
06E7 to 06EF	Comm	CRASH	Reserved for future high priority task crash codes.	1
06F0	Comm	CRASH	Could not set Peer to Peer Statistics LEF.	2, 1
06F1	Comm	CRASH	Could not reset Peer to Peer Statistics LEF.	2, 1
06F2	Comm	CRASH	Could not reset Diagnostic Overflow LEF.	2, 1
06F3	Comm	CRASH	Could not set Diagnostic Overflow LEF.	2, 1
06F4 to 06FF	Comm	CRASH	Reserved for future high priority task crash codes.	1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0700	Comm	CRASH	Change Task Priority call failed.	2, 1
0701	Comm	CRASH	Mail box entry has bad MTOS return code.	2, 1
0702	Comm	CRASH	Pause Timeout if pause selected.	2, 1
0703	Comm	CRASH	Mailbox fetch returned illegal code.	2, 1
0704	Comm	CRASH	Mailbox send of response returned illegal code.	2, 1
070E	Comm	CRASH	Mailbox fetch returned illegal code.	2, 1
070F	Comm	CRASH	Resume of user's task returned illegal code.	2, 1
0710	Comm	CRASH	Task ran out of resources; not legally possible since there are more of these than SMS buffers.	2, 1
0711	Comm	CRASH	Wait for event flag returned illegal code.	2, 1
0712	Comm	CRASH	Reset of event flag returned illegal code.	2, 1
0713	Comm	CRASH	IF_action passed in MSG_if_rec is not supported.	2, 1
0714 to 07FF	Comm	CRASH	Reserved for future IOI Subsystem crash codes.	1
0800	Comm	CRASH	Mail box send returned illegal code.	2, 1
0801	Comm	CRASH	Set of event flag for CCITrn task failed.	2, 1
0802	Comm	CRASH	Reset of IMR event flag failed.	2, 1
0803	Comm	CRASH	Wait for IMR event flag failed.	2, 1
0804	Comm	CRASH	Timed set of event flag failed.	2, 1
0805	Comm	CRASH	Mail box send to DBIRET failed.	2 1
0806	Comm	CRASH	Setting of CCIbuf EF failed.	2, 1
0807	Comm	CRASH	Timed set of event flag failed.	2, 1
0808	Comm	CRASH	Wait for mailbox or timeout EF failed.	2, 1
0809	Comm	CRASH	Test of timeout EF failed.	2, 1
080A	Comm	CRASH	Reset of mailbox event flag failed.	2, 1
080B	Comm	CRASH	Reset of CCIbuf EF failed.	2, 1
080C	Comm	CRASH	Wait for CCIbuf EF returned illegal code.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
080D	Comm	CRASH	Send of mailbox data to DBIRET failed.	2, 1
080E	Comm	CRASH	Set of IMR free EF failed.	2 1
080F	Comm	CRASH	Wait for CCI receive EF failed.	2, 1
0810	Comm	CRASH	Reset of CCI receive EF failed.	2, 1
0811	Comm	CRASH	No IMR so cannot perform clean swap.	2, 1
0812	Comm	CRASH	Reset of TMOT event flag failed.	2, 1
0813 to 08FF	Comm	CRASH	Reserved for future CCI Subsystem crash codes.	1
0900	Comm	CRASH	Mail box send to DBIGET failed.	2, 1
0901	Comm	CRASH	Pause completion returned illegal code.	2, 1
0902	Comm	CRASH	Reset of no resource EF failed.	2, 1
0903	Comm	CRASH	Wait for message if record EF failed	2, 1
0904	Comm	CRASH	Reset of DBI_ASSO_Rec EF failed.	2, 1
0905	Comm	CRASH	Wait for Asso record failed.	2, 1
0906	Comm	CRASH	Mail box receive of input data failed.	2, 1
0907	Comm	CRASH	Mail box send of response to user failed.	2, 1
0908	Comrn	CRASH	Mailbox receive of data from servers failed.	2, 1
0909	Comm	CRASH	Incorrect priority mailbox received.	2, 1
090A	Comm	CRASH	Illegal ASSOC record returned.	2, 1
090B	Comm	CRASH	Illegal MIR record returned.	2, 1
090C to 09FF	Comm	CRASH	Reserved for future DBI Subsystem crash codes.	1
0A00	Comm	CRASH	Redundancy task reset EF failure.	2, 1
0A01	Comm	CRASH	Redundancy task set timed EF failure.	2, 1
0A02	Comm	CRASH	Redundancy task change priority failure.	2, 1
0A03	Comm	CRASH	I/O Link timeout.	2, 6, 7, 1
0A04	Comm	CRASH	I/O Link in primary failed.	2, 6, 7, 1
0A05	Comm	CRASH	Spare crash 1.	1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0A06	Comm	CRASH	Timeout Entering Ring.	2,15,1
0A07	Comm	CRASH	Set timeout EF failure.	2, 1
0A08	Comm	CRASH	Timeout failure.	2, 1
0A09	Comm	CRASH	Set timeout EF failure 2.	2, 1
0A0A	Comm	CRASH	Secondary is wrong PI.	2, 1
0A0B	Comm	CRASH	Timeout failure 2.	2, 1
0A0C	Comm	CRASH	Terminate failed.	2, 1
0A0D	Comm	CRASH	Spare crash 4.	1
0A0E	Comm	CRASH	Illegal pause status.	2, 1
0A0F	Comm	CRASH	Could not read own Checkpoint.	2, 6, 1
0A10	Comm	CRASH	Could not gain I/O Link.	2, 6, 7, 1
0A11	Comm	CRASH	Control processor failure detected.	14
0A12	Comm	CRASH	Control card mismatch	1
0A13	Comm	CRASH	Secondary lost synch.	18, 3, 10, 6
0A14	Comm	CRASH	Secondary incompatible database	2, 1
0A15	Comm	CRASH	Set EF failure.	2, 1
0A16	Comm	CRASH	Wait EF failure.	2, 1
0A17	Comm	CRASH	Could not write own Checkpoint.	2, 6, 1
0A18	Comm	CRASH	Primary timesynch hardware failure	2, 6, 1
0A19	Comm	CRASH	Secondary timesynch hardware failure.	2, 6, 1
0A1A	Comm	CRASH	Control watchdog timed out.	2, 6, 1
0A1B	Comm	CRASH	I/O Link watchdog timed out.	2, 6, 7, 1
0A1C	Comm	CRASH	Control processor in reset.	2, 6, 1
0A1D	Comm	CRASH	I/O Link processor in reset.	2, 6, 7, 1
0A1E	Comm	CRASH	Comm database checksum compare failed	2
0A1F	Comm	CRASH	Reserved for future RDN Subsystem crash codes.	1
0A20	Comm	CRASH	UCN in primary has failed.	3, 8, 6, 1
0A21	Comm	CRASH	Secondary alone on UCN.	3, 8, 6,1
0A22	Comm	CRASH	EHPM Firmware Image (also known as the Application Image) has failed.	22

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0A23 to 0A2F	Comm	CRASH	Reserved for future RDN Subsystem crash codes. Upon issuing the Recovery (that is, shutdown command, a RAM Retention startup is attempted for the A2x crash codes).	1
0A30	Comm	CRASH	Reset sync-time latch EF failed.	2, 1
0A31	Comm	CRASH	Set latch sync-time timer EF failed.	2, 1
0A32	Comm	CRASH	Wait sync-time latch EF failed.	2, 1
0A33 to 0A7F	Comm	CRASH	Reserved for future RDN Subsystem crash codes.	1
0A80	Comm	CRASH	RDR receive failed.	2, 8, 6,1
0A81	Comm	CRASH	RDR add MMS failed.	2, 1
0A82	Comm	CRASH	Node status size error.	2, 1
0A83	Comm	CRASH	Wait for EF failure.	2, 1
0A84	Comm	CRASH	Reset EF failure.	2, 1
0A85	Comm	CRASH	Set response EF failure.	2, 1
0A86 to 0AFF	Comm	CRASH	Reserved for future RDR Subsystem crash codes.	1
0B00	Comm	CRASH	MTOS resource error.	2, 1
0B01	Comm	CRASH	Reserved 1.	2, 1
0B02	Comm	CRASH	Initialize task error on supervisor request.	2, 1
0B03	Comm	CRASH	Initialize task detected IOL failure in redundancy.	2, 7, 1
0B04	Comm	CRASH	Set timed EF failure.	2, 1
0B05	Comm	CRASH	Wait for timed EF failure.	2, 1
0B06	Comm	CRASH	Reset EF failure.	2, 1
0B07	Comm	CRASH	Initialize task detected wrong Comm FW.	1
0B08	Comm	CRASH	Initialize task detected wrong Control FW.	1
0B09	Comm	CRASH	Initialize task detected wrong IOL FW.	1
0B0A	Comm	CRASH	Change priority failure.	2, 1
0B0B	Comm	CRASH	I/O Link timeout.	2, 6, 7,1
0B0C	Comm	CRASH	Set/reset swap EF failure.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
0B0D	Comm	CRASH	Wait swap EF failure.	2, 1
0B0E to 0B7F	Comm	CRASH	Reserved for future Supervisor Subsystem crash codes.	1
0B80	Comm	CRASH	Illegal task invocation.	2, 1
0B81	Comm	CRASH	Set timed EF failure.	2, 1
0B82	Comm	CRASH	Illegal wait for EF	2, 1
0B83	Comm	CRASH	Illegal pause status.	2, 1
0B84	Comm	CRASH	Reset EF failure.	2, 1
0B85 to 0BFF	Comm	CRASH	Reserved for future IOP Failover Subsystem crash codes.	1
0C00	Comm	CRASH	Operating system has no SRBs available.	2,1
0C01	Comm	CRASH	Bad MMU alignment.	1
0C02 to 0CFF	Comm	CRASH	Reserved for future Operating system (MTOS) Subsystem crash codes.	1
0D00 to 0D0F	Both	CRASH	Unused on HPM platform.	1
0D10	Both	CRASH	SW EDAC unrecoverable Local RAM PERR.	2, 6,1
0D11	Both	CRASH	SW EDAC multiple Local RAM PERRs failure.	2, 6, 1
0D12	Comm	CRASH	SW EDAC unrecoverable I/O Link RAM PERR.	2, 7, 1
0D13	Comm	CRASH	SW EDAC multiple I/O Link RAM PERRs failure.	2, 7, 1
0D14 to 7FFF	Comm	CRASH	Reserved for future Comm crash codes.	1
8000 to FFFF	Comm	CRASH	Unused by Communications processor.	1
8000 to FFD9	Control	CRASH	Reserved for future Control crash codes.	1
FFDA	Control	CRASH	Flush address out of Control database boundary.	2, 6, 1
FFDB	Control	CRASH	Illegal SIZ-A1A0 combination.	2, 6, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
FFDC	Control	CRASH	Wait for 10 scan response timeout.	15
FFDD	Control	CRASH	I/O scan response failed.	15
FFDE	Control	CRASH	Control IOL Overrun Conditions for more than 4 seconds.	23, 1
FFDE	Control	CRASH	Unused on HPM Platform.	1
FFDF	Control	CRASH	Unused on HPM Platform.	1
FFE0	Control	CRASH	Diagnostic task detected bad PI checksum.	2, 6, 1
FFE1	Control	CRASH	Bad common memory signature.	1
FFE2	Control	CRASH	Memory sizing remainder error.	1
FFE3	Control	CRASH	PPX task could not set CPU Free LEF.	2, 1
FFE4	Control	CRASH	PPX task could not reset CPU Free LEF.	2, 1
FFE5	Control	CRASH	CPU Free pause failure.	2, 1
FFE6	Control	CRASH	CPU Free change priority fail #2.	2, 1
FFE7	Control	CRASH	CPU Free change priority fail #1.	2, 1
FFE8	Control	CRASH	Bad counts for tracking counter.	2, 6, 1
FFE9	Control	CRASH	End2end context save failed.	2, 6, 1
FFEA	Control	CRASH	End2end checksum failed.	2, 6, 1
FFEB	Control	CRASH	Invalid slot in sequence.	2, 1
FFEC	Control	CRASH	Sequence memory corrupted.	2, 6, 1
FFED	Control	CRASH	Invalid command during upgrade.	2, 1
FFEE	Control	CRASH	Database revisions incompatible.	2,1
FFEF	Control	CRASH	Prefetch-poststore wait timeout.	2, 7, 6, 1
FFF0	Control	CRASH	Free IMR not available.	2, 1
FFF1	Control	CRASH	Inconsistent Pascal and assembly database definitions.	2, 1
FFF2	Control	CRASH	Redundancy private path initialization failed.	9, 6, 1
FFF3	Control	CRASH	Comm or IOL failed.	15
FFF4	Control	CRASH	IOL poststore response failed.	15
FFF5	Control	CRASH	IOL prefetch response failed.	15
FFF6	Control	CRASH	Bad request or reply-pointer in pas task.	2, 1

Table 58 Communications and Control Processor Hard Failure Codes

Error Code	CPU	Failure Mnemonic	Description	Corrective Action (See Table 57)
FFF7	Control	CRASH	Bad type of startup transition.	2, 1
FFF8	Control	CRASH	MTOS task start returned bas status.	2, 1
FFF9	Control	CRASH	MTOS pause failed.	2, 1
FFFA	Control	CRASH	MTOS task priority change failed.	2, 1
FFFB	Control	CRASH	Default scan rate fails data owner checks.	2, 1
FFFC	Control	CRASH	Default number of slots fails data owner checks.	2, 1
FFFD	Control	CRASH	Largest slot db too big for tracked RAM.	2, 1
FFFE	Control	CRASH	Actual slot size greater than slot size constant.	2, 1
FFFF	Control	CRASH	Slot plus sequence program database is less than the total number of memory units reserved.	2, 1

HPMM Soft Failure Codes

> **ATTENTION**
>
> The HPM I/O Link Interface periodically monitors the integrity of each resident driver circuit on the I/O Link Interface. This capability did not exist until the introduction of the HPM. There is a possibility that upgrading to an HPM from a PM or APM, while retaining the existing IOPs, could uncover some marginal link drivers. These marginal IOP I/O Link Interface drivers, although still able to function, will generate I/O Link Interface driver errors and the accompanying Soft failures.

If no I/O Link Interface driver errors are reported, then all the drivers on the I/O Link Interface are operating properly. If I/O Link Interface driver errors exist, the offending IOP or High-Performance I/O Link card(s) should be replaced.

Errors that are logged against the I/O Link Interface resident IOP drivers are added to that IOP's (A or B) error count in the IOM I/O Link Information display. The mnemonic IOLDRVER is also displayed according to the IOP's DSA under the column that is labeled LAST ERR.

Errors logged against the HPMM's I/O Link Interface drivers are added into the appropriate CABLE (A or B) ERRORS and TOTAL ERROR counts which are displayed in the HPMM I/O Link Information display. The mnemonic IOLDRVER is also displayed in the field that is labeled LAST COMMUNICATION ERROR.

The normal cable swap algorithm annunciates a Soft failure and disables cable swap. Existing Soft failure codes (#16 – I/O LINK CABLE A FAILURE and #17 – I/O LINK CABLE A FAILURE) are used to report I/O Link Interface driver failures as well as other communications failures.

Some faults, for example power or ground shorts that produce an HPMM I/O Link Interface driver error can also produce other I/O Link Interface errors such as the LOOPBACK error. When this occurs, the IOLDRVER error may be obscured from the LAST COMMUNICATION ERROR field by another error. Even though some errors may be obscured from the display, they are still recognized, logged, and included in the error statistics.

Comm/Control Soft failure error codes

Table 59 Comm/Control Soft Failure Error Codes defines the Soft failure codes for both the HPMM Communications and the Control processors.

The corrective action(s) is identified by a number. Corrective actions are listed in Table 57 HPMM Corrective Actions.

Table 59 Comm/Control Soft Failure Error Codes

Bit Position	Failure Mnemonic	Display Text	Corrective Action (See Table 57)
00	CTRLNRSP	CTRL RESET/WDT EXPIRED	2, 6, 1
01	CTRLFAIL	CTRL PROCESSOR FAILURE	2, 6, 1
02	CMLDFAIL	COMM PROCESSOR LOAD FAILURE	2, 6,1
03	IOLFAIL		1
04	COMMDIAT	COMM PROC DIAG INIT TIMEOUT	2, 1
05	COMMDIAO	COMM PROC DIAG CYCLE OVERFLOW	16
06	MEMPTCHK	GLOBAL RAM EDAC CIRCUITRY	6, 1
07	SRMPTCHK	COM DETECT IOL RAM PARITY CKT	7, 1
08	LMPCCOM	COM LOCAL RAM PARITY CIRCUITRY	6, 1
09	UCNADDR	UCN ADDRESS CHANGE DETECTED	4, 1
10	PWRDROP	TRANSIENT POWER DOWN DETECTED	12, 1
11	SRMPTERR	COMM DETECTED IOL PERR HI-RATE	7, 1
12	SWITCHES		1
13	SOFTERR	PRIVATE RAM PARITY CIRCUITRY	6, 1
14	IOLNORSP	NO RESPONSE FROM IOL #1	7, 1
15	IOLMAXER	IOL MAX COMM ERRORS EXCEEDED	10, 7, 1
16	IOLAFAIL	IOL CABLE A FAILURE	10, 7, 1
17	IOLBFAIL	IOL CABLE B FAILURE	10, 7, 1
18	IOLPRSFL	NO PRIMARY IOL1 COMM TO SECNDY	10, 7, 1
19	UCNPRSFL	NO PRIMARY UCN COMM TO SECNDY	3, 8
20	UCNSCPFL	NO SECNDY UCN COMM TO PRIMARY	3, 8
21	NOSYNCH		1
22	LMBATFAL		1
23	DUPIOLAD	PRIM/SECNDY DUPLICATE IOM ADDR	5
24	INCOMPFW	INCOMPATIBLE FIRMWARE	6,
25	TSCLOCK	TIMESYNCH CLOCK ERROR/DRIFT	2, 6, 1

Table 59 Comm/Control Soft Failure Error Codes

Bit Position	Failure Mnemonic	Display Text	Corrective Action (See Table 57)
26	IOL_TS	IOL TIMESYNCH FAILURE	2, 7, 1
27	TSIOLLAT	TIMESYNCH IOL #1 LATCH ERROR	2, 7, 1
28	TSUCNLAT	TIMESYNCH UCN LATCH ERROR	2, 6, 1
29	COMSTACK	COMM PROC STACK LIMIT OVERFLOW	2, 1
30	COM_SWE	COMM DETECTED LRM PERR HI-RATE	2, 6, 1
31	CTL_SWE	CTRL DETECTED LRM PERR HI-RATE	2, 6, 1
32	GBLRAMPE		1
33	IOLOVRUN	CTRL IOL OVERRUNS	16 1
34	UCNOVRUN	CTRL UCN OVERRUNS	16, 1
35	PPXOVRUN	CTRL POINT PROCESSOR OVERRUNS	16, 1
36	CTRLDIAT	CTRL PROC DIAG INIT TIMEOUT	16, 1
37	CTRLDIAO	CTRL PROC DIAG CYCLE OVERFLOW	16, 1
38	LMPCCTL	CTRL LOCAL RAM PARITY CIRCUITRY	6, 1
39	REDDTRN	CTRL REDUN DATA TRANSFER ERR	9, 6, 1
40	REDDTRK	CTRL REDUN DATA TRACKING ERR	6, 1
41	COMMFAIL	COMM WATCH DOG TIMER EXPIRED	2, 6, 1
42	EVTHRACT	EVENT THROTTLING ACTIVE	21, 1
43	REDBYTE		1
44	REDADAC		1
45	REDADDL	REDUN PRIVATE PATH INIT ERROR	9, 6, 1
46	REDCLRR		1
47	REDPGEN		1
48	REDTRK		1
49	REDFULL		1
50	REDLOCK	ALT. REDUN CABLE APPLIED	18
51	PLCOVRUN	EXCESSIVE COM CPU LOAD	16, 1
52	LCIONRDY	EXCESSIVE CTL CPU LOAD	16, 1
53	KEYDISBL	EXCESSIVE I/O LINK LOAD	16, 1
54	LCLLNOSC	UCN CABLE SWITCH HW FAULT	2, 8, 1
55	LCSYSERR		1

Table 59 Comm/Control Soft Failure Error Codes

Bit Position	Failure Mnemonic	Display Text	Corrective Action (See Table 57)
56	LCCKSMFL		1
57	LCIOPPWFL		1
58	LCSWDTFL	IOL PF BUF SIZE EXCEEDED	19
59	LCBATTFL	IOL PS BUF SIZE EXCEEDED	19
60	PCSLFTST	UCN PF BUF SIZE EXCEEDED	19
61	LCSIOMOL	UCN PS BUF SIZE EXCEEDED	19
62	CTLSTACK	CTRL PROC STACK LIMIT OVERFLOW	2, 6, 1
63	LCIOCDFL		1
64	IOLIUNKN		1
65	IOLISTCO	IOL PROC STC OVERRUN	2, 7, 1
66	IOLIREQO	IOL PROC TASK REQUEST OVERFLOW	2, 7, 1
67	IOLIBADR	IOL PROC RESUME NON-WAIT TASK	2, 7, 1
68	IOLIDIAT	IOL PROC DIAG INIT TIMEOUT	2, 1
69	IOLIDIAO	IOL PROC DIAG CYCLE OVERFLOW	2, 7, 1
70	IOLIFTAN		1
71	IOLCBL1A	IOL CABLE 1A FAILURE	10, 7, 1
72	IOLCBL1 B	IOL CABLE 1 B FAILURE	10, 7, 1
73	IOLCBL2A	IOL CABLE 2A FAILURE	1
74	IOLCBL2B	IOL CABLE 2B FAILURE	1
75	SPARE110	NO RESPONSE FROM IOL#2	1
76	SPARE110	IOL #2 WATCH DOG TIMER EXPIRED	1
77	SPARE110	TIMESYNCH IOL #2 LATCH ERROR	1
78	SPARE110	NO PRIMARY IOL2 COMM TO SECNDY	1
79	SMBATSFL		1
80	SMTSFLT		1
81	LCTSFLT		1
82	IOL_HMRG	HIGH POWER SUPPLY MARGINING	13
83	IOL_LMRG	LOW POWER SUPPLY MARGINING	13
84	IOLIPERR	IOL DETECTED IOL PERR HI-RATE	7, 1
85	IOLPCHKR	IOL DETECT IOL RAM PARITY CKT	7,1

Table 59 Comm/Control Soft Failure Error Codes

Bit Position	Failure Mnemonic	Display Text	Corrective Action (See Table 57)
86	SPARE110	UART ACCESSIBILITY ERROR	6, 1
87	SPARE110	BATTERY BACKUP CIRCUITRY FAIL	6, 1
88	STCKLIM	IOL PROC STACK LIMIT OVERFLOW	7, 1
89	SPARE110	EHPM REDUN PORT NOT CONNECTED	9
90	SPARE110		1
91	WDTOFF	WATCH DOG TIMER DISABLED	6, 1
92	CTL_NOTG	NO TOG FROM CTRL PROCESSOR	6, 1
93	DRM_SBE	GLOBAL DRAM EDAC SBE HI-RATE	6, 1
94	CTL CE	CTRL CONSOLE EMULATOR UNLOCKED	17
95	COM_CE	COMM CONSOLE EMULATOR UNLOCKED	17

I/O Link processor Hard failure error codes

Table 60 I/O Link Hard Failure Error Codes provides the I/O Link processor Hard failure codes.

The corrective action(s) that are identified in the table are located in Table 57 HPMM Corrective Actions.

Table 60 I/O Link Hard Failure Error Codes

Error code	Failure Mnemonic	Description	Corrective Action (See Table 57 HPMM Corrective Actions)
00	UNKNOWN	Unknown Hard Failure.	None
01	POWERDWN	Powerdown occurred.	None
02	I NVPRGEX	Unused on I/O Link interface	1
03	EPROMERR	Program checksum error.	2, 7, 1
04	RAMCNTER	RAM contents error.	2, 7, 1
05	RAMADRER	RAM address decoding error.	7
06	DPAERROR	Device Physical Address (DPA) error.	2, 7, 1
07	DSAERROR	Device Soft Address (DSA) error.	2, 7, 1
08	RXBUFOFL	Unused on I/O Link interface	1
09	IOLJA8ER	I/O Link jabber circuit fired.	7
0A	SRAMFAIL	Unused on I/O Link interface.	1
0B	BADPGJMP	Unused on I/O Link interface.	1
0C	ADCINCMP	Unused on I/O Link interface	1

Table 60 I/O Link Hard Failure Error Codes

Error code	Failure Mnemonic	Description	Corrective Action (See Table 57 HPMM Corrective Actions)
0D	ADOUTOVF	Unused on I/O Link interface.	1
0E	ADOUTUDF	Unused on I/O Link interface.	1
0F	ADCCALER	Unused on I/O Link interface.	1
10	BADDCLTC	Unused on I/O Link interface.	1
11	DMT_TMOT	Dead Man Timer timeout.	2, 7, 1
12	MLTOUTFL	Unused on I/O Link interface.	1
13	DATBUSFL	Unused on I/O Link interface.	1
14	BADDARNG	Unused on I/O Link interface.	1
15	MSTRTMOT	Communications timeout.	2, 6, 1
16	UM51_WDT	UM51 Watch Dog Timer timeout.	2, 7, 1
17	CTRCKTFL	Unused on I/O Link interface.	1
18	SOECNTFL	Unused on I/O Link interface.	1
19	OUTCTLFL	Unused on I/O Link interface.	1
1A	PRC TYPE	Wrong processor type.	7
1B to FF	SPARExxx	Unused on I/O Link interface.	1

IOP Hard failure error codes

The following table defines the Input/Output Processor (IOP) Hard failure codes. The recommended corrective action(s) are included in the table.

Table 61 IOP Hard Failure Error Codes

Last Failure Mnemonic	Description	Corrective Action
ADCCALER	Internal calibration signal in the HLAI is off by more than ± 5%.	Replace the HLAI IOP card.
ADCINCMP	A/D conversion incomplete.	Replace the HLAI IOP card.
ADOUTOVF	Not applicable	
ADOUTUDF	A/D reference point conversion value ≤ zero.	Replace the HLAI IOP card.
BADDARNG	AO IOP card DAC load value is NAN or +INF or -INF.	Replace the AO IOP card.
BADDCLTC	AO card detected that DAC IOP card interface latch was bad.	Replace the AO IOP card.

Table 61 IOP Hard Failure Error Codes

Last Failure Mnemonic	Description	Corrective Action
BADPGJMP	Current Calibration/Conversion mode is invalid for this IOP	Select Calibration/Conversion mode that is valid for this IOP.
CTRCKTFL	IOP counter failed.	Replace IOP card.
DMT_TMOT	Dead man timer timeout	Replace the LLAI IOP card. Call TAC if problem persists.
DPAERROR	A physical device address error.	Replace the IOP card.
DSAERROR	Device software address error.	Replace the IOP card. If multiple IOP cards failed with this code, or a replacement IOP card fails with this same code, the card file backpanel may be bad.
EPROMERR	EPROM checksum error.	Replace the IOP card.
INVPRGEX	Invalid program execution.	Replace the IOP card. If the replacement card provides the same results, call TAC for assistance.
IOLJABER	I/O Link jabber circuit fired.	Replace the IOP card.
MLTOUTFL	More than one output has failed in a DO IOP card. The DO IOP card has failed so the outputs are set to their shed states.	Check for the unexpected presence of an active DO Standby Manual device connected to the FTA. Also, check for blown fuse F17 on the 24 Vdc nonisolated DO FTA or improper TB1-17, 18, 19 connections on the same FTA. Check the FTA wiring, replace the DO IOP card and/or the FTA.
MSTRTMOT	68K timeout.	Applicable to I/O Link Interface only (not an IOP error).
OUTCTLFL	Not applicable	
POWERDWN	Power down occurred. The IOP card lost power and restarted.	None, unless only a single IOP or group of IOPs exhibit this problem continually when a loss of power should not be occurring in the HPM. Check to see that the IOP is properly inserted in the card file. Also check the seating of the power distribution cables between the card file and the power system.
RAMADRER	RAM address decoding error.	Replace the IOP card.
RAMCNTER	RAM contents error.	Replace the IOP card.
RXBUFOFL	Not applicable	
DATBUSFL	PI data bus diagnostic test failure	Replace the IOP card
SPARE026 to SPARE255	Not used.	N/A
SOECNTFL	SOE counter failure.	Reset IOP. Replace the IOP card if the problem persists.
SRAMFAIL	SRAM failure.	Reset IOP. Replace the IOP card if the problem persists.
UM51_WDT	Not applicable	

Table 61 IOP Hard Failure Error Codes

Last Failure Mnemonic	Description	Corrective Action
UNKNOWN	Unknown hardware failure.	If an IOP card fails and this code is present during restart, the IOP was disabled, probably by the Watch Dog Timer time-out circuit, ESD, or RFI. Check the situation. Replace the IOP if the problem persists.
WRONGCPU	CPU is not the correct part - 80C31 or 80C32	Applicable to I/O Link Interface only (not presently an IOP error).

IOP Box Soft failure error codes

The IOP Box Soft failure codes are defined in the following table. The corrective actions are identified in the table.

Table 62 IOP Box Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
00	UNKNOWN	Null Soft failure. No failure	None.
01	STCOVRUN	Sample time clock overrun.	Investigate a possible I/O Link problem. Data access to the IOP cards may not be operating properly. Check the High-Performance I/O Link card, the I/O Link cable, and the IOP cards.
02	REQOFLOW	IOP task request overflow.	Call TAC for assistance.
03	BADRESUM	IOP executive resumed a nonwaiting task.	Call TAC for assistance.
04	DIAGTMOT	Diagnostics not run in at least 5 seconds indicates a processing overload.	Investigate control point mix/strategy for an excessive load. Otherwise, a possible I/O Link problem exists. Check the High-Performance I/O Link card, the I/O Link cable, and the IOP cards.
05	DIAGOFLO	Entire diagnostic cycle overran the 2-minute allocated time in which diagnostics have to run to completion.	Same as error code 04.
06	FTAMISSG	The FTA is missing.	Install the FTA. If an FTA is present, replace the FTA or check the FTA cable. (Note: For the LLMux or RHMUX, this code refers to the Power Adapter assembly. RTD and TC FTAs are diagnosed by error codes 50 and 51).
07	EECKSMER	EEPROM (used to hold calibration information in Analog Output IOPs) checksum failure. It usually means an Analog Output IOP is not calibrated properly.	Calibrate the Analog Output IOP card (refer to the "IOP Calibration Procedures" section for the procedure). If the error persists, replace the HLAI, or the AO IOP card, or the FTA.

Table 62 IOP Box Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
08	EECNTERR	EEPROM counter error. The number of writes to EEPROM has exceeded the safe number (10,000). This could indicate the IOP has not been calibrated because a virgin EEPROM will fail this test.	Same as error code 07.
09	EEFLAGER	EEPROM semaphore (incomplete) error.	Same as error code 07.
09	EEFLAGER	EEPROM semaphore (incomplete) error.	Same as error code 07.
10	SWTCHERR	No longer used.	No action required.
11	ADRAMCNT	ADP (Analog to Digital Processor – LLAI only) private RAM contents failure.	Replace the appropriate IOP card because the ADP has failed.
12	ADRAMADR	ADP (LLAI only) private RAM address error.	Replace the IOP card.
13	MBRAMCNT	LLAI shared RAM contents failure.	Replace the IOP card.
14	MBRAMADR	LLAI shared RAM address error.	Replace the IOP card.
15	MBCHKMER	LLAI shared RAM checksum error.	Replace the IOP card.
16	ADROMERR	ADP (LLAI only) ROM checksum failure.	Replace the IOP card.
17	BADADPER	Application processor (LLAI or STI) has a communication failure with the High-Performance I/O Link card.	If the error persists, replace the IOP card.
18	ADSTRTUP	ADP (LLAI only) failed on IOP startup.	Replace the IOP card.
19	SCANORUN	Input IOP overran its input scan. Inputs have been lost.	Check for a "chattering" DI point. Another possible cause would be intermittently bad I/O link hardware.
20	SCANURUN	DI IOP scan underrun.	No longer used. No action required.
21	INPTFAIL	Input point failure.	Check which input is failing, then check the hardware for that input. Replace the hardware if required.
22	BADSECRG	DO IOP card secondary regulator is not functioning.	Replace the DO IOP card.

Table 62 IOP Box Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
23	OUTPUTFL	Output point failure.	Check which output is failing, then check the hardware for that output. Replace the hardware if required.
24	STCKLIM	Internal stack usage in the 8051 processor is close to the limit.	Call TAC for assistance.
25		Not used.	N/A
26	DIAGCTFL	Output loopback circuit is bad.	Replace the appropriate IOP card.
27	ADPCOMFL	I/O Link processor cannot gain access to the shared RAM. Input conversion will be prohibited.	Replace the IOP card.
28	NOACLINE	No external ac line is present in the LLAI. The 6 Vac is used for power noise cancellation.	Check optical coupler and associated fuse on the backpanel. Check that the primary (left side)Power Supply Module in the Power System is installed and functional.
29	BADPLUGM	Bad plug-in module on the FTA.	Replace the plug-in module.
30	VTESTFAL	Test Volume Reference Failure. PV is set to NAN by the IOP.	Replace the IOP card.
31	FTAMSMCH	The FTA type and point configuration are mismatched.	Replace the FTA type or reconfigure.
32	VZERO_FL	Zero Reference Volume failure.The PV is set to NAN by the IOP.	Replace the IOP card.
33	BADRJVAL	LLAI reference junction value is bad.	Check that the reference junction wire or jumper (P1) is correctly implemented on the FTA.
34	BADADPJP	Probable RAM failure in ADP portion.	Replace the LLAI IOP card for the LLAI FTA.
35	ZEROCNFG	Bad configuration byte passed to the ADP.	Check the configuration.
36	FTA1FAIL	LLMux or RHMUX: FTA 1 has a Soft failure.	LLMux or RHMUX: Check FTA 1. SI: Correct the error condition at the device connected to FTA 1.
37	FTA2FAIL	LLMux or RHMUX: FTA 2 has a Soft failure.	LLMux or RHMUX: Check FTA 2. SI: Correct the error condition at the device connected to FTA 2.
38	CALBABRT	Calibration of an IOP card has been aborted during the procedure.	Check the precision voltage/resistance source for accuracy. Also, make sure that the correct calibration procedure is being followed
39	BADCALRF	Calibration reference input is bad.	Replace the HLAI.

Table 62 IOP Box Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
40	EEFAILED	Output EEPROM write failure.	If an HLAI or AO, replace the IOP. If an LLAI, replace the affected plug-in module.
41	VREFFAIL	LLMUX FTA ref voltage failure	If the problem persists replace the FTA
42	ADOUTUDF	Analog to digital conversion value underflowed (HLAI only).	Check the input wiring at the FTA; possible bad contact. Otherwise, replace the IOP card and/or the FTA.
43	ADOUTCAL	HLAI A/D is out of calibration by more than ±3%.(refer to the "IOP Calibration Procedures" section).	Calibrate or replace the IOP card (refer to the "IOP Calibration Procedures" section).
44	BADFLREG	AO IOP failure selection register is bad.	Replace the AO IOP card.
45	BDSNDTC	Bad output module secondary latch.	Replace the IOP. Use a Standby Manual device if nonredundant.
46	BDOUTBFR	Bad output buffer.	Replace IOP. Use Standby Manual device if nonredundant.
47	VCALFAIL	Calibration reference out of range.	Replace the IOP or recalibrate.
48	F1NOTCAL	LLMux or RHMUX: FTA 1 is not calibrated. SI: FTA 1 write buffer has overflowed.	LLMux or RHMUX: Calibrate FTA 1. SI: Reduce the number of writes to the FTA.
49	F2NOTCAL	LLMux or RHMUX: FTA 2 is not calibrated. SI: FTA 2 write buffer has overflowed.	LLMux or RHMUX: Calibrate FTA 2. SI: Reduce the number of writes to the FTA.
50	F1COM_FL	LLMux or RHMUX: FTA 1 fails to communicate. SI: FTA 1 fails to communicate.	Check the connection from the Power Adapter to FTA 1. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA.
51	F2COM_FL	LLMux or RHMUX: FTA 2 fails to communicate. SI: FTA 2 fails to communicate.	Check the connection from the Power Adapter to FTA 2. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA.
52	F1_IDERR	FTA #1 is pinned as #1.	Verify/correct the FTA pinning.
53	F2_IDERR	FTA #2 is pinned as #0.	Verify/correct the FTA pinning.
54	F1VREFFL	FTA 1 has a reference voltage failure.	Replace the FTA.
55	F2VREFFL	FTA 2 has a reference voltage failure.	Replace the FTA.
56	F1CAL_FL	FTA 1 calibration procedure failed.	Recalibrate the FTA.

Table 62 IOP Box Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
57	F2CAL_FL	FTA 2 calibration procedure failed.	Recalibrate the FTA.
58	LOSTSYNC	Secondary IOP has lost synchronization.	If the primary IOP is in OK, resynch with the START command. If the primary IOP is in IDLE, resynch with the IDLE command.
59	WRITENBL	AO or DO IOP write enable failure.	Replace the IOP at the earliest convenience. IOP failure can result in indeterminate outputs.
60	MLTINPFL	Multiple input failure detected.	Replace the IOP.
61	REDNDIAG	Redundancy diagnostic failure.	If an AO, replace the FTA's plug-in module after forcing IOP A to be the primary. If an HLAI, replace the IOPs one at a time following database synchronization.
62	Spare062		
63	WRONG_HW	Wrong hardware revision for IOP redundancy	Replace the IOP with an IOP that supports redundancy (proper hardware revision).
64	HWFIFOFL	The DISOE Hardware FIFO diagnostic failed. The PVs of all points are set to BAD.	Replace the IOP.
65	PRVRAMFL	The DISOE Private RAM diagnostic failed. The PVs of all points are set to BAD.	Replace the IOP.
66	SOECLKFL	The DISOE clock failed. The PVs of all points are set to BAD.	Replace the IOP.
67	PVVALDFL	The PV validation diagnostic failed. The PVs of all points are set to BAD.	Replace the IOP.
68	SOECNTFL	The DISOE SOE counter diagnostic failed.	Replace the IOP.
69	DTPATHFL	Data path failure.	Replace the FTA when convenient.
70	DTPATHTO	Data path failure.	Replace the FTA when convenient.
71	STAMCHFL	The DISOE State Machine diagnostic failed. The PVs of all points are set to BAD.	Recalibrate the FTA.
72 to 255		Not used.	Not applicable.

IOP Slot Soft failure error codes

The following table defines the Input/Output Processor (IOP) Slot Soft failures. The recommended corrective actions are included in the table.

Table 63 IOP Slot Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
00	Null	No error	
01 to 06		Not used.	N/A
07	EECKSMER	LLAI EEPROM checksum during write.	Replace the FTA plug-in module or recalibrate.
08	EECNTERR	LLAI EEPROM counter error.	Replace the FTA plug-in module or recalibrate.
09 to 20		Not used.	N/A
21	INPTFAIL	Input failure.	Replace the IOP or check the FTA wiring.
22		Not used.	N/A
23	OUTPUTFL	Output failure (AO or DO).	Check the output connection at the FTA. If it is good, try replacing the FTA and/or the appropriate IOP card.
24 to 25		Not used.	N/A
26	DIAGCTFL[1]	Input/output loopback failure for the slot.	Replace the IOP when convenient. Use a Standby Manual device if appropriate.
27 to 28		Not used.	Replace the IOP card. If the replacement card provides the same results, call TAC for assistance.
29	BADPLUGM	Plug-in module failure.	Test that the slot is wired correctly. If it is, replace the FTA plug-in module.
30		Not used.	N/A
31	FTAMSMCH	FTA mismatched with slot configuration.	Reconfigure or replace the FTA.
32 to 34		Not used.	N/A
35	BADADPJP	Illegal internal zero configuration attempted on this channel.	Check for an open thermocouple, fuse, or replace the IOP.

[1] Slot Soft failure only. The display is incorrect.

Table 63 IOP Slot Soft Failure Error Codes

Error Code	Failure Mnemonic	Description	Corrective Action
36 to 37		Not used.	N/A
38	CALBABRT	Calibration of this slot has aborted.	Check the precision voltage source for accuracy.
39 to 41		Not used.	N/A
42	ADOUTUDF	Analog to digital conversion value under flowed (HLAI only).	Check the input wiring at the FTA; possible open contact. Otherwise, replace the IOP card and/or the FTA.
43 to 255		Not used.	N/A

Additional Troubleshooting for EUCN nodes

EHPM Node not coming to "ALIVE" state

If an EHPM is not coming into the "ALIVE" state on the UCN Status Display, and it shows OFFNET, it could mean that the ENIM has not authenticated that EHPM. To resolve this problem:

1. Check that the UCN Node Configuration for the ENIMs and EHPMs are checkpointed to the ENIMs, and that the ENIMs are freshly re-booted and re-loaded with this checkpoint.

2. Check the UCN Node Configuration for the EHPM as to whether it is configured in the same ENIM network or not.

3. Power cycle the EHPM to see if it helps to resolve the issue.

4. Verify that the same EHPM is not configured in any other ENIM or any other Authentication Group in the same LCN.

Authentication Group showing Zero (0) from the $FTESTS2 display

If the $FTESTS2 Display details for a specific EUCN node (shown when an individual FTE status line is selected), shows an Authentication Group of "0" for any of the EUCN nodes, it could mean that the node is not authenticated by the ENIM. To resolve this problem:

1. Check that the UCN Node Configuration for the ENIMs and EHPMs are checkpointed to the ENIMs, and that the ENIMs are freshly re-booted and re-loaded with this checkpoint.

2. Check the UCN Node Configuration for the EHPM as to whether it is configured in same ENIM network or not.

3. Power cycle the EHPM to see if it helps to resolve the issue.

4. Verify that the same EHPM is not configured in any other ENIM or any other Authentication Group in the same LCN.

5. Finally, check your switch configuration settings to make sure all nodes are properly configured at the switch level.

4.4   Smart Transmitter Interface

Introduction

A fault in an Smart Transmitter Interface (STI) point can be isolated to one of the following areas.

- STI (STIM) IOP

- Associated FTA

- Smart Transmitter device

STI IOP and FTA faults

If a fault occurs in the STI (STIM) IOP or the FTA, the fault can be isolated by the same procedure as was described previously for other IOPs.

Two wire link or Smart Transmitter faults

If the fault is in the 2-wire link or in the transmitter, the PV value on the Universal Station display changes to a **BADPV** value for the particular STI point. Perform the procedure in the following table to isolate the fault to either the link or the transmitter.

Step	Action
1	Check the Transmitter Status Field on the second page of the Detail Status display. If "Device Not Communicating" or "In Analog Mode" is displayed, proceed to step 2. Otherwise, determine the status of the transmitter by using Table 77 Alphanumeric Display for Failover HPMM Swapping Sequence (Detailed Display Mode) and take the appropriate action.
2	Check the status of the transmitter using the Smart Field Communicator (SFC) as described in the appropriate Honeywell publication.
3	If the status check of the transmitter indicates that it has no malfunction, the fault may be in the 2-wire link. Proceed with the following steps. Disconnect the 2-wire link at the transmitter and at the FTA. Perform a wire continuity test. If necessary, replace the 2-wire link. If the status check of the transmitter indicates that it is a malfunction, troubleshoot the transmitter according to the procedures provided in the appropriate Honeywell publication.
4	After the fault has been corrected, reload the transmitter data base from the Universal Station.
5	Remove the control loop from the manual mode.

4.5 FTA Redundancy Indicators

Introduction

The switching indicator, DS1, on the High Level Analog Input FTA and the Analog Output FTA indicate different IOP control conditions. Output control of the Analog Output FTA is switched on the FTA between IOP A and IOP B. The inputs to the High Level Analog Input IOPs from the FTA are connected in parallel.

AO FTA redundancy indicator

If the indicator, **DS1**, on the Analog Output FTA is illuminated, IOP A is controlling the FTA's output terminals. When IOP A is controlling the FTA's output terminals, IOP B, the switching module, M1, or the cable between IOP B and the FTA can be replaced.

When the indicator on the Analog Output FTA is extinguished, IOP B is controlling the FTA's output terminals, and IOP A or the cable between IOP A and the FTA can be replaced. The indicator may briefly illuminate during self-test. This is a normal condition.

HLAI FTA redundancy indicator

If the indicator, **DS1**, on the High Level Analog Input FTA is illuminated, IOP A is the primary IOP or available to become the primary IOP. When the indicator on the FTA is not illuminated, IOP A is not available to be the primary IOP.

4.6 Redundant Analog Output IOP Failure Diagnosis

Introduction

The procedure that follows is recommended when encountering a problem with redundant Analog Output IOPs. It is not intended to be a replacement for the experience acquired in the use of redundant

Analog Output IOPs, but it should improve your approach to locating, isolating, and correcting a problem.

Considerations

A knowledge of the information provided by the Universal Station displays, detailed in the "UCN Status Displays" section and discussions in early subsections of the "Fault Isolation" section is needed to understand a systematic troubleshooting procedure. Consider the following information and suggestions.

Avoid removing IOP A

If at all possible, do not remove IOP A. The IOP A is the IOP connected by cable to the FTA Cable A connector, J1, on the Analog Output FTA.

IOP A preference

Redundancy for the Analog Output IOPs is biased toward IOP A. A hardware bias exists because IOP B (the physical secondary) is connected to the Analog Output FTA through a switching module on the FTA, while IOP A (the physical primary) is connected directly to the FTA circuitry that interfaces the FTA's field wiring outputs.

Replacing the FTA switching module

The switching module can be replaced without disturbing the FTA's outputs when IOP A is the primary IOP because IOP A has a direct connection to the field wiring terminals, independent of the switching module's presence.

Switch to IOP A when a Soft failure occurs

If the IOP pair has a Soft failure because of a redundancy hardware problem, and IOP B is the primary IOP **BSF/SF**** on the HPM Status display] and still in synch, it is important to switch to IOP A before proceeding. Once IOP A becomes the primary IOP, replacement of IOP B, or the switching module on the FTA, can occur without the loss of outputs to the field.

- ** The "**XX/YY**" represents the status shown on the HPM Status display. The correct interpretation is that "**XX**" is IOP A, and "**YY**" is IOP B. The backup IOP is identified by either "**BKP**" or "**BSF**."

Consider use of an AO Standby Manual device

If the user is conservative, you can always connect an Analog Output Standby Manual device to the FTA and then replace either the Analog Output IOP or the switching module on the FTA. However, you must realize that with the Analog Standby Manual device in place, all control points using these outputs will go into initialization.

OK/CNF [S] status

If the HPM Status display indicates an **OK/CNF [S]*** status, or any combination of **SF**, **IDL**, or **ISF** for IOP A, the problem is either the cables are improperly wired to the FTA, or the FTA switching module is bad. Do <u>not</u> attempt to disrupt power to IOP A by toggling its upper retractor or remove the IOP. Additional information may be available in the "Status" field on the IOP's Detail Status display.

- * The **[S]** represents the synchronization status of the redundant IOP pair. The "**S**" has two background colors, red for **SYNC_FAIL** and yellow for **SYNC_WARNING**. A **SYNC_FAIL** status indicates the IOP has tried several times to synchronize the database between the IOPs with no success. The only way to reinitiate a synchronization for the IOP with a **CFG** status, from the Universal Station, is to send the present state of the communicating IOP to its redundant partner. For example, if the HPM Status display indicates **OK/CFG [S]**, execute the **RUN** command for the pair. If the status is **IDL/CFG [S]**, execute the **IDLE** command. You will see the red "**S**" change color to yellow as synchronization of the IOPs is attempted again.

Replacing the switching module

If it is determined that the switching module is bad, the switching module can be replaced without disturbing the field outputs, as long as IOP A is the primary IOP.

[S] CNF/OK status

If the HPM Status display indicates a ***[S] CNF/OK** status, or any combination of **SF**, **IDL**, or **ISF** for IOP B, the problem is either the cables are improperly wired to the FTA, or the switching module on the FTA is defective. If any of the FTA outputs are in the "on" state, a special problem exists because the removal of the switching module will result in the loss of control output to the device.

- * The **[S]** represents the synchronization status of the redundant IOP pair. The "**S**" has two background colors, red for **SYNC_FAIL** and yellow for **SYNC_WARNING**. A **SYNC_FAIL** status indicates the IOP has tried several times to synchronize the database between the IOPs with no success. The only way to reinitiate a synchronization for the IOP with a **CFG** status, from the Universal Station, is to send the present state of the communicating IOP to its redundant partner. For example, if the HPM Status display indicates **OK/CFG [S]**, execute the **RUN** command for the pair. If the status is **IDL/CFG [S]**, execute the **IDLE** command. You will see the red "**S**" change color to yellow as synchronization of the IOPs is attempted again.

Best solution when replacing switching module

The best solution is to use the Analog Output Standby Manual device to hold the field outputs in a safe state while the IOP or switching module is replaced.

Switching module replacement procedure

The procedure in the following table is required when any of the outputs are in the "on" state and the switching module is defective.

Step	Action
1	Verify that a current Checkpoint for the problem IOP is available, and if not, save a Checkpoint before proceeding.
2	Connect an Analog Output Standby Manual device to the FTA and balance the outputs.
3	On the Analog Output Standby Manual device, switch control of the FTA output field terminals from the IOP to the Analog Standby Manual device.
4	Remove the switching module on the FTA and then disrupt power at IOP A.
5	IOP A should now be in the idle state and the primary IOP. Restore the Checkpoint to the IOP and start the IOP. IOP B should be in Soft failure with a **MISSING FTA** status and should synchronize with IOP A.
6	Replace the switching module on the FTA and verify that IOP B clears its Soft failure and synchronizes with IOP A. The HPM Status display should now indicate **OK/BKP**.
7	Align the outputs with those on the Analog Output Standby Manual device and switch control of the field terminals from the Analog Standby Manual device back to the IOP.

IOP B should be secondary

Always remember that IOP B should be the secondary during normal operation to provide the best subsystem availability. IOP B's functions should be periodically tested using the procedure found subsection "Redundant 8-Channel Analog Output IOPs" ("Periodic Redundancy Tests" section).

4.7 Battery Backup Exhaustion

Introduction

When the 48 Vdc backup batteries become exhausted after approximately 20 minutes of operation because of Power Supply Module failure or loss of ac power, the 24 Vdc output from the Power System collapses abruptly to zero. Until that time, the 24 Vdc output from the Power System remains within specification. There is no gradual decay of the 24 Vdc output.

Loss of 24 Vdc

If the 24 Vdc output is lost, the control signals from the Analog Output and Digital Output FTAs in the cabinet or cabinet complex that are powered by the particular Power System will become inactive, with the AO FTA outputs dropping to a nonpowered condition and the DO FTAs output relays assuming their deenergized state.

Multiple battery backup

Be aware that other Power Systems (additional cabinets) with battery backup that may be in the High-Performance Process Manager subsystem may not exhaust their battery capacity at the same time. The effect of the situation on the overall control and safety of the process being controlled should be considered.

US response to 48 Vdc battery failure

As a result of the loss of 24 Vdc power, the HPM cabinet becomes nonpowered. The HPM status displays at the Universal Station (US) will show the status of the HPMMs to be **OFFNET** or **UNKNOWN**. Without access to the HPMMs, the IOP displays are not available.

4.8   HPMM Card and Module Indicators

Application of power

When power is first applied to the HPMM, check the **Power** indicator on each HPMM card and the HPM UCN Interface module. The **Power** indicator should be illuminated whenever dc power is present.

Status indicators and Alphanumeric display

After a few seconds, the **Status** indicator on the High-Performance Communications/Control and High-Performance I/O Link cards should be illuminated and the alphanumeric display at the front of the High-Performance Communications/Control cards should display an code that indicates the HPMM is in the Alive state, such as **Axxx**.

HPM UCN Interface module

Either the **Rx-A** or **Rx-B** indicator at the front of the HPM UCN Interface module should be illuminated, indicating which UCN cable is active. Normally, the Transmit indicator will flicker to indicate communication with the Universal Control Network.

Indicator functionality

The following table describes the functionality of the indicators at the front of the High-Performance Communications/Control and High-Performance I/O Link cards, and the HPM UCN Interface module.

Table 64 HPMM Card and Module Indicators

Card/Module Type	Indicator	Functionality
High-Performance Comm/Control	Power Status	The LED illuminates when power is applied to the HPMM card file. If the LED is not illuminated, check the Power System, the power cables to the card file, and the High-Performance I/O Link card. The High-Performance I/O Link card provides power to itself, the High-Performance Comm/Control card and the HPM UCN Interface module. When power is applied to the HPMM card file, the indicator illuminates and self-test begins. If the LED extinguishes after a few seconds, the self-test has encountered a Hard failure. The LED blinks once a second if the self-test encounters a failure. The LED remains on continuously if there are no failures.
High-Performance I/O Link	Power Status	The LED should be illuminated when power is applied to the HPMM card file. If the LED is not illuminated, check the Power System and the power cables to the card file. The High-Performance I/O Link card provides logic power to itself, the High-Performance Comm/Control card, and the HPM UCN Interface module. A field replaceable 3.2 amp. fuse on the card provides overload protection for the +5 volt HPMM supply on this board. The Status LED illuminates when the HPMM personality has been successfully downloaded. If a failure occurs, the LED extinguishes.

Card/Module Type	Indicator	Functionality
UCN Interface Module	Power Transmit Rx-A Rx-B	The LED is illuminated when power is applied to the HPMM card file. If the LED is not illuminated, check the Power System, the power cables to the card file, and the High-Performance I/O Link card. The High-Performance I/O Link card provides power to the card and the HPM UCN Interface module through a fuse which is mounted on the backpanel immediately behind the module itself.. The LED flickers when transmitting data. This does not occur unless the HPMM is loaded or is in network test mode. Before the HPMM personality is downloaded, the LED will blink occasionally. The indicator illuminates (or flickers rapidly) when the UCN A cable is active. The indicator illuminates (or flickers rapidly) when the UCN B cable is active.

High-Performance Comm/Control card Status indicator

During power startup, the High-Performance Comm/Control card's internal diagnostic tests should complete after approximately 10 seconds, and the **Status** indicator should stay on, indicating the diagnostic tests were successful. If the **Status** indicator does not stay on, the card has detected a hardware or firmware failure.

High-Performance I/O Link card Status indicator

The **Status** indicator does not indicate whether or not the High-Performance I/O Link card's internal diagnostic tests were successfully completed. The **Status** indicator illuminates only after the HPMM's personality has been has been successfully downloaded. A failure detected after the personality is loaded (HPMM is in operation) will cause the Status indicator to turn off.

HPM UCN Interface module Transmit indicator

On the HPM UCN Interface module, the **Transmit** indicator is used to indicate that the card is transmitting data on the UCN and flickers periodically. Many times the off state of this indicator is very short. If the Network Interface Module (NIM) has not been downloaded and token passing has not begun, the **Transmit** indicator remains off. See the *High-Performance Process Manager Checkout* manual.

Power and Status indicators

Check the **Power** and **Status** indicators on both cards and the HPM UCN Interface module. If any of the indicators are off, troubleshoot the cause based on descriptions and checks previously described. Replace the failed card or module by using the appropriate procedure described in the "Removal and Replacement" section.

HPMM fuse

The HPMM card set is powered through a 3.2 A fast-action fuse on the High-Performance I/O Link card. If the fuse is blown, power to the entire HPMM card set is removed. If either HPMM cards or its UCN Interface module has its **Power** indicator illuminated, the status of the fuse on the High-Performance I/O Link card is good.

UCN Interface Module fuse

The UCN Interface Module is supplied regulated dc power from the High-Performance I/O Link card through a 2 amp. fuse on the backpanel. This fuse is located immediately to the right of the leftmost connector on the backpanel. Removal of the UCN Interface Module is required to gain access for replacement of this fuse.

Note: If the same 7-Slot or 15-Slot card file is used as an IOP card file, the fuse will provide power protection for the IOP (and associated FTA) in the leftmost card slot.

HPMM Card extractors

If the upper card extractor on either the High-Performance Communications/Control card or High-Performance I/O Link card is unlocked and lifted slightly, power is disconnected from the card.

The 24 Vdc from the Power System is distributed on the card file backpanel from the backpanel's power connectors to the High-Performance Communications/Control card. On the card, it passes through a switch that is controlled by the upper card extractor back through the backpanel to the High-Performance I/O Link card.

On the High-Performance I/O Link card, it passes through a switch that is controlled by the upper card extractor, through a 3.2 Amp. fuse, to the a voltage converter on the card that produces +5 Vdc that is distributed internally to the High-Performance I/O Link card and externally through the backpanel to the High-Performance Communications/Control, and the UCN Interface module.

4.9 HPMM Alphanumeric Display

Introduction

The High-Performance Comm/Control card has a four character alphanumeric display at the front of the card that provides the following types of diagnostic information.

- Runtime Operation – Provides indication of normal HPMM operation which includes the HPMM state, primary/secondary status, and UCN node address (number).

- Failure Status – Display startup, or UCN load or Runtime failure status information

- Cold/Warm Startup Diagnostics – Displays the **STRT** status during the startup diagnostic tests, system bootstrap operations, and software integrated checks.

Detailed Display switch

The amount of detailed information that is displayed can be conditionally enabled by the use of the Detailed Display switch that is located in a recess behind the front panel on the High-Performance Comm/Control card. Use of the switch determines whether detailed information such as test sequence numbers or non-detailed messages that indicate the general phase of HPMM validation/transition/operation. In general, the Detailed-display switch is used primarily for detailed Hard failure analysis.

Rapidly changing of display contents

When the Detailed Display mode (switch) is enabled, the alphanumeric display will frequently show a rapidly changing display content as the various detailed sequences are cycled through. It is impossible to distinguish each unique sequence number displayed. The value lies in the test number/indication displayed when a particular sequence fails to complete (hangs).

Detailed HPMM sequence tables are provided in subsection "HPMM Alphanumeric Display" ("Fault Isolation" section).

Alphanumeric Display Format

The High-Performance Comm/Control card has a four digit alphanumeric display. Generally, the left one or two most significant positions on the display indicate the state of the HPMM with alpha characters, and the right two positions on the display indicate either a test sequence number or a UCN node number with numeric characters. In addition, there are generic text messages that describe the overall phase of the HPMM.

UCN node number

When displaying the UCN node number, it is important to realize that the HPMM has no concept of redundancy while in the Alive, Loading, or Fail state. Therefore, at best, the HPMM knows the user configured UCN node number (pinned odd address only) and the physical card file number (pinned), and whether it resides in a 7 or 15 slot HPM backpanel. This information produces the following methods of uniquely displaying a UCN node number at all times.

- **Fnn nn** represents the user configured decimal UCN node number (01-64) preceded by a physical position indicator during the Alive, Loading. and Fail HPM states.

- The actual physical position indicators are represented as "L" and "R" to indicate residency in a 7-Slot card file and "1" and "2" to indicate residency in the file-1 and file-2 15-Slot backpanels.Although this information is inconsistent when viewed from the LCN, it eliminates the ambiguity of having another HPMM node in the Alive, Loading, or Fail state display the identical UCN node number of its redundant partner in the Idle or OK state.

- **nn nn** represents the decimal UCN node number (01-64) during normal HPMM Runtime operation. The primary (or nonredundant configured) HPMM node displays the user configured odd node address, and the secondary HPMM, if configured and loaded, displays the even node address. This is consistent with the information that is viewed from the LCN.

Format descriptions

Using the UCN node number conventions described on the previous page, the alphanumeric display formats are described in the following table.

Table 65 Alphanumeric Display Formats

Condition	Format	Description
	Afnn	A = Alive f = actual physical position indicators (as "L" and "R" to indicate residency in a 7-Slot card file and "1" and "2" to indicate residency in the file-1 and file-2 15-Slot backpanels) nn = user configured decimal UCN node number (01-64)
		Indicates the successful Cold startup of the HPMM Communications processor. In this state the Communications processor loops indefinitely while performing background diagnostics and waiting for a UCN download to occur. The Control processor and I/O Link processor are held initialized. This display message blinks at a 1/2 second rate to indicate the Communications processor is still running.
Backup State	B nn	Indicates the personalities of the Communications, Control, and I/O Link processors have been loaded into the secondary HPMM, or the primary HPMM has successfully transitioned to the synchronized secondary status. This display does not blink.
Backup Soft Fail State	BSnn	Indicates that the HPMM has transitioned to the Backup Soft Fail state.

Condition	Format	Description
Fail State	Ffnn	Indicates that the HPMM has transitioned to the Fail state. If the Detailed-display switch is not engaged after a failure is noted, the display continues to blink showing the Ffnn. If the Detailed Display switch is engaged after a failure is noted, the display alternates between the Communications processor and Control processor crash code displays and the Fail state display as long as the failure condition permits the Communications processor to maintain the display.
		Refer to "Comm/Control Hard failure codes" subsection ("Fault Isolation" section) for descriptions of the Communications and Control processor Hard failure codes.
		Since the Communications and Control processor crash codes are not all unique to the processors, they are preceded by a flag in the display sequence (COMM/CTRL). For example, Fail state, COMM flag, Communications processor Hard failure code, CTRL flag, Control processor Hard failure code, blank, Fail state, --pattern repeats.
		Note that prior to successfully loading the HPMM, the Control processor is held initialized. Therefore, only the code for the Communications Hard failure code is significant. In this case the Control processor code would be null.
Idle State	Inn	Indicates that the HPMM personalities for the Communications, Control, and I/O Link processors have been loaded, and the HPMM has transitioned to the Idle state or has been placed in the idle state from the Universal Station display.
Idle Soft Fail State	ISnn	Indicates that the HPMM has transitioned to the Idle Soft Fail state.
Loading State	Lfnn	Indicates that the HPMM is currently in the process of down loading the HPMM personality from the LCN. This display blinks at a 1/2 second rate to indicate the Communications processor is still running.
Run State	OKnn	Indicates the HPMM has transitioned to the Run state and is the primary HPMM. This display does not blink.
Run Soft Fail State	SFnn	Indicates that the HPMM has transitioned to the Run Soft Fail State. This display does not blink.
Startup	STRT	Indicates that the HPM is performing its Cold or Ram Retention Startup processing. This generic message does not blink, and it is only available when the HPMM Diagnostic detailed-display mode (switch) is not enabled. Otherwise, (with the detailed display mode enabled) this display scrolls through the test sequence numbers (i.e. T xx) of the Cold or RAM Retention startup diagnostics.
Swap Primary	SWAP	This message is momentarily displayed by the primary HPMM while transitioning to secondary status. This generic message does not blink, and it is only available when the HPM alphanumeric detailed-display mode (switch) is not enabled. Otherwise (with the detailed-display enabled), this display scrolls through the test sequence numbers (i.e. Txx) of the RAM Retention startup diagnostics required to reach the Secondary status.
		Note that there is no visible delay while the secondary HPMM transitions to the primary status.
Synchronize Secondary	SYNC	This message is temporarily displayed by a Secondary HPMM while performing database synchronization with the Primary HPMM. It indicates that the Personalities of the High-Performance Comm/Control and High-Performance I/O Link cards have been loaded into the secondary HPMM or that a Primary HPMM has successfully transitioned to the non-synchronized Secondary status (See "B nn" above). This display does not blink.

Condition	Format	Description
Test Sequence Number	Txx	The display provides the hexadecimal test sequence number, "xx," which is performed during a HPMM Startup. The test sequence numbers are unique for both the Communications and Control processors. (See Table 4-1 for a complete list) The test sequence numbers are displayed only when the detailed-display mode (switch) has been previously enabled (since the last power cycle). Otherwise, the appropriate generic message is displayed (for example, STRT, Afnn, SWAP).

Format descriptions

Using the UCN node number conventions described earlier in this section, with TPN R684, the alphanumeric display formats for an EHPM are described in the following table.

Table 66 EHPM Alphanumeric Display Formats

Format	Description
STRT	Begin Communications processor firmware based tests.
	For an EHPM, depending on whether a BootP server is configured or not, the **STRT** text may show for a longer time period.
Afnn	A = Alive f = actual physical position indicators (as "L" and "R" to indicate residency in a 7-Slot card file and "1" and "2" to indicate residency in the file-1 and file-2 15-Slot backpanels) nn = user configured decimal UCN node number (01-64)
	Indicates the successful Cold startup of the HPMM Communications processor. In this state the Communications processor loops indefinitely while performing background diagnostics and waiting for a UCN download to occur. The Control processor and I/O Link processor are held initialized.
UCN	It is a text indication that the EHPM's UCN Node address is about to be displayed.
<this UCN node number>	The EHPM's UCN Node address which is configured from its HPM backplane switches.
INDX	The FTE device index. This indicates the value from the hardware's rotary switches.
<this FTE device index>	The EHPM's FTE Device Index value.
IP	Internet Protocol Address of the node. The last octet is set by the FTE device index.
<First IP address octet>	The first octet of the IP Address.
<Second IP address octet>	The second octet of the IP Address.
<Third IP address octet>	The third octet of the IP Address.
<Fourth IP address octet>	The fourth octet of the IP Address. Matches the FTE Device Index from the EHPM FTE Interface card's hardware rotary switches.

TIP

- The display message listed in the table above blinks at a 1/2 second rate to indicate the Communications processor is still running.

- During an HPM personality load for an EHPM node, the message continues to scroll and repeat. However, the **Afnn** will be replaced with **Lfnn** (L=Loading).

- While loading, the display changes to continuously flash **Lfnn**. It continues to flash **Lfnn** until the EHPM node is fully loaded.

Unsynchronized secondary HPMM

Note that a unsynchronized secondary HPMM displays **I nn** instead of **B nn** since this is a transitional state.

Notification Displays

In addition to the standard display formats, the alphanumeric display provides the user with special event notification. Notification messages blink at a 1/2 second rate.

Soft failure

Soft failure conditions which require more than a blinking Status LED are also conveyed through the Alphanumeric display as user notification messages.

Note that **any** Soft failure status is indicated by the blinking Status LED on the High-Performance Comm/Control card. This is true for the entire Process Manager family

Message descriptions

The notification messages are described in the following table.

Table 67 User Notification Message Formats

Message	Format	Description
Control Processor Failure	FCTL	Notifies the user that the Control processor has failed in a nonredundant HPMM configuration. Since this is considered a Soft failure condition, the High-Performance Communications/Control card's **Status** indicator blinks at a 1/2 second rate.
Factory Test	FTST	Notification that the Factory Test mode is enabled. At this point, a subset of startup diagnostics has been successfully completed, the Comm Console Emulator has been initialized, and the Communications processor lops indefinitely. The Control and I/O Link processors are held in the reset state. Note the LLC initialization does not occur when the Factory Test mode is enabled.
I/O Simulation Mode	SIML	Notifies the user that the Communications and Control processors are executing I/O simulation software. This display blinks at a 1/2 second rate.
UCN Token Holder Test	UTST	Notifies the user that the UCN Token Holder Test mode has been invoked through a backpanel jumper. (For factory use only.)

Cold HPMM Startup Display Sequences

Cold start scenarios

A cold HPMM Startup is done any time that power is applied to the HPMM card set and the contents of the HPMM memory is not valid. A Cold Startup is also performed when the **RECOVER** target on the HPM Status display is used to reset a Hard failure condition in the HPMM.

When an HPMM Cold Startup is performed, only the Communications processor is released from reset and it executes from the Startup and Base Utilities firmware. Therefore, the information displayed during startup reflects the Communications processor's powerup diagnostics, followed by the transition to the HPMM Alive state.

Startup sequence

An example of a (short) HPMM Startup display sequence is listed in
The following table for the Detailed Display mode and non-Detailed Display mode.

Table 68 Alphanumeric Display for a Normal Startup Sequence

Detailed Display	Non-Detailed Display	Description
STRT	STRT	Begin Communications processor firmware based tests.
T 0D	STRT	Global DRAM EDAC sweep
T 13	STRT	Global DRAM initialization
T 17	STRT	Comm Local RAM destructive pattern test
T 1B	STRT	Comm Local RAM initialization
T 21	STRT	UCN TBC Private RAM destructive pattern test
T 25	STRT	UCN TBC Private RAM Initialization
T 4F	STRT	Initialize the (FW resident) LLC Communications layer
A139	A139	Alive state (file 1, UCN node 39)

Startup/Factory Test mode sequence

If the Factory Test mode had been selected, the Startup sequence would end prior to LLC initialization as listed in the following table for the Detailed-display mode and non-Detailed Display mode.

Table 69 Alphanumeric Display for Startup/Factory Test Mode Sequence

Detailed Display	Non-Detailed Display	Description
STRT	STRT	Begin Communications processor firmware based tests.
T 0D	STRT	Global DRAM EDAC sweep
T 13	STRT	Global DRAM initialization
T 17	STRT	Comm Local RAM destructive pattern test
T 1B	STRT	Comm Local RAM initialization
T 21	STRT	UCN TBC Private RAM destructive pattern test
T 25	STRT	UCN TBC Private RAM Initialization
T 4C	STRT	Transition to the FW Alive state
AR00	AR00	Alive state (UCN node 00, Right file position)
FTST	FTST	Factor Test mode notification
AR00	AR00	Status is displayed for 1/2 second.
FTST	FTST	Notification is displayed for 1/2 second.

Startup/HPMM failure sequence

An HPMM failure occurs during or after a Startup results in alternating failure and Communications processor Hard failure code. This is dependent upon whether the Detailed Display mode (switch) is enabled. The description in the following table is an example of a sequence when a spurious interrupt failure occurs listing both the Detailed Display mode and non-Detailed Display mode.

Table 70 Alphanumeric Display for HPMM Cold Startup Failure Sequence

Detailed Display	Non-Detailed Display	Description
A239	A239	Alive state (file 2, UCN node 39)
F239	F239	Failure (file 2, UCN node 39)
COMM	F239	Flag – Communications processor failure code follows
0057	F239	Communications processor failure: bad or unexpected exception.
CTRL	F239	Flag – Control processor failure code follows.
NULL	F239	Control processor failure code. No failure reported (because Control processor was still being held in reset condition at this point).
The failure pattern repeats		
COMM	F239	Flag – Communications processor failure code follows.
. **.** **.**	F239	. . .

> **ℹ ATTENTION**
> The non-Detailed Display mode blinks at a 1/2 second rate when the failure is displayed.

HPMM Load display sequence

The HPMM remains in the Alive state until a UCN download is initiated at the Universal Station. Midway through the loading process, the Control processor is released from reset to perform its local Startup diagnostics. The loading then continues by using the Communications processor.

Alphanumeric display sequence for HPMM load

An example of the Alphanumeric display sequence during the personality download process is listed in the following table for the Detailed Display mode and non-Detailed Display mode.

Table 71 Alphanumeric Display for Load Sequence

Detailed Display	Non-Detailed Display	Description
AR07	AR07	In the Alive state (right file, UCN node 7).
LR07 **.** **.** **.**	LR07 . . .	Start the Communications processor's personality image download. Display blinks at 1/2 second rate.
LR07	LR07	Complete Communications processor personality image download.

Detailed Display	Non-Detailed Display	Description
T 5B	LR07	Initialize the (SW resident) LLC Communications layer.
LR07 **.** **.** **LR07**	LR07 . . LR07	Start Control processor personality image download. Continue with Control processor personality download.
T 5E	LR07	Monitor Control processor local State Change (i.e. release Control processor from the reset state).
T 70	LR07	Control processor Local RAM destructive pattern test.
T 98	LR07	Control processor transition to the SW Alive state.
LR07 **.** **.** **.** **LR07**	LR07 . . . LR07	Continue with the Control processor personality image download (i.e. Control Local RAM portion). Complete the Control processor personality image download.
T A5	LR07	I/O Link RAM destructive pattern test.
T B4	LR07	Transition I/O Link processor to Idle state.
T FB	LR07	Backup Local RAM into Global RAM.
T FE	LR07	Transition to MTOS.
I 07	I 07	HPMM download is completed. This is the HPMM idle state. (The Idle state display does not blink.)

ATTENTION

- The **Lxxx** message blinks at a 1/2 second rate.
- During an HPM personality load for an EHPM node, the message continues to scroll and repeat. However, the **Afnn** is replaced with **Lfnn**. After loading halfway (approximately 2.5 minutes), the display changes to constantly flash **Lfnn** instead of scrolling the original detailed information. It continues to flash **Lfnn** until the EHPM node is fully loaded.

Nonredundant HPM Failure Sequences (After Load)

Comm or I/O Link processor failure (nonredundant HPMM)

A Communications or I/O Link processor failure of a nonredundant HPMM (after transitioning to the Idle or Run state) results in a blinking Fxxx indication. It enables the detailed display mode using the Detailed Display switch results in a sequenced Fail/Comm error/Control error display.
The following table lists the display sequence for both the Detailed Display and non-Detailed Display modes.

Table 72 Communications/I/O Link Processor Failure Display Sequence

Detailed Display	Non-Detailed Display	Description

OK39	OK39	In the Run state (UCN node 39). This display does not blink.
F239	F239	Fail (UCN node 39, file position 2) The Non-detailed failure display blinks at a 1/2 second rate.
COMM	F239	Flag – Communications processor failure follows.
0010	F239	Communications processor failure: Local RAM parity error.
CTRL	F239	Flag – Control processor error code follows.
FFF3	F239	Control processor failure code: No response from Communications processor.
	F239	Failure display repeats
F239	F239	Fail (UCN node 39, file position 2)
COMM	F239	Flag – Communications processor failure follows.

Control processor failure (nonredundant HPM)

A Control processor failure of a nonredundant HPM (after transitioning to the Idle or Run state) results in a sequencing display of **IDLE** or **OK** alternating with FCTL. If the Detailed Display mode (switch) is enabled, a failure code is displayed in the sequence. The following table lists the sequences.

Table 73 Control Processor Failure Display Sequence

Detailed Display	Non-Detailed Display	Description
OK39	OK39	In the Run state (UCN node 39). This display does not blink.
SF39	SF39	Run Soft Fail state. (UCN node 39)
COMM	FCTL	Flag – Communications processor failure code follows.
NULL	SF39	Communications processor failure. No failure reported.
CTRL	FCTL	Flag – Control processor failure code follows.
004E	SF39	Control processor failure code: No response from Communications processor
blank	FCTL	
Detailed Display error sequence repeats		
SF39	SF39	Run Soft Fail state. (UCN node 39)
COMM	FCTL	FLag -- Communications processor failure code follows.

HPMM RAM Retention Startup Sequence

An HPMM RAM Retention startup is performed whenever power is restored and the CMOS memory battery backup was successful in maintaining the integrity of the operating personality software and database in the RAM memory.

When an HPMM RAM Retention Startup process is performed, only the Communications processor is initially released from reset and executes from the Startup and Base Utility firmware. Once a RAM Retention Startup is considered possible, program execute control is transferred to the previously loaded Communications processor software image. The Control processor and I/O Link processors are then released so that they can verify their respective Startup conditions. The following table lists a HPMM RAM Retention startup to Run state.

> **ATTENTION**
>
> Due to security authentication in the EUCN network, at least one ENIM must be up and running in order for an EHPM node to be able to perform a RAM Retention startup. The EHPM is re-authenticated during a RAM retention restart, and the ENIM is the master authenticator node.

> **ATTENTION**
>
> Due to the processor restart time of the EHPM, the RAM Retention response time for the EHPM is slightly longer than that of a HPM.

Table 74 RAM Retention Startup Display Sequence

Detailed Display	Non-Detailed Display	Description
OK39	OK39	In the Run state (UCN node 39). This display does not blink.
STRT	STRT	Communications processor based tests
T 0D	STRT	Global DRAM EDAC sweep
T 13	STRT	Global DRAM initialization
T 17	STRT	Communications processor Local RAM destructive pattern test
T 1B	STRT	Communications processor Local RAM initialization
T 21	STRT	UCN TBC Private RAM destructive pattern test
T 25	STRT	UCN TBC Private RAM initialization
T 3E	STRT	Communications processor builds memory reference table.
T 59	STRT	Transition to the SW Alive state.
T 5E	STRT	Monitor Control processor local state change (i.e release Control processor from reset state)
T 70	STRT	Control processor Local RAM destructive pattern test
T 76	STRT	Control processor Local RAM initialization

Detailed Display	Non-Detailed Display	Description
T 8E	STRT	Control processor builds memory reference table
T A5	STRT	I/O Link RAM destructive pattern test
T B4	STRT	Transition I/O Link processor to the Idle state.
T FE	STRT	Transition to MTOS
OK39	OK39	Run state (UCN node 39)

HPMM Redundancy Display Sequences

Each redundant HPMM partner conforms to the Startup sequences as described earlier in this section. In addition, upon receiving a Swap command, the primary HPMM temporarily displays the **SWAP** text while transitioning to a secondary status. However, there is no visible delay while the secondary HPMM transitions to a primary status. An example of the this sequence is given in the table below.

SWAP sequence (Detailed Display mode)

An example of a display sequence during the HPMM swapping process with the Detailed Display mode enabled is listed in the following figure for HPMM 1 and HPMM 2.

Table 75 Alphanumeric Display for HPMM Swapping Sequence (Detailed Display Mode)

HPMM 1	HPMM 2	Description
OK39	B 40	Run state (UCN node 39 = primary/UCN node 40 = Backup)
SWAP	**OK39**	HPMM swap command received
T 17	OK39	Communications processor Local RAM destructive pattern test
T 1B	**OK39**	Communications processor Local RAM initialization
T 21	OK39	UCN TBC Private RAM destructive pattern test
T 25	**OK39**	UCN TBC Private RAM initialization
T 3E	OK39	Communications processor builds memory reference table.
T 59	**OK39**	Transition to the SW Alive state.
T 5E	OK39	Monitor Control processor local state change (i.e release Control processor from reset state).
T 70	**OK39**	Control processor Local RAM destructive pattern test.
T 76	OK39	Control processor Local RAM initialization.
T 8E	**OK39**	Control processor builds memory reference table.
T A5	OK39	I/O Link RAM destructive pattern test.
T B4	OK39	Transition I/O Link processor to the Idle state.
T FE	OK39	Transition to MTOS.
SYNC	**OK39**	Secondary HPMM performing database synchronization.
B 40	**OK39**	HPMM swap complete.

SWAP sequence (non- Detailed-Display mode)

If the Detailed Display mode is not enabled, then the swap sequence described on the previous page would not display any of the test sequence numbers as listed in the following table for HPMM 1 and HPMM 2.

Table 76 Alphanumeric Display for HPMM Swapping Sequence (Non-Detailed Display Mode)

HPMM 1	HPMM 2	Description
OK39	B 40	Run state (UCN node 39).
SWAP	**OK39**	HPMM swap command received.
SWAP **SWAP**	**OK39** **OK39**	HPMM 1 begins RAM Retention startup diagnostics. HPMM 1 completes RAM Retention startup diagnostics.
SYNC	**OK39**	Secondary HPMM performs database synchronization
B 40	**OK39**	HPMM swap complete.

HPMM failover

In the event of an HPMM failover, the primary HPMM transitions to the Fail state and the secondary HPMM becomes the primary.

Failover sequence (Detailed Display mode)

An example of a display sequence for a failover when a RAM parity error occurs with the Detailed Display mode enabled is listed in the following table for HPMM 1 and HPMM 2.

Table 77 Alphanumeric Display for Failover HPMM Swapping Sequence (Detailed Display Mode)

HPMM 1	HPMM 2	Description
OK39	B 40	Run state (UCN node 39)
F139	OK39	HPMM 1 failure
COMM	OK39	Flag -- Communications processor Hard failure code is next
0010	OK39	HPMM 1 Communications processor failure: Local RAM parity error
CTRL	OK39	Flag -- Control processor Hard failure code is next
FFF3	OK39	HPMM (file 1) Control processor failure: No response from Communications processor.
Blank	OK39	
F139	OK39	HPMM 1 failure
COMM	OK39	Flag -- processor Hard failure code is next
0010	OK39	HPMM 1 Communications processor failure: Local RAM parity error
CTRL	OK39	Flag -- Control processor Hard failure code is next
FFF3	OK39	HPMM (file 1) Control processor failure: No response from Communications processor
The above failure pattern repeats indefinitely or until the Detailed-display mode is disabled.		

Failover display sequence (non- Detailed Display mode)

An example of a display sequence for a failover when a RAM parity error occurs with the Detailed Display mode not invoked is listed in the following table for HPMM 1 and HPMM 2.

Table 78 Alphanumeric Display for Failover HPMM Swapping Sequence (Non-Detailed Display Mode)

HPMM 1	HPMM 2	Description
OK39	B 40	Run state (UCN node 39)
F139	OK39	HPMM 1 failure
blank		
F139	OK39	HPMM 1 failure
blank		
The failure pattern repeats and blinks (F139, blank, F139, blank, - - -.)		

HPMM Alphanumeric Display Blanking

The HPMM's Communications processor is the designated owner of the Alphanumeric display and is responsible for maintaining the display with current information. In the event of a Communications processor failure, it is undesirable for the alphanumeric display to latch erroneous information. To prevent this situation from occurring, the alphanumeric display is blanked by the hardware if the Communications processor Watch Dog Timer (WDT) times out. This covers any ungraceful Communications processor failures scenarios.

It is possible to override the alphanumeric display blanking by pressing and holding the Detailed Display switch on the High-Performance Comm/Control card. The information gained by doing this cannot be guaranteed to be correct or meaningful.

Control processor WDT timeout

In the event of a HPMM Control processor Watch Dog Timer (WDT) timeout, the operation of the alphanumeric display is unaffected except that the Communications processor displays the appropriate failure information to indicate that the Control processor's WDT has timed out.

HPMM Diagnostic Tests List

Test List

The following table lists all of the existing HPMM diagnostic tests. They are listed in step number order. These diagnostic tests are not necessarily executed in sequential order. The sequences were defined earlier in this section.

Table 79 HPMM Diagnostic Test List

Sequence Number	Label	Description
00	None	Null sequence number
01		Spare
02	CMF_ROMTST	ROM checksum validation
03		Spare
04		Spare
05	CMF_CPUTST	CPU Register test
06		Spare
07	CMF_QKDRAM	Quick DRAM accessibility test
08		Spare
09	CMF_GRMSYS	Initialize system portion of Global DRAM
0A		Spare
0B	CMF_ASICREG	ASIC Register accessibility test
0C		Spare
0D	CMF_GRMPAR	Global DRAM EDAC sweep
0E		Spare
0F	CMF_GRMDRT	Global DRAM destructive pattern test
10		Spare
11	CMF_GRM_BWL	Global DRAM B/W/L decode test
12		Spare
13	CMF_GRMCLRR	Global DRAM initialization
14		Spare
15	CMF_GRMPCHK	Global DRAM EDAC circuitry test
16		Spare
17	CMF_LRMDRT	Local SRAM destructive pattern test
18		Spare
19	CMF_LRM_BWL	Local SRAM B/W/L decode test
1 A		Spare
1 B	CMF_LRMCLRR	Local SRAM initialization
1 C		Spare
1 D	CMF_LRMPCHK	Local SRAM parity circuitry test
1 E		Spare
1 F	CMF_PRMPCHK	UCN TBC Private SRAM parity circuitry test
20		Spare
21	CMF_PRMDRT	UCN TBC Private SRAM destructive pattern test

Sequence Number	Label	Description
22		Spare
23	CMF_PRM_BW	UCN TBC Private SRAM B/W decode test
24		Spare
25	CMF_PRMCLRR	UCN TBC Private SRAM initialization
26		Spare
27		Spare
28	CMF_BLDVECT	Build Exception Vector table
29		Spare
2A	CMF_BLDMRF	Build Memory Reference table
2B		Spare
2C		Spare
2D		Spare
2E		Spare
2F		Spare
30		Spare
31	CMF_TIMER	Timer comparison test
32		Spare
33		Spare
34	CMF_GETSLOT	Get Slot address and verify odd parity
35	CMF_GETFILE	Get File address and verify odd parity
36	CMF_GETUCN	Get UCN address and verify odd parity
37		Spare
38		Spare
39	CMF_EEPRMC	COMM/CTRL Serial EEPROM access test
3A		Spare
3B	CMF_EEPRMU	UCN I/F Serial EEPROM access test
3C		Spare
3D		Spare
3E	CMF_FV_EXC	Force and verify Exception test
3F		Spare
40		Spare
41	CMF_COLD	HPM COLD startup
42		Spare
43	CMF_WARM	HPM RAM retention startup
44		Spare
45		Spare
46	CMF_RBLDVEC	Rebuild Exception Vector table
47		Spare
48		Spare
49	CMF_CEINIT	FW Console Emulator initialization
4A	CMF_PRCTYPE	Verify correct processor type

Sequence Number	Label	Description
4B		Spare
4C	CMF_ALIVE	Transitions to the (FW) Alive state
4D		Spare
4E		Spare
4F	CMF_LLCINIT	Initialize the LLC UCN layer
50	CMS_BLDEXC	Build Exception Vector table
51		Spare
52		Spare
53	CMS_CEINIT	SW Console Emulator initialization
54		Spare
55		Spare
56	CMS_FLASHRW	Build Exception Vector table
57		Spare
58		Spare
59	CMS_ALIVE	Transitions to the (SW) Alive state
5A		Spare
5B	CMS_LLCINIT	Initialize the LLC UCN layer
5C		Spare
5D		Spare
5E	CMS_MON_CTL	Monitor Control Local state change
5F		Spare
60		Spare
61	CTS_CPUTST	CPU Register test
62		Spare
63		Spare
64	CTS_QKDRAM	Quick DRAM accessibility test
65		Spare
66		Spare
67	CTS_GRMSYS	Initialize system portion of Global DRAM
68		Spare
69		Spare
6A	CTS_ASICREG	ASIC Register accessibility test
6B		Spare
6C		Spare
6D	CTS_GRMPCHK	Global DRAM EDAC circuitry test
6E		Spare
6F		Spare
70	CTS_LRMDRT	Local SRAM destructive pattern test
71		Spare
72		Spare
73	CTS_LRM_BWL	Local SRAM B/W/L decode test

Sequence Number	Label	Description
74		Spare
75		Spare
76	CTS_LRMCLRR	Local SRAM initialization
77		Spare
78		Spare
79	CTS_LRMPCHK	Local SRAM parity circuitry test
7A		Spare
7B		Spare
7C	CTS_BLDVECT	Build Exception Vector table
7D		Spare
7E		Spare
7F		Spare
80		Spare
81		Spare
82	CTS_BLDDMRF	Build Memory Reference table
83		Spare
84		Spare
85	CTS_TIMER	Timer comparison test
86		Spare
87		Spare
88	CTS_TRKRAM	Tracking Mechanism test
89		Spare
8A		Spare
8B	CTS_CEINIT	Console Emulator initialization
8C		Spare
8D	CTS_FV_EXC	Force and verify Exception test
8E		Spare
8F	CTS_PRCTYPE	Verify correct processor type
90		Spare
91		Spare
92	CTS_COLD	HPM COLD startup
93		Spare
94		Spare
95	CTS_WARM	HPM RAM Retention startup
96		Spare
97		Spare
98	CTS_ALIVE	Transitions to the (SW) Alive state
99		Spare
9A		Spare
9B	CTS_LR_BKUP	Backup the Local RAM to Global RAM
9C		Spare

Sequence Number	Label	Description
9D		Spare
9E	CTS_MTOS	Transitioning to MTOS
9F to A1		Spare
A2	CMS_PRGFLASH	Program the Flash ROM
A3		Spare
A4		Spare
A5	CMS_I OLD RT	I/O Link SRAM destructive pattern test
A6		Spare
A7	CMS_IOL_BWL	I/O Link SRAM B/W/L decode test
A8		Spare
A9	CMS_IOLCLRR	I/O Link SRAM initialization
AA		Spare
AB	CMS_IOLPCHK	I/O Link SRAM parity circuitry test
AC		Spare
AD	CMS_GB_PCHK	Global Bus parity circuitry test
AE		Spare
AF	CMS_EEPRMI	I/O Link Serial EEPROM access test
B0		Spare
B1		Spare
B2	CMS_IOL1 RST	Release I/O Link #1 from reset
B3		Spare
B4	CMS_IOL1 IDL	Transition I/O Link #1 to IDLE
B5		Spare
B6		Spare
B7	CMS_IOL1 RUN	Transition I/O Link #1 to RUN
B8		Spare
B9	CMS_IOL2RST	Release I/O Link #2 from reset
BA		Spare
BB	CMS_IOL2IDL	Transition I/O Link #2 to IDLE
BC		Spare
BD	CMS_IOL2RUN	Transition I/O Link #2 to RUN
BE to FA		Spare
FB	CMS_LR_BKUP	Backup the Local RAM to Global RAM
FC		Spare
FD		Spare
FE	CMS_MTOS	Transitioning to MTOS
FF		Spare

4.10 HPM Alternate Private Path

Overview

This maintenance procedure allows the redundant operation of the HPM to be restored after the failure of certain Private Path interface components in a primary HPM Comm/Control card.

Background

HPM Private Path failures can occur where the secondary HPMM fails, but the primary HPMM has the failed hardware. The failure itself does not interrupt control, but redundant HPMM operation cannot be restored until the primary HPMM is repaired, requiring control to be shut down.

When the Private Path fails and the software cannot determine which HPMM controller contains the defective hardware, the software will fail the secondary HPMM controller. This assumption minimizes the probability that control will be lost. If the software were to fail over, there would be no way to fail back should the secondary HPMM be unable to assume control.

If the defective hardware is in the primary HPMM, the standard Private Path cannot be used to restore redundant HPMM operation unless control is shut down and the primary HPMM controller is replaced.

The HPM has an Alternate Private Path. The Alternate Private Path contains an independent set of interface drivers and receivers that can be used to restore redundant HPMM operation should the standard Private Path drivers or receivers fail. The Alternate Private Path is intended for temporary use only. It is not mechanically robust enough for continuous use.

When to use the procedure

This procedure should be used only when the all of the following conditions are true.

- A failure has been reported for the secondary HPM Comm/Control card of a redundant HPMM pair with the failure code indicating a Private Path failure.

- After replacing the secondary HPM Comm/Control card and the backpanel redundancy cable, the secondary HPMM loads without error but will not synchronize with the primary HPMM.

- The Primary HPMM is still controlling the process.

When these conditions exist, it is reasonable to assume that the secondary HPMM is functional and that the primary HPM Comm/Control card's Private Path interface circuits have been damaged.

Equipment and Revision Requirements

This procedure requires access to service areas in both HPMM controllers..

> **ESD HAZARD**
>
> ESD precautions, particularly the use of wrist straps, are required to avoid loss of control and/or equipment damage

The Alternate Private Path will be functional only if the following two hardware requirements are met.

- Both HPM COMM/Control cards must be at hardware revision G, or a later revision.

- The Redundancy cable used for the alternate connection must be Honeywell part number 51201667-100 or –200 at revision B, or later revision.

The Alternate Private Path is operational with any present R500 software release. A future software release will indicate a soft failure to confirm that the alternate path is connected.

HPPM Redundancy Restoration Procedure

> **CAUTION** This procedure requires access to the Debug ports on both HPM Comm/Control cards. These are service areas, and precautions against ESD damage must be observed. "ESD Guidelines for HPMM and IOP Cards" subsection ("Removal and Replacement" section) describes the use of an ESD wriststrap and provides detailed instructions for the removal and replacement of HPM components. Failure to observe these precautions can result in loss of control and/or damage to HPM hardware.

If the inability to resynchronize the HPMM controllers is caused by damaged interface drivers or receivers in the primary HPMM controller, and if there are no other hardware failures, the procedure in the following table will restore redundancy operation. The order of these steps is critical. If any step fails, do **NOT** proceed any farther.

Step	Action
1	Verify that the hardware revision of both HPM Comm/Control cards is revision G or a later revision and that a redundancy cable at revision B or a later revision is available for the Alternate Private Path connections. The revision of the board is not normally visible with the card installed, but can be verified on the Manufacturing Information display at a Universal Station (US), Universal Station^X (U^{X}S), or Global User Station (GUS).
2	Place the secondary HPMM in the Alive state. It must NOT be loaded before connecting the Alternate Private Path.
3	Slip on an ESD wriststrap and connect it the cabinet's AC Safety Ground bus that is shown in Figure 199. The wriststrap is required up to and including Step 15 in this procedure.
4	Open the Debug Panel doors at the front of both HPM Comm/Control cards. The doors are located just below the Power and Status LEDs and are opened by pulling the top edge of the door toward you. The door will drop down and reveal the 25-pin Debug connector.
5	If there are protective boots on the Debug connectors, remove and save them.

Step	Action
6	Connect a standard Redundancy cable (Honeywell part number 51201667-100 or -200, revision B) between the Debug ports of the two HPM Comm/Control cards. To minimize the probability of disturbing other cabling, it is preferable not to disconnect the backpanel Redundancy cable for this procedure; however, the backpanel cable can be used if it is the only revision B cable available. The connectors will fit, but the latches on the cable will not engage. This is normal.
7	It is planned that a future software release will detect the presence of the Alternate Private Path connection and indicate a soft failure. If this feature is implemented, each card will indicate a soft failure code of 50 ("ALT REDUN CABLE APPLIED" on a US, U^{X}S, or GUS display, or "SF50" on the HPM Comm/Control card's Alphanumeric display) as soon as the cable is connected. This is expected. See Note 1.
8	Load the secondary HPMM from a US, U^{X}S, or GUS, and wait for it to synchronize. When the operation has completed successfully, the secondary HPMM status should display BKUP.
9	From the US, U^{X}S, or GUS, command a swap. Do NOT power down the primary HPMM.
10	Wait for the two HPMMs to resynchronize (about 6 seconds).
11	From the US, U^{X}S, or GUS, command the defective HPMM (now operating as secondary HPMM) to shut down.
12	Remove the cable between the two Debug ports and reinstall the protective boots, if any.
13	Close both Debug Panel doors.
14	Verify that the standard redundancy cable is properly connected to both HPMM backpanels.
15	Replace the defective HPM Comm/Control card by using the procedure in subsection "HPMM and IOP Cards" ("Removal and Replacement" section).
16	From the US, U^{X}S, or GUS, load the HPMM in which the Comm/Control card was replaced. There should be no soft failure indication for either HPMM controller.
17	Wait for the repaired HPMM to synchronize. At this point, normal HPMM redundancy operation is restored.

Note 1

The soft failure indication does not appear with the currently released version of the software, but the Alternate Private Path will work correctly. If future releases check for the presence of the Alternate Path connection, the soft failure will only appear if both the HPM COMM/Control card and Debug cable revisions support the Alternate Private Path. This indication serves several purposes.

- The soft failure provides conformation, both on the local Alphanumeric display and the console that the board has recognized the connection of the cable and has switched the Alternate Private Path.

- If the software checks for the Alternate Private Path connection, the absence of a soft failure alerts the technician to verify the revision of the HPM COMM/Control card and the Redundancy cable.

- If someone attaches the Alternate Private Path cable to the normally operating HPMM controller, the action will be journalized.

4.11 I/O Card Indicators

Loss of Power

CAUTION	Loss of power detected by an Analog Output IOP card causes all of the channels of an Analog Output IOP to drop to a nonpowered state and all channels of a Digital Output IOP to set its outputs to off. Refer to "Removal and Replacement" section regarding use of a Standby Manual device to maintain process point output values.

A Journal output status of **NORESP** may indicate this detected loss of power. Check the outputs and the mode of the related control points should this occur.

Overview

When power is first applied to any IOP or I/O Link Extender card, check the **Power** and **Status** indicators. The **Power** indicator is illuminated whenever dc power is applied. After a few seconds, the **Status** indicator should be illuminated in a steady state.

Indicator functionality

The following table describes the function of the **Power** and **Status** indicators on IOP and I/O Link Extender cards. The functionality of the **Status** indicator on IOPs with model numbers that have a "Y" in the model number, such as MU-PAOY22, have additional functionality which is described in Table 79 HPMM Diagnostic Test List. The function of the Power indicator is the same for all IOPs.

Table 80 IOP Card Indicators

Card Type	Indicator	Functionality
IOP	Power Status	Power is applied to the card. If the indicator is extinguished, check the Power System, the power cable to the card file, and the fuse on the backpanel. If the LED blinks once a second, a Soft failure has occurred. If the LED remains off, a Hard failure has occurred.
I/O Link Extender	Power Status	Power is applied to the card. If the indicator is extinguished, check the Power System, the power cable to the card file, and the fuse on the backpanel. Flickers when data is being transmitted. If the LED blinks at a one second rate, an Optic Coupler module is disconnected.

Multifunctional Status indicator

The **Status** indicator on an IOP with model number that has a "Y" in the model number, such as MU-PAO<u>Y</u>22, has functionality beyond the description in Table 80 IOP Card Indicators. One of two colors is normally displayed. A third color, red, is abnormal and would be an LED failure. Table 81 IOP Multicolor Status Indicator defines the colors.

Table 81 IOP Multicolor Status Indicator

Color	Status
Green	The IOP is assigned primary status.
Orange	The IOP is assigned backup status. Occurs in redundant IOP configurations.

4.12 FTA Indicators

Introduction

FTA indicators provide functional status information. The number of indicators and their purpose varies with the type of FTA.

FTA indicator functions

The following table describes the function of the various indicators on the FTAs and associated assemblies.

Table 82 FTA Indicators

Card Type	Indicator	Functionality
Power Adapter	Cable Fault	The red LED indicates a grounded or shorted cable when lit. There is one indicator for each cable.
LLMux/RHMUX	Power	Indicates that power is present on the FTA.
Analog Input	Power Calibration	Indicates that power is present. Extinguishes for approximately 15 seconds during a calibration cycle.
Redundant Analog Output	Switch Position	Lit when IOP A is active and not lit when IOP B is active or either IOP is not active. Cable A and IOP A can be replaced when the LED is not lit, and Cable B and IOP B can be replaced when the LED is lit.
Redundant HLAI	IOP Availability	When lit, the A IOP is the primary or available to be the primary. When not lit, the A IOP is not available to be the primary.
Serial Device Interface	Power Status	Indicates that power is present on the FTA. One of the following indicator conditions exists. Not lit: The FTA self-test failed. Slow blink: A communication error between the FTA and (Symmetrical 1 sec. blink) the IOP/HPMM was detected. Fast blink: A communication error between the device (Symmetrical .5 sec. blink) and the FTA was detected. Constantly lit: The FTA self-test was successful and the FTA is fully operational.

Card Type	Indicator	Functionality
Serial Interface	Power Status	Indicates that power is present on the FTA. One of the following indicator status conditions exists. The conditions are listed in the order of importance. Not lit: This condition exists only when the FTA is in a Hard failure state. Slow blink: This condition indicates that the FTA has not (Symmetrical 1 sec. blink) received a Time Out Gate (TOG) refresh from the SI IOP within 10 seconds. Fast blink: This condition indicates that one or more Array (Symmetrical .5 sec. blink) Points configured for this FTA have a communications error. Odd blink: This condition indicates that one or more Array (Asymmetrical 1/.25 sec. blink) Points configured for this FTA have an error in the Array Point configuration error category. The IOP/HPMM is not configured or configured improperly. Constantly lit: This condition indicates that no errors exist in the FTA. Due to the long ACK/Message timeout time and the required three tries, the FTA may indicate a TOG timeout if the CIM is responding with an ACK to the FTA requests, or if the destination PLC device is not responding to the requests. Additional troubleshooting information can be found in the *Serial Interface Options* manual.

4.13 Power System Indicators

Standard Power System

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Examine the **DC Out**, **Battery**, **Fan/Temp**, **AC In**, and **Charging** indicators for each Standard Power Supply module. The Standard Power System cover, illustrated by the following figure, identifies the LED indicators. If the Power system is fully functional, all five of the indicators are Illuminated.

Figure 186 Standard Power System Indicators
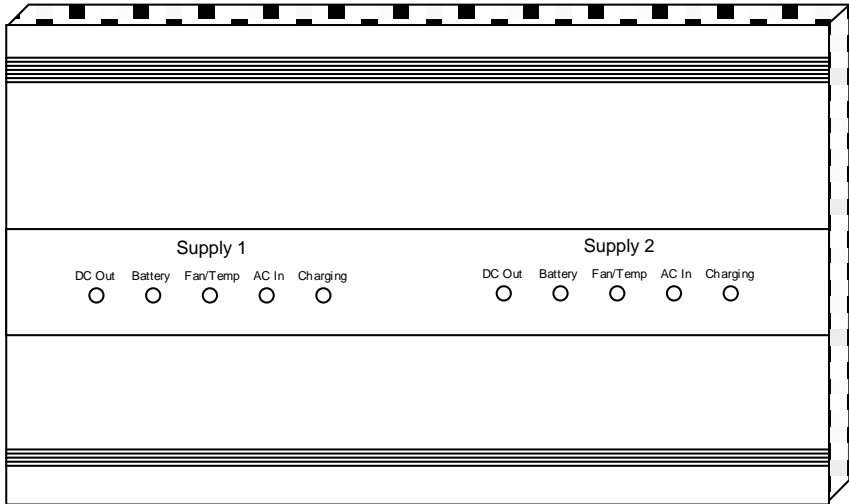
DC Out indicator

If a **DC Out** LED is off, ac line power has been lost (check the **AC In** LED) or the Power Supply Module has failed. If the Power System is nonredundant, or if both **DC Out** LEDs are off, the HPM has lost 24 Vdc. The CMOS backup system maintains power to the CMOS memory, so subsystem programs are not lost. See the **Battery** LED description below. A set of annunciator contacts, which are illustrated in Figure 187, open when these conditions occur.

Battery indicator

If the **Battery** LED is off and the **Charge** LED is on, the **48 Volt Battery** switch is in the off position or the 48 V Battery Backup system has failed. A set of annunciator contacts, which are illustrated in Figure 187, open when these conditions occur. If the Power System does not have the battery pack option, the **Battery** LED will normally be on, and the **Charge** LED will normally be on.

Fan/Temp indicator

If the **Fan/Temp** LED is off, the fan in the Power Supply Module has failed or the temperature of the HPM has exceeded a safe value. An annunciator contact, discussed below, is activated by any of the five conditions described below.

AC In indicator

If the **AC In** LED is off, ac power to the HPM has been lost or the switch on the Power Supply Module is off. Backup systems, if operating, are maintaining the unit. Check the **DC Out** and **Battery** indicators to determine the state of the system. Some installations may have the Power Supply Modules connected to the separate ac power sources to minimize outage caused by a power loss. Annunciator contacts, illustrated in Figure 187, signifying power loss from either supply, are activated independently.

Charging indicator

When the **Charging** LED is off, the charging circuit that maintains the optional 48 V Battery Backup system has failed. Check the batteries, their corresponding connections, and the charging circuits in the Power Supply Module (s). An annunciator contact output, illustrated in Figure 187, is activated by this condition.

Alarms

The primary Power Supply Module alarm and secondary Power Supply Module alarm contacts monitor five functions within each Power Supply Module. They will open if:

- The dc output voltage is not within normal limits.

- AC input power to the supply has failed.

- The Power Supply Module electronics have overheated or the Power Supply Module fan has failed.

- The 48 V backup battery system has failed because the batteries have discharged or they have been disconnected.

- The battery charger in the Power Supply Module has failed.

Three annunciator contacts are shown in the following figure. These contacts are normally wired in series by the user as illustrated.

Figure 187 Standard Power System Annunciator Contact Connections
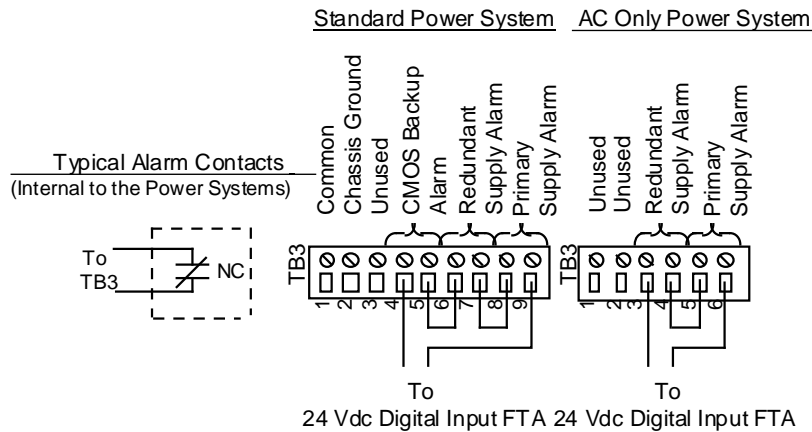
CMOS alarm

The CMOS Backup Alarm contacts open if the CMOS backup batteries have been removed or the batteries have been degraded to where the CMOS charging and monitoring circuit has determined they should be replaced.

Component replacement

Power System component replacement is discussed in the "Removal and Replacement" section.

AC Only Power System

Introduction

There are two LED indicators on the AC Only Power System and no test points. The two green LED indicators are located on the AC/DC Distribution assembly and provide a visual indication of the primary and redundant Power Supply Modules' operational status. When the LED is illuminated, its associated Power Supply Module is functional. The locations of the indicators are illustrated in Figure 184.

CMOS batteries

The three alkaline batteries on the AC/DC Distribution Assembly provide backup power for the CMOS Memory in the HPMM. They are not rechargeable and must be replaced periodically. The period should not exceed 6 months, provided there is no sustained loss of power to the CMOS Memory. If there is, replace the batteries after dc power is restored to the HPM.

Alarm Annunciator contacts

Connection points for two sets of annunciator contacts that signal the status of the primary and redundant Power Supply Modules are provided by terminals on TH3. See Figure 188. Terminals 3 and 4 are connection points for the secondary Power Supply module. The annunciator contact connection terminals are normally wired in series to a monitoring 24 Vdc Digital Input FTA.

4.14 Power System Voltage Checks

Introduction

ATTENTION

Redundant power cables normally provide power to a card file or Power Distribution Assembly, so a single power cable can be disconnected for voltage measurements at the Power System connector without affecting the performance of the equipment. However, sometimes an insufficient number of Power System connectors are available and only a single cable provides power to the card file or Power Distribution Assembly.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Before disconnecting a power cable for voltage measurements, be sure power to a card file or Power Distribution Assembly will not be interrupted.

Standard Power System

Voltage test points

Refer to the following figures for identification of the voltage points listed in the following table.

Table 83 Standard Power System Voltage Test Points

Voltage Test Point	Acceptable Range	Corrective Action
AC Input **120 Vac or 240 Vac**	100 to 264 Vac	Check ac power source.

Power Supply Module
Common
DC Out
    PSM (25.5 Vdc)
    Battery Power (54.5 Vdc)
AC Out (6 Vac for clock)
	None
	24 to 26 Vdc
	54 to 55.2 Vdc
	4.8 to 7.2 Vdc
		Common reference
		Replace Power Supply Module.
		Replace Battery Pack or Power Supply Module.
		Replace primary (left) Power Supply Module.

CMOS Battery Backup **NiCad Battery (Set of 3)**	1.2 - 1.6 Vdc (across 1 battery) 3.6 - 4.8 Vdc (across 3 batteries)	Replace NiCad batteries.

Figure 188 Power System Power Output Connector Pin Assignments

Figure 189 Power Supply Module Test Points and Indicators
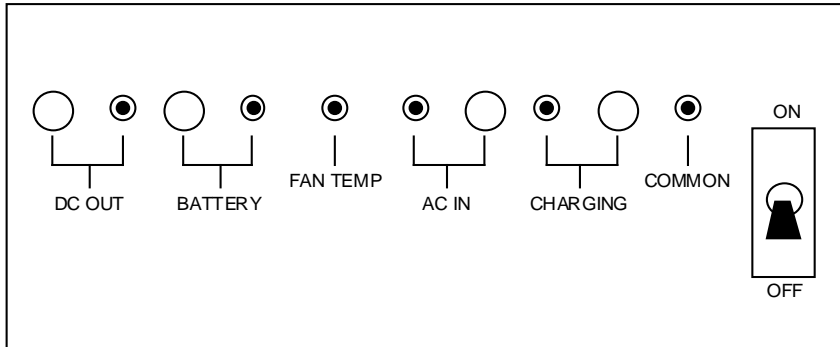
Figure 190 Power System AC Wiring
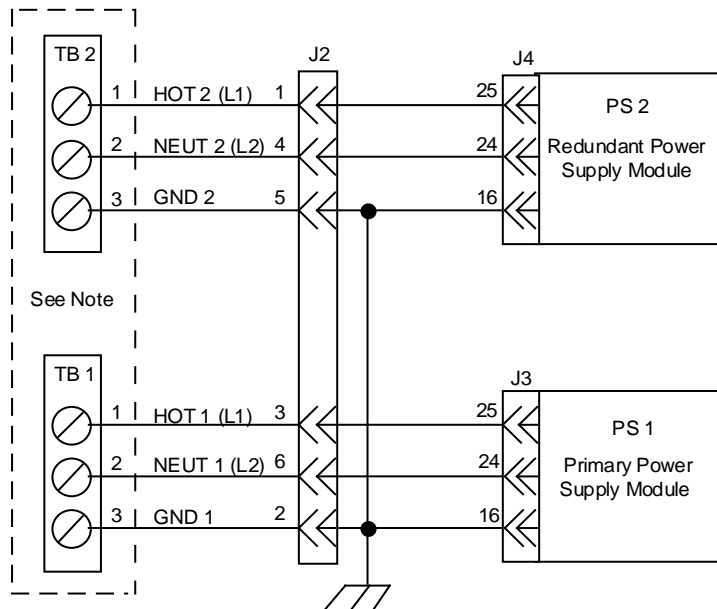
Note:

Terminal strips TB1 and TB2 are located on the backplane in the Standard Power System. The terminal strips are located on the AC/DC Distribution Assembly in the AC Only Power System.
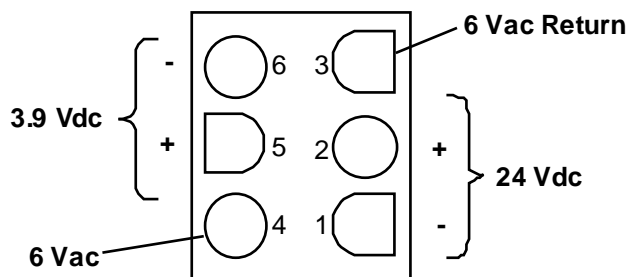
6643

AC Only Power System

Voltage test points

Refer to Figure 188 for identification the voltage points listed in the following table.

Table 84 AC Only Power System Voltage Test Points

Voltage Test Point	Acceptable Range	Corrective Action
AC Input **120 Vac** **230 Vac**	100 to 132 Vac 187 to 264 Vac	Check ac power source.
Power Supply Module **Common** **DC Out (24 Vdc)** **Connector Pins 3 and 4** **(6 Vac for clock)**	None 24 to 26 Vdc 2.0 to 6.0 Vac	Common reference Replace Power Supply Module. Replace primary (left) Power Supply Module.
CMOS Battery Backup **Alkaline Battery** **(Set of 3)**	1.2 to 1.5 Vdc (across 1 battery) 3.6 to 4.5 Vdc (across 3 batteries)	Replace the batteries.

5. UCN Exerciser

5.1 Overview

Purpose

This section covers the operation of the UCN Exerciser program that is used for isolating communications problems in a UCN node.

CAUTION	The UCN Exerciser is an <u>off-process</u> program intended to provide a level of confidence in the connectivity and communication capabilities of an installed network. This test must <u>not</u> be used for an <u>on-process</u> system because the added communication and CPU loads induced by the test may cause throughput and response time degradation of the control system. The test works best if the physical node states of the participating configured nodes do not change during the duration of the test.

Each node must be configured in the NIM to participate in either test.

More than one logical UCN can normally be configured for a single physical UCN. The UCN Exerciser program must be configured to include, for test, only NIMs (and their redundant partners) from the same logical UCN. Configuring NIMs from more than one logical UCN will cause false errors to be indicated for some of the NIMs. This restriction does not apply to for other UCN node types, such as a High-Performance Process Manager, Advanced Process Manager, Process Manager, or Logic Manager.

5.2 Applications

Purpose

The purpose of the UCN Exerciser is:

- To provide the user with confidence that the UCN is operating properly by sending messages between UCN nodes.
- To test the peer-to-peer communications path. The status of peer-to-peer communications between High-Performance Process Managers is not shown on the Universal Station (US) display.
- To provide a means of isolating communication problems to a certain High-Performance Process Manager by observing the gross level of errors detected.

Two part test

The test has two parts, an RDR test and a Triangulation test, with both performed in succession repeatedly until the test is halted.

5.3   Request Data Response (RDR) Test

Introduction

In the Request Data Response test, as illustrated in the following figure, the Test Master, a Network Interface Module (NIM), attempts to communicate on a point-to-point basis with every UCN node configured to participate in the test. A node can be ALIVE, BUT NOT TOKEN PASSING and still participate in this test using its "shadow address," numbered 65-128. This check is to determine with which participants in the test the Master can communicate.

Figure 191 RDR Test Configuration
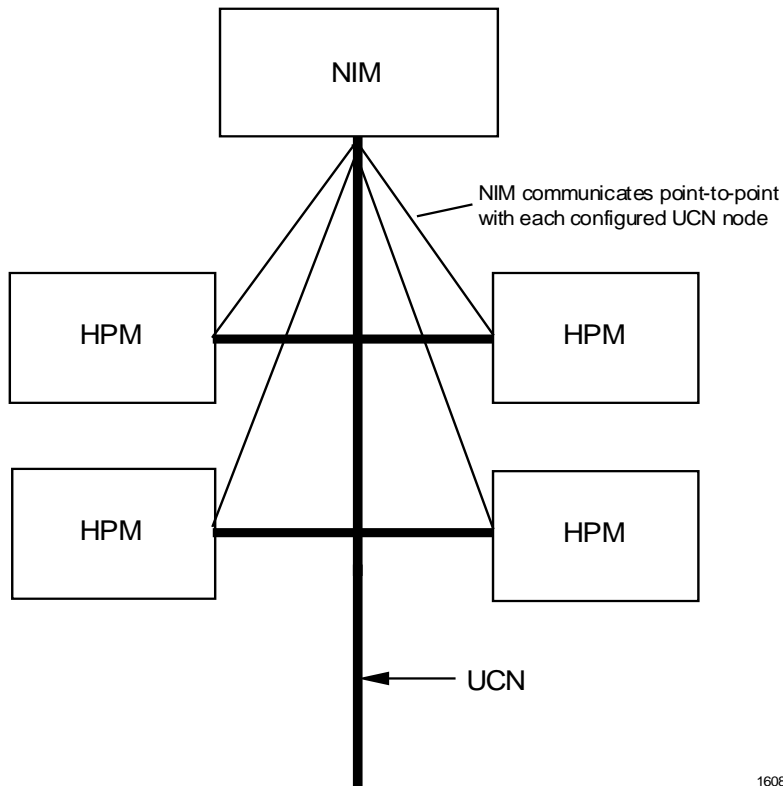
RDR protocol

The communications protocol used for this part of the test is RDR protocol. All nodes that are powered on and/or are capable of receiving and transmitting messages, should respond to the RDR from the test Master. A node that does not respond is assumed to be not on the network and is not requested to participate in the triangulation part of the test. A node that does respond but whose status indicates that it is not capable of token passing will also not be requested to participate in the triangulation part of the test.

5.4   Triangulation Test

ATTENTION

This test requires a minimum of one NIM and one server (other UCN nodes). With only two nodes, the NIM talks point-to-point. Three nodes are required for true triangulation.

Introduction

In the triangulation test, as illustrated in the following figure, only nodes that are configured in the test are capable of token passing participate. For example, HPMs that have not been loaded, cannot pass tokens and therefore do not participate. For those nodes that do participate, the test Master issues a message to another node in the test and requests the message to be forwarded to a third node. The third node in the test then sends a message back to the test Master, which verifies that the path has successfully completed. While passing the message, the following communication paths are checked: Master (NIM) to Slave 1, Slave 1 to Slave 2, and Slave 2 to back to the Master.

Figure 192 Triangulation Test
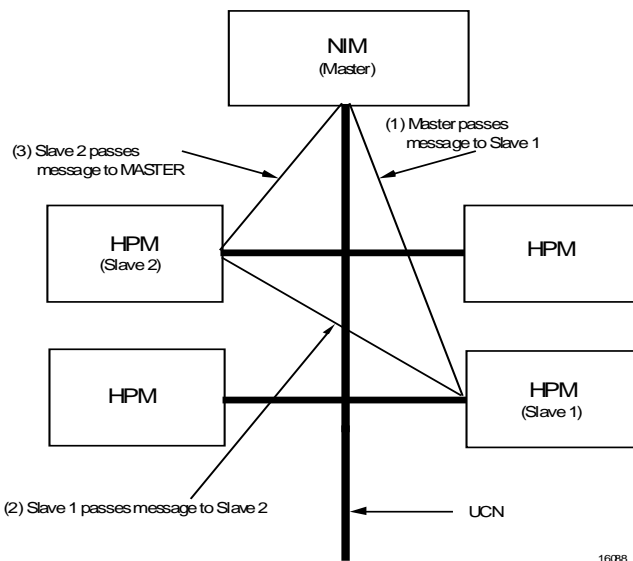
Timeout policy

Because a message may be lost or an error may occur, the Master has a reasonable timeout policy for receiving the response back from Slave 2. The timeout policy assumes that each Slave in the test is serving only one Master. This means that responses arriving late are considered errors. By examining several paths together, it is usually possible to determine which nodes are experiencing communication problems.

5.5   Test Operation

UCN Exerciser operation

The operator at the Universal Station (US) can control the operation of the UCN Exerciser. Use the following procedure to perform the UCN Exerciser tests. The display used in the test is explained below. Use the procedure in UCN Exerciser test procedure to run the UCN Exerciser.

> **ATTENTION**
>
> If the display does not appear after starting the UCN Exerciser, the Pathname Catalog must be reconstituted by adding the search path **NET>DIA1**.

Starting the UCN Exerciser

The UCN Exerciser is started by pressing the <**SCHEM**> key, typing in **HPNXOVR**, and pressing the <**ENTER**> key.

Page 1 of the UCN Exerciser Overview display will appear as shown in Figure 193. The display shows the status of the UCN Exerciser for the LCN nodes 1 through 64 that are NIMs on the LCN. If no status is indicated for the node address, the node is not a NIM.

PAGE target

Selecting the **PAGE** target will invoke Page 2 of the UCN Exerciser Overview display as shown in Figure 194. LCN nodes 65 through 96 are represented.

HELP target

Selecting the **HELP** target will invoke the UCN Exerciser Help display as shown in Figure 195. Selecting the **UCN EX OVERVIEW** target provides a return to the UCN Exerciser Overview display.

UCN Exerciser Overview display Page 1

Figure 193 UCN Exerciser Overview Display – Page 1

54109

UCN Exerciser Overview display Page 2

Figure 194 UCN Exerciser Overview Display – Page 2

54110

UCN Exerciser Help display

Figure 195 UCN Exerciser Help Display

54111

Connection Test Summary display – Page 1

Each box in the grid on the UCN Exerciser Overview is a target that when chosen and followed by selection of the **CONNECT TEST SUMM** target, invokes Page 1 of the Connection Test Summary display for the NIM node.

The display is shown in the following figure. Nodes 1 through 64 are represented.

Figure 196 Connection Test Summary Display – Page 1

```
                                              28 Apr 95 08:19:04    2

       LCN NODE: 24   UCN EXERCISER - CONNECTION TEST SUMMARY   RDR ATTEMPTS
       TEST STATUS: NOTRUNNG    ERRORS: TRI         START TIME: 28 Apr 95 08:01

      ┌──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┐
      │ 1  ON│ 2 OFF│ 3 OFF│ 4 OFF│ 5  ON│ 6 OFF│ 7  ON│ 8 OFF│
      │------│      │      │      │T   27│      │T   27│      │
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │ 9 OFF│10 OFF│11 OFF│12 OFF│13 OFF│14 OFF│15 OFF│16 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │17 OFF│18 OFF│19 OFF│20 OFF│21 OFF│22 OFF│23 OFF│24 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │25 OFF│26 OFF│27 OFF│28 OFF│29 OFF│30 OFF│31 OFF│32 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │33 OFF│34 OFF│35 OFF│36 OFF│37 OFF│38 OFF│39 OFF│40 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │41 OFF│42 OFF│43 OFF│44 OFF│45 OFF│46 OFF│47 OFF│48 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │49 OFF│50 OFF│51 OFF│52 OFF│53 OFF│54 OFF│55 OFF│56 OFF│
      ├──────┼──────┼──────┼──────┼──────┼──────┼──────┼──────┤
      │57 OFF│58 OFF│59 OFF│60 OFF│61 OFF│62 OFF│63 OFF│64 OFF│
      └──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┘

    MESSAGE DELAY         MESSAGE MIX       PRIORITY MSGSIZ
   ┌────┬────┬─────┐  ┌─────┬─────┬────┐  ┌──────┬─────┐ ┌──────┬──────┬────┐
   │NONE│50ms│100ms│  │TYPE1│TYPE3│BOTH│  │LOWEST│Small│ │ RDR  │ TEST │HELP│
   │    │    │█████│  │     │█████│    │  │ ALL  │SmLrg│ │TRIANG│OVRVW │    │
   └────┴────┴─────┘  └─────┴─────┴────┘  └──────┴─────┘ ├──────┼──────┼────┤
               C O M M A N D S                           │ATTMPS│RESLTS│PAGE│
   ┌────────┬───┐ ┌────┬─────┬─────┬────┬──────┐         │ERRORS│DETAIL│    │
   │END TIME│SET│ │STRT│RESET│RESET│IMED│ENDCYC│         ├──────┼──────┤    │
   │28 Apr 95│ON │ │    │CONFG│STATS│ABRT│ ABRT │         │DESELCT│CANCEL│   │
   │ 08:05  │   │ │    │     │     │    │      │         │ NODE │COMMND│    │
   └────────┴───┘ └────┴─────┴─────┴────┴──────┘         └──────┴──────┴────┘
                                                                        54112
```
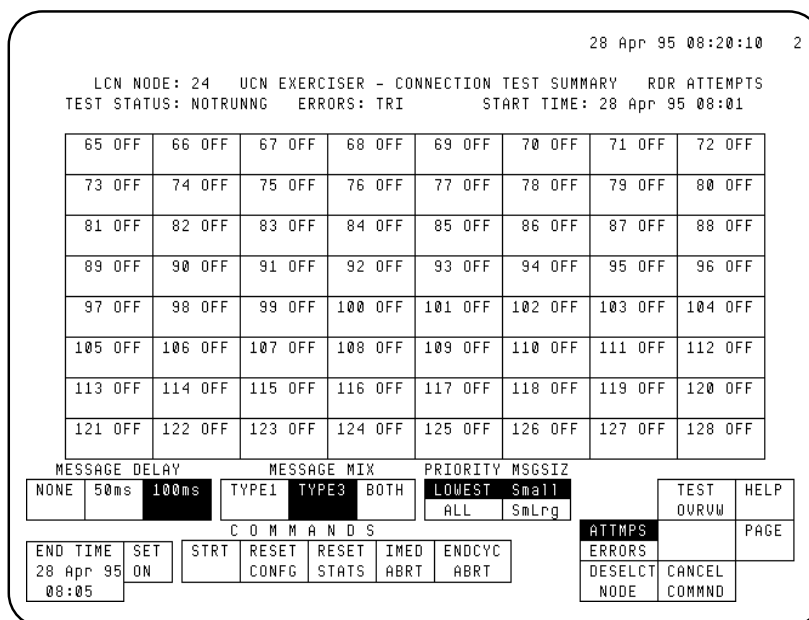
Connection Test Summary display – Page 2

Selecting the **PAGE** target invokes Page 2 of Connection Test Summary display. Nodes 65 through 128 are represented. The display is shown in the following figure.

Selecting the **PAGE** target provides a return to Page 1 of the Connection Test Summary display.

Figure 197 Connect Test Summary Display – Page 2

```
                                          28 Apr 95 08:20:10   2

       LCN NODE: 24   UCN EXERCISER - CONNECTION TEST SUMMARY   RDR ATTEMPTS
       TEST STATUS: NOTRUNNG    ERRORS: TRI       START TIME: 28 Apr 95 08:01

       65 OFF │ 66 OFF │ 67 OFF │ 68 OFF │ 69 OFF │ 70 OFF │ 71 OFF │ 72 OFF

       73 OFF │ 74 OFF │ 75 OFF │ 76 OFF │ 77 OFF │ 78 OFF │ 79 OFF │ 80 OFF

       81 OFF │ 82 OFF │ 83 OFF │ 84 OFF │ 85 OFF │ 86 OFF │ 87 OFF │ 88 OFF

       89 OFF │ 90 OFF │ 91 OFF │ 92 OFF │ 93 OFF │ 94 OFF │ 95 OFF │ 96 OFF

       97 OFF │ 98 OFF │ 99 OFF │100 OFF │101 OFF │102 OFF │103 OFF │104 OFF

      105 OFF │106 OFF │107 OFF │108 OFF │109 OFF │110 OFF │111 OFF │112 OFF

      113 OFF │114 OFF │115 OFF │116 OFF │117 OFF │118 OFF │119 OFF │120 OFF

      121 OFF │122 OFF │123 OFF │124 OFF │125 OFF │126 OFF │127 OFF │128 OFF

      MESSAGE DELAY          MESSAGE MIX    PRIORITY MSGSIZ
     NONE │ 50ms │ 100ms │ TYPE1 │ TYPE3 │ BOTH │ LOWEST │ Small │      │ TEST  │ HELP
                                                 │ ALL    │ SmLrg │      │ OVRVW │
                           C O M M A N D S                   ATTMPS │        │ PAGE
     END TIME │ SET │ STRT │ RESET │ RESET │ IMED │ ENDCYC   ERRORS │
     28 Apr 95│ ON  │      │ CONFG │ STATS │ ABRT │ ABRT     DESELCT│ CANCEL │
       08:05  │     │      │       │       │      │          NODE   │ COMMND │
                                                                              54 113
```

UCN Exerciser test procedure

The following table is a UCN Exerciser test procedure. Follow the procedure to test the UCN.

Step	Action
1	Start the UCN Exerciser by pressing the <**SCHEM**> key, type in **HPNXOVR**, and press the <**ENTER**> key.
2	Each box in the grid on the UCN Exerciser Overview display is a target, that when chosen and followed by selection of the **CONNECT TEST SUMM** target, invokes Page 1 of the Connection Test Summary display for the NIM node. Nodes 1 through 64 are represented. Selecting the **PAGE** target invokes Page 2 of Connection Test Summary display. Nodes 65 through 128 are represented. Make a selection.
3	Select each node on the UCN that is to participate in the test. This is accomplished by choosing the node in the grid and then the **SET ON** target. Repeat this procedure until all desired nodes are on. For example, Figure 196 and Figure 197 show nodes 1, 5, and 7 configured for the test. If a node is selected by mistake, select it again and the **SET ON** target will toggle to **SET OFF**. Selecting **SET OFF** deselects that node.
4	Configure the MESSAGE DELAY parameter by selecting the **NONE**, **50 ms**, or **100 ms** target. For example, Figure 196 and Figure 197 show 100 ms selected.

Step	Action
5	Configure the MESSAGE MIX parameter by selecting one of the three targets
	TYPE 1 Send only Type 1 messages. These are unacknowledged unconnected messages.
	TYPE 3 Send only Type 3 messages. These are acknowledged messages.
	BOTH Send both Type 1 and Type 3 messages.
	Figure 196 and Figure 197 show **TYPE 3** selected.
6	Configure the **PRIORITY** parameter by selecting one of two targets.
	LOWEST Send messages at the lowest priority.
	ALL Send messages at each of four priorities.
7	Configure the **MSGSIZ** (MESSAGE SIZE) parameter by selecting one of two targets.
	SMALL Send 50 word messages.
	SMLRG Send 50 and 100 word messages.
8	Configure the end time date parameter by selecting the **END TIME** target and entering the date in the format shown. Press <**ENTER**>. Enter the time parameter in the format shown and press <**ENTER**>.
9	Select the **STRT** (START) target followed by the **EXEC** (EXECUTE) target to start the test. The **EXEC** target appears to the right of the **ENDCYC** (END CYCLE) target when the **STRT** target has been selected.
	There are five commands shown in Figures Figure 196 and Figure 197. To execute the chosen command, the **EXEC** target must also be selected. The following commands are available.
	STRT Starts the RDR and Triangulation test.
	RESET CONFG Resets the configuration to off for all nodes.
	RESET STATS Resets the statistics to zero.
	IMED ABRT Aborts the test wherever it is in the procedure.
	ENDCYC ABRT Aborts the test at the end of the current test cycle.
10	Select the **TEST OVRVW** (TEST OVERVIEW) target to return to the UCN Exerciser Overview display. See Figure 196 and Figure 197 . Wait for the test to complete. The **NOTRUNNG** (NOT RUNNING) status appears on the UCN Exerciser Overview display as shown in Figure 193.

5.6   Analyzing Results

Connect Test Detail display

To see the results, chose the node of interest and select the **RESLTS DETAIL** (RESULTS DETAIL) target on the Connect Test Summary display. This invokes the Connection Test Detail display as shown in the following figure.
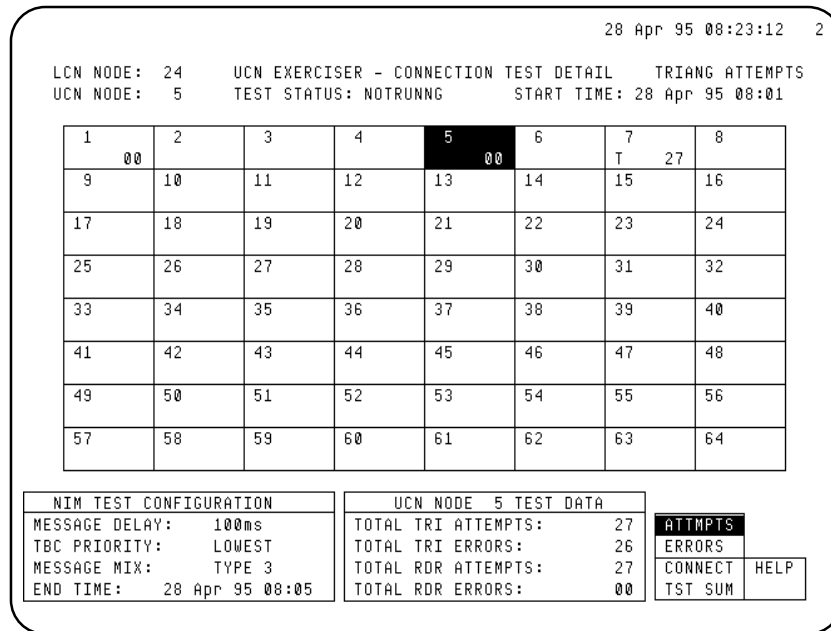
Figure 198 Connection Test Detail Display

Number of attempt errors

Check the boxes in the grid target for nodes 0, 5, and 7. The number in the lower right corner of the box reports the number of attempts if the **ATTMPS** (ATTEMPTS) target is backlighted, or the number of errors if the **ERRORS** target is backlighted on the Connect Test Summary display. The display is selected with the **CONNECT TST SUM** (Connect Test Summary) target.

Problem correction

The node that has the highest number of errors is likely to be the node causing a problem. The problem should be corrected by replacing the HPM UCN Interface module or by checking the UCN cable connections. If this does not correct the problem, call the Technical Assistance Center (TAC) for assistance.

6. Removal and Replacement

6.1 Overview

Introduction

This section describes how to remove and replace assemblies in the High-Performance Process Manager.

ATTENTION

A Honeywell designed fusepuller, part number 51190586-100, is available to extract and insert HPM backpanel fuses. Refer to subsection "24 Vdc Fuse Protection" ("Equipment Description" section) to learn how to use the fusepuller.

Electrostatic Discharge Protection

ESD HAZARD

It is extremely important that you wear a properly connected Electrostatic Discharge (ESD) wriststrap while removing, handling, and installing these High-Performance Process Manager components. Slip the strap on your wrist like a wristwatch and connect its clip to the ground bus located inside the left front side of the cabinet. See the following figure for connection points. There is no danger of personnel receiving shocks from wearing an approved wrist strap. Be sure to place the component in a static-safe carrying pouch, if appropriate, immediately after its removal.
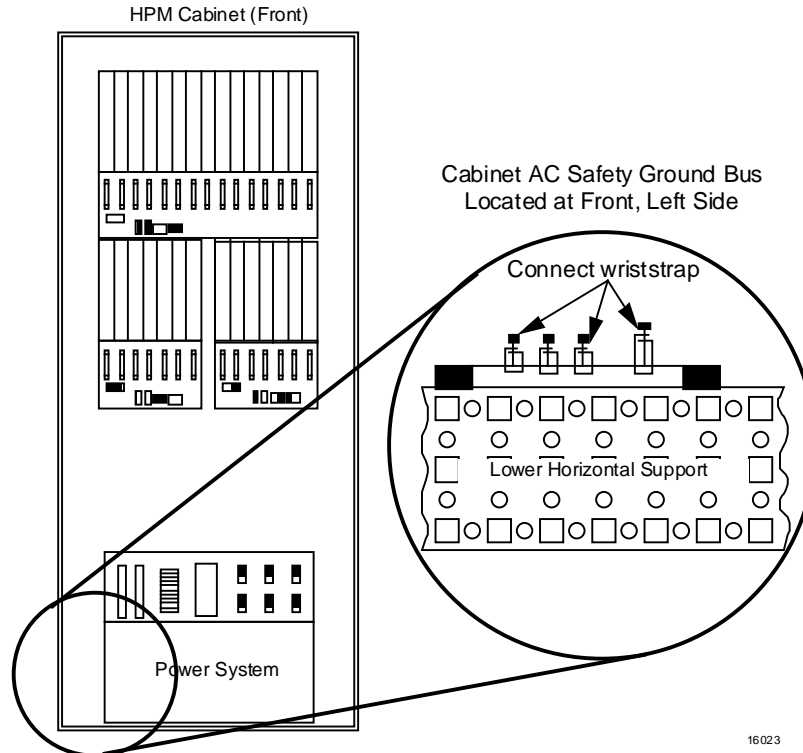

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Honeywell can supply a wriststrap manufactured by 3M Company that has a maximum resistance of 10 megaohms and a minimum resistance of 500 kohms.

Figure 199 Cabinet ESD Wriststrap Connection

HPM Cabinet (Front)

Cabinet AC Safety Ground Bus
Located at Front, Left Side

Connect wriststrap

Lower Horizontal Support

Power System

16023

6.2   ESD Guidelines for HPMM and IOP Cards

Static discharge effects

When inserting an HPMM or IOP card into a card file and following normal ESD procedures, other cards in the card file, HPMM or IOP, can go **OFFNET** because of electrostatic discharge. It does not result in damage to any of the components on the card when an ESD wriststrap is worn, but does affect subsystem integrity. A procedure has been developed to discharge the card using a 10 megaohms Static Discharge Probe.

ESD kit

Honeywell has available an ESD kit, part number 30185H, that contains the following components.

- 10 megaohm static discharge probe
- Static discharge wriststrap (AESOPS Inc. Model 31531)
- Static discharge cord, 15 feet (AESOPS Inc. Model 30204)
- Static discharge cord, 6 feet (AESOPS Inc. Model 30205)
- Antistatic work surface with bag

Building a static discharge probe

A static discharge probe can be built by placing a 10 megaohm resistor in series with any available probe or clip lead.

ESD prevention rules

When installing a firmware upgrade, or replacing or adding a card, adhere to the following rules to prevent ESD from affecting the HPMM or IOP cards.

- Ground the antistatic work surface to the card file chassis.

- Ground the wriststrap that is to be worn when removing or inserting card to the card file chassis.

- Ground the wriststrap that is to be worn when upgrading card firmware to the antistatic work surface.

- When removing, or inserting a card, handle only the card frame. Do not touch the circuit board or the components.

- The 10 megaohm static discharge probe must be grounded to the card file chassis.

- When inserting a card, insert the card 3/4 of the way into the slot and then discharge the card with the 10 megaohm static discharge probe by touching the lower lead of the upper LED, or if there is a daughter board, touch the minus/lower lead of the bypass capacitor labeled C1 or C2.

- Ensure that the Primary PM IOP card is in IDLE state before it is removed/replaced from the HPM card file.

6.3   HPMM and IOP Cards

Removal and Replacement

CAUTION	Cycling power or removing nonredundant Analog or Digital Output IOPs results in their outputs going to the nonpowered state regardless of the **FAILOPT** selection configured. Follow the Analog or Digital Standby Manual device instructions in this section.

CAUTION

Inserting/removing the EHPM Communication/Control card without pulling on the upper and lower extractor levers might damage the EHPM Communication/Control card.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

HPMM and IOP card removal and replacement

Use the procedure in the following table to remove and replace an HPMM or IOP card.

Step	Action
1	When removing an HPMM or IOP card, first connect your ESD wriststrap to the cabinet's ground bar.
2	Ensure that the Primary PM IOP card is in IDLE state before it is removed/replaced from the HPM card file.
3	Before removing an analog or digital output IOP from a card file, system operational requirements may require that a Standby Manual device be connected to the FTA to control operations while the IOP is removed.
4	Any HPMM or IOP card can be removed by simultaneously pulling on the upper and lower extractor levers. When the upper extractor is first moved, power is disconnected from the card. Further operation of both extractors moves the card away from its backpanel connector.
5	After the card is free from the connector, carefully slide it out on the card rails and into your hands. Immediately place the card in a static-safe pouch for transport.
6	When installing an HPMM or IOP card, first connect your ESD wrist strap, then remove the card from its pouch.
7	Carefully slide the card onto the card rails, checking to be sure that the card is inserted in both rails.
8	Slide the card into the card file until it has made contact with the backpanel connectors. Then firmly press on the front of the card with the heel of your hand. Do not use excessive force! If the card doesn't slip easily into its connectors, remove the card and locate the source of the obstruction. Check for bent contacts at the backpanel connectors.

HPM UCN Interface module removal and replacement

The HPM UCN Interface module uses a power interlock technique that allows it to be removed from, or installed, in the card file without affecting operation of the High-Performance Comm/Control or High-

Performance I/O Link cards. The module is not provided with ground, by way a metal strip on both the module and a mounting rail, until the module is seated in its connector.

The HPM UCN Interface module is mounted in the connector directly below the High-Performance Comm/Control card in slot 1 of the Left 7-Slot or 15-Slot card file, or in slot 9 of the Right 7-Slot card file. The module's case has two extrusions that are inserted into a rail below the card cage to guide the module into position. A captive spring-loaded screw with a knurled head secures the module in place.

Tightening the knurled screw

The UCN Interface Module knurl knob (grounding) fastener must be sufficiently tightened while no UCN drop cables are connected to the front panel connectors. The cables interfere with the tightening procedure. The knurled screw must first be finger-tightened by using your thumb and forefinger and then tightened further using a screwdriver. Use the Phillips-head screwdriver slot in the end of the knurled screw. If a torque screwdriver is available, a setting of 15 inch-pounds is sufficient. If a torque screwdriver is not available, tighten the screw one more turn past finger-tight. Do not over tighten and possibly strip the Phillips-head screw insert.

HPM UCN Interface module

The following figure illustrates the installation of the HPM UCN Interface module in a card file.

Figure 200 HPM UCN Interface Module Installation

52564
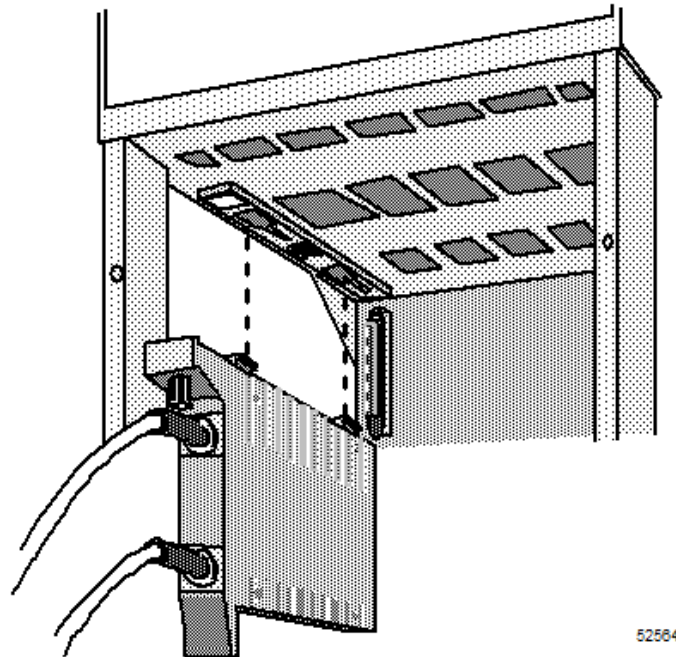
EHPM FTE module installation

The following figure illustrates the installation of the FTE Interface module in a card file.

Figure 2 FTE Interface Module Installation
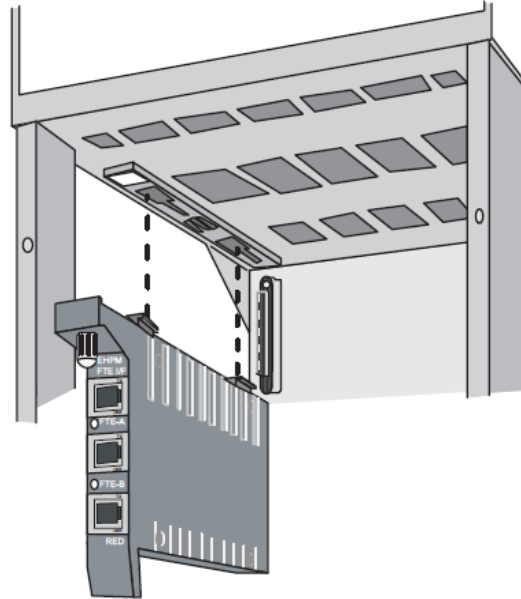
Note: This module is applicable for both EHPM and C300PM.

6.4   Standby Manual Device Overview

Introduction

A Standby Manual device provides the capability to maintain output signals from an Analog Output or 24 Vdc Digital Output FTA while its nonredundant IOP is replaced.

No external power source option

The Analog and Digital Output Standby Manual device does not have an external power source option.

Standby Manual device connections

The connection of the Analog Output Standby Manual device and the Digital Output Standby Manual device to the FTA differs. The Analog Output Standby Manual device connects by cable to a unique connector on the FTA that is labeled **STANDBY MANUAL**. The Digital Output Standby Manual device connects to one of the two IOP interface connectors.

DO Standby Manual device connection

The following figure illustrates the connection of a Digital Output Standby Manual device to a model MU-TDON12 24 Vdc Digital Output FTA.

Figure 201 Digital Output Manual Device Interconnection
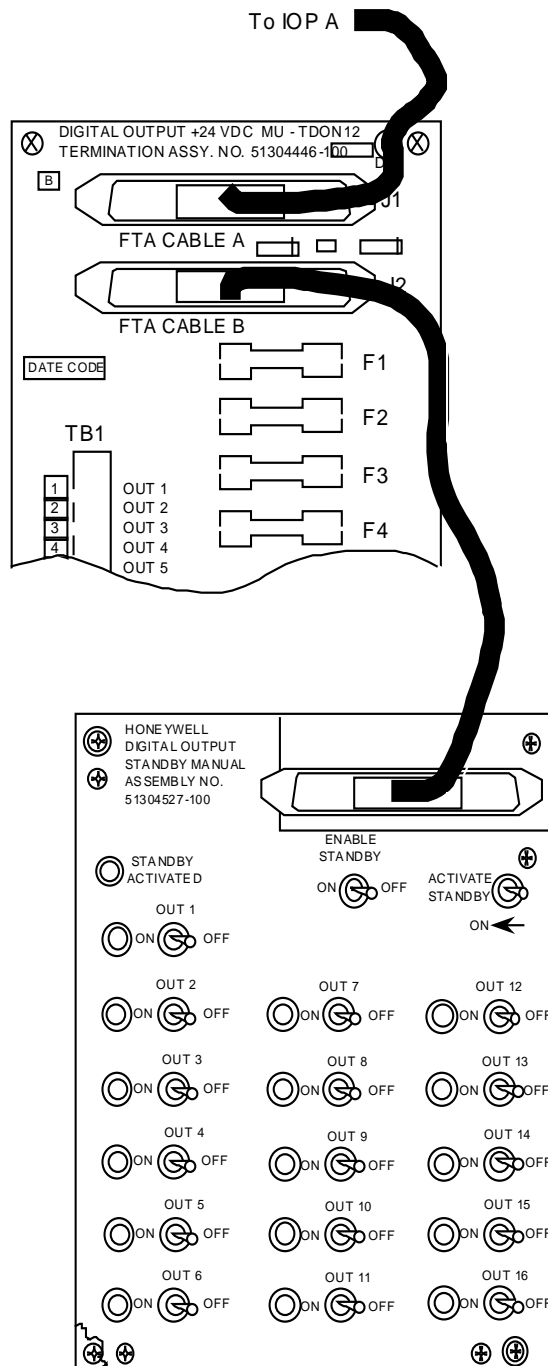
Device interchangeability

There is an interchangeability problem with the Digital Output Standby Manual devices. The software Release 300, or later, model of the Digital Output Standby Manual device is not compatible with a Release 230, or earlier Digital Output FTA, nor is the Release 230, or earlier, Digital Output Standby Manual device compatible with a software Release 300, or later, FTA. Software Release 300, or later, devices are identified by having phone-type cable connectors, while software Release 230, or earlier, devices have DIN-type cable connectors.

DIN to phone connector adaptor cable

A DIN to phone connector adaptor cable, Honeywell part number 51201561-xxx, where the suffix "xxx" is the length of the cable in meters, can be used to interconnect an incompatible Digital Output Standby Manual device to an FTA, provided the circuit board inside the Digital Output Standby Manual device is the proper revision as follows.

- Digital Standby Manual device with phone connectorPWB 51304451-100, Revision B
- Digital Standby Manual device with DIN connectorPWB 51304076-100, Revision C

Board revision level

The 24 Vdc required by the Digital Output Standby Manual device will be missing if the device's circuit board is not at the listed revision level.

The R230 and R300 Analog Output Standby Manual devices do not have the same problem.

6.5   AO Standby Manual Device Operation

Purpose

There are two models of the Analog Output Standby Manual (AOSM) device. Both models provide the same primary function, which is to control the loads connected to an Analog Output FTA while its associated Analog Output IOP can be removed from service and replaced. The Analog Output Standby Manual device connects to the Analog Output FTA and provides control of any or all eight of the outputs that are normally controlled by the IOP.

Two models

The original Analog Output Standby Manual device model is not as convenient to use as the newer compact Analog Output Standby Manual device model which also offers more features. A description and the use of both models is discussed in the information that follows.

Original Analog Output Standby Manual device

The original model MU-SMAC01/MU-SMAC02 Analog Output Standby Manual (AOSM) device, as shown in the following figure, monitors the outputs of an Analog Output (AO) IOP by displaying its output values on meters as a percentage of the range. The following figure illustrates one of the two Analog Output Standby Manual device assemblies that comprise the Analog Output Standby Manual device. When you press one of the **BAL** switches on the Analog Output Standby Manual device, the corresponding meter indicates the IOP's output value. Using the **VALVE** knob, you adjust the Analog Output Standby Manual device's output to match the output of the IOP. Then, you switch control of the FTA output to the Standby Manual device by moving the mode switch to the **MAN** position.

Figure 202 Original Analog Output Standby Manual Device (Two per device)
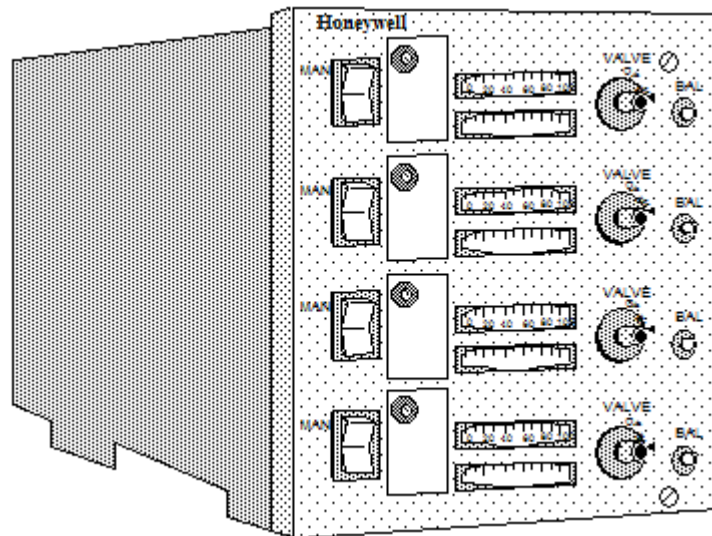
Control of FTA outputs

To use an Analog Output Standby Manual device to control the FTA outputs to the field while an Analog Output IOP or the IOP switching module on a redundant Analog Output FTA is being replaced, place all of the mode switches on the Standby Manual device to the position opposite the **MAN** position after you have duplicated the IOP's outputs.

FTA connection

Connect the Standby Manual device to the **STANDBY MANUAL** connector on the FTA with its cable.

> **ATTENTION**
>
> If the FTA cable to be connected to the Standby Manual device has a phone-type connector, use the adapter cable, Honeywell part number 51201561-xxx (The suffix "xxx" represents the length of the cable in meters), to make the connection.
>
> When a Regulatory Control point indicates its Analog control output is in Standby Manual mode (STDBYMAN) on an operating display, such as Group or Detail, the output cannot be changed using that display due to control initialization. To set the point output to match the Analog Output Standby Manual device setting, the output point must be set using the IOP Slot Summary display.

Standby Manual device control procedure

Use the HPM Status display to save the Checkpoint for the IOP, and then use the procedure in the following table to provide Standby Manual device control of the FTA field devices.

Step	Action
1	For the first output, press the **BAL** switch and note the IOP's output value.
2	Release the **BAL** switch and adjust the **VALVE** knob to make the output of the Analog Output Standby Manual device equal to the output of the IOP.
3	Place the mode switch for this output in the **MAN** position.
4	Repeat steps 1 through 3 for all remaining outputs from the IOP.
5	Remove and replace the IOP or switching module, as appropriate, and proceed to the **Normal IOP Control** procedure.

Normal IOP control procedure

Use the procedure in the following table to return to normal IOP control of the FTA field devices.

Step	Action
1	Use the HPM Status display to restore the Checkpoint to the replacement IOP, to select **RUN STATES**, and to **STARTUP** the IOP.
2	For the first point controlling the output of the IOP, use the point's Detail or Group display to place the point in the Manual mode.
3	Use the IOP's slot summary display to adjust the first IOP output to match that of the Analog Output Standby Manual device as follows: (NOTE: the keyswitch access level must be in the SUPERVISORY position or the ENGINEER position to perform this function); Select the slot, and then select the slot's "OP". Type in a value equal to the current output from the Standby Manual device for that slot, and then press the ENTER key. This allows the IOP to regain FTA output control and provide the same output level, if so desired, that existed before the Analog Output Standby Manual device established control.
4	On the Analog Output Standby Manual device, change the mode switch for this output to the position opposite the **MAN** position.
5	Use the point's Detail or Group display to select the Normal mode for the point.
6	Repeat steps 2 through 5 for all remaining outputs from the IOP.
7	Disconnect the Analog Output Standby Manual device cable from the **STANDBY MANUAL** connector on the FTA, if desired.

Compact Analog Output Standby Manual device

The compact Analog Output Standby Manual (AOSM) device display panel, as shown in the following figure, monitors the outputs of an Analog Output (AO) IOP as well as the AOSM itself, presenting their output values on the display panel as a percentage of the range. It can be ordered by Honeywell part number 51401926-100.

Figure 203 Compact Analog Output Standby Manual Device
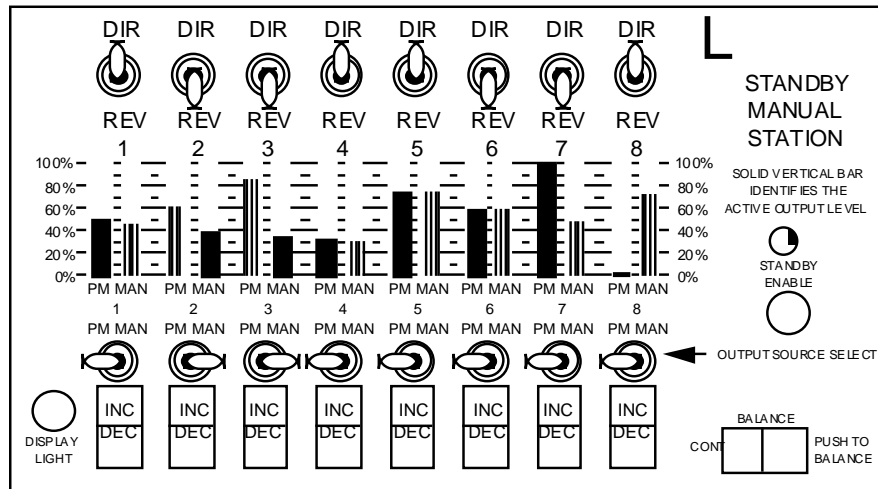
Features

The Analog Output Standby Manual device has the following features.

- The Analog Output Standby Manual device will accept the standard IOP to FTA cables with either DIN or phone type connectors.

- The Analog Output Standby Manual device can be powered by any of two methods.
    - The HPM card file backpanel through its connection to the **STANDBY MANUAL** connector on the FTA.
    - By applying 110 or 220 Vac to connector at the side of the AOSM. The universal power supply in the AOSM will accept 100 to 240 Vac, 50/60 Hz.

- The panel display shows the 4-20 milliamp current levels in a 0% to 100% scale for all eight IOP outputs as well as the level of all eight AOSM outputs.

- The toggle switches are a "tamper-proof" style that require the operator to lift up on the bat handle before changing the switch position.

- The compact AOSM's output current and the its **OUTPUT SOURCE SELECT** switches are disabled when the device is first connected to the FTA, the **STANDBY ENABLE** indicator is extinguished, or the cable to the FTA is disconnected.

- When the AOSM is enabled by depressing the **STANDBY ENABLE** switch, the **STANDBY ENABLE** indicator is illuminated and the **OUTPUT SOURCE SELECT** switch settings are active.

- The balancing of the AOSM output values to equal the IOP output values is performed automatically, either continuously, or by single snapshot action. Balancing in the other direction, IOP to AOSM, is an operator function.

- A **DIR/REV** switch for each channel flips the display and reverses the **INC/DEC** action relative to the actual current level. In the **DIR** position, 4 mA equals 0% and 20 mA equals 100%. The **INC** position of the **INC/DEC** switch will increase current and the **DEC** position will decrease current.

With the **DIR/REV** switch in the **REV** position, 20 mA equals 0% and 4 mA equals 100%. The **INC** position of the **INC/DEC** switch will decrease current and the **DEC** position will increase current.

Standby Manual device control procedure

Use the HPM Status display to save the Checkpoint for the IOP, and then use the procedure in the following table to provide Standby Manual device control of the FTA field devices.

Step	Action
1	Be sure all the **OUTPUT SOURCE SELECT** switches are in the **PM** position.
2	Place the **DIR/REV** switches in the correct position for all eight channels.
3	Connect a standard IOP to FTA cable between the **STANDBY MANUAL** connector on the FTA and the AOSM.
4	Verify that all **OUTPUT SOURCE SELECT** switches are in the **PM** position.
5	The **BALANCE** switch has three positions, left (**CONT**), center (inactive), and right (**PUSH TO BALANCE**). Select the left or right position. **CONT** Position In the **CONT**inuous (left) position, the switch remains toggled and all the channels with their **OUTPUT SOURCE SELECT** switch in the **PM** position will automatically have their Standby Manual device output level continuously set equal to the IOP level. Manual **INC**rement and **DEC**rement control for a channel is not possible when a channel is in the **PM** position while the **BALANCE** switch is in the **CONT** position. **PM** Position In the **PUSH TO BALANCE** (right) position, the position is momentary and all channels with their **OUTPUT SOURCE SELECT** switch in the **PM** position will automatically have their Standby Manual device output level set equal to the IOP output level. However, this balance method is a single event and the switch returns to the center position when it is released. Any subsequent change in the IOP's output level will not be transferred to the Standby Manual, but the **INC**rement and **DEC**rement control for a channel can alter the Standby Manual device's current level.
6	The **STANDBY ENABLE** switch can now be depressed. The green LED illuminates to indicate that the FTA is now ready for control by the Standby Manual device.
7	Placing any or all of the **OUTPUT SOURCE SELECT** switches in the **MAN**ual position will automatically place all eight IOP channels in the Standby Manual mode.
8	When all eight **OUTPUT SOURCE SELECT** switches are in their **MAN**ual position, the Analog Output IOP can be placed in the Idle state and removed.

Normal IOP control procedure

Use the procedure in the following table to return to normal IOP control of the FTA field devices.

Step	Action
1	Use the HPM Status display to restore the Checkpoints to the replacement IOP, to select RUN STATES, and to STARTUP the IOP.
2	For the IOP's first point that controls the channel 1 output level of the IOP, use the point's Detail or Group display to place the point in the Manual mode.
3	Use the IOP's slot summary display to adjust the first IOP output to match that of the Analog Output Standby Manual device as follows: (NOTE: the keyswitch access level must be in the SUPERVISORY position or the ENGINEER's position to perform this function); Select the slot, then select the slot's "OP", type in a value equal to the current output from the Standby Manual device for that slot, press the ENTER key. This allows the IOP to regain FTA output control and provide the same output level, if so desired, that existed before the Analog Output Standby Manual device established control.
4	When the output level for channel 1 matches the output level of the Analog Output Standby Manual device, place the **OUTPUT SOURCE SELECT** switch for channel 1 in the **PM** position. The IOP will now be controlling channel 1.
5	Use the point's Detail or Group display to select the Normal mode for the point.
6	Repeat steps 2 through 5 for IOP channels 2 through 8.
7	Disconnect the Analog Output Standby Manual device cable from the **STANDBY MANUAL** connector on the FTA, if desired.

6.6   DO Standby Manual Device Operation

Purpose

The primary function of the model MU-SMDC02 or model MU-SMDX02 Digital Output Standby Manual (DOSM) device is to control Digital Output FTAs while the associated Digital Output IOP card is serviced. Except in the case of the +24 Vdc nonisolated FTA which has no relays, the FTA's relays are controlled, not their loads.

Secondary function

A secondary function of the Digital Output Standby Manual device is to indicate the state of each IOP output (LED on = output on). The LEDs indicate the output state of the IOP as soon as the connection is made.

Mounting locations

The model MU-SMDX02 Digital Output Standby Manual device can be mounted in an HPM cabinet on an FTA Mounting Channel. The model MU-SMDC02 Digital Output Standby Manual device is mounted in a carrying case for portable applications.

Connection

Connection of the Digital Output Standby Manual device to the FTA Standby connector is made with a standard IOP to FTA cable. A 3-meter cable is included with the model MU-SMDC02 Digital Output Standby Manual device that is shown in the following figure.

Figure 204 Model MU-SMDC02 Portable Digital Output Standby Manual Device

Mounted in Portable Case
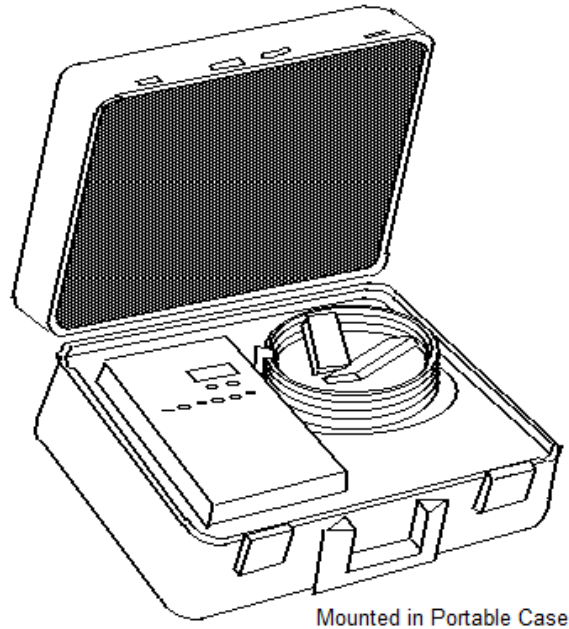
Output control switches disablement

The Digital Output Standby Manual device's output control switches are disabled when the DOSM is first connected to the FTA, or whenever the **ENABLE STANDBY** switch on the DOSM is in the **OFF** position.

Switch activation

When the **ENABLE STANDBY** switch is in the **ON** position, momentary operation of the **ACTIVATE STANDBY** switch latches the manual mode of the Digital Output Standby Manual device and activates the 16 output switches to control the FTA as discussed below.

> **ATTENTION**
>
> The IOP to FTA cable, from the card file backpanel to the FTA, must be connected to carry the +24 Vdc and the common from the IOP backpanel to the FTA and the Digital Output Standby Manual device. Also, the Digital Output Standby Manual device cannot be used with the 24 Vdc nonisolated Digital Output FTA if the FTA load voltage for any output is other than +24 Vdc.

Standby Manual device control procedure

Use the HPM Status display to save a Checkpoint for the IOP(s), if desired, and then use the following procedure to provide Standby Manual device control of the FTA field devices.

Step	Action
1	Place **ENABLE STANDBY** switch on the Digital Output Standby Manual device in the **OFF** position.
2	Connect the Digital Output Standby Manual device cable to the **FTA CABLE B** connector, J2, on the Digital Output FTA.
3	When the Digital Output Standby Manual device is connected to the connector on the Digital Output FTA, all "on" IOP outputs light their corresponding indicator on the Digital Output Standby Manual device. See Figure 205 for an illustration of the model MU-SMDX02 Digital Output Standby Manual device panel. If you only want to display outputs, stop at this point.

Figure 205 Digital Standby Manual Device Panel
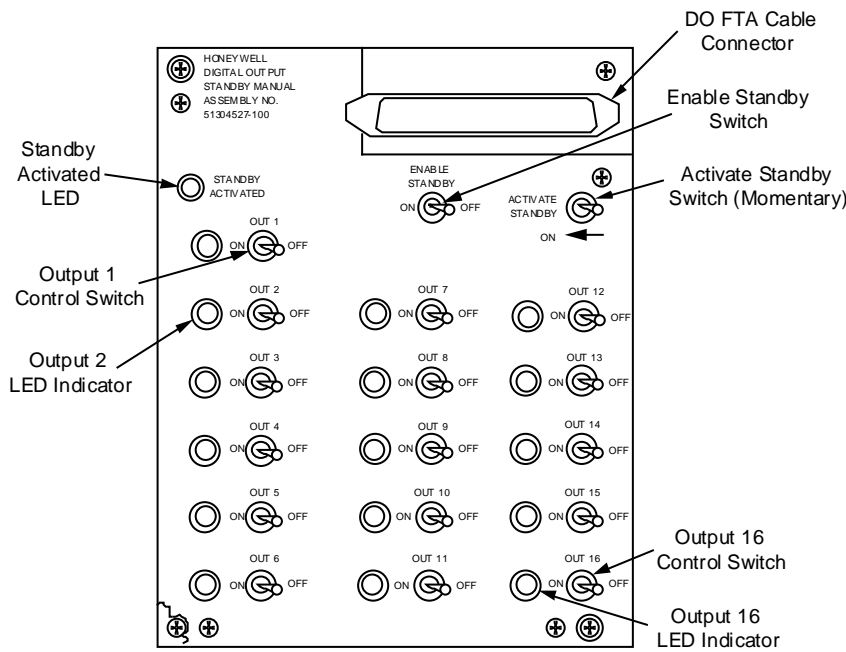
Note:

The Digital Output Standby Manual device is designed to install on an FTA Mounting Channel, but it can be installed elsewhere.

Step	Action
4	If you want to use the Digital Output Standby Manual device to hold the current FTA output states while servicing the associated Digital Output IOP, set the 16 output switches equal to the output state that is displayed by the LEDs on the Digital Output Standby Manual device and perform Steps 5 through 7 below. You can also set any of the 16 output switches to an alternate state, if desired.
5	Place the **ENABLE STANDBY** switch on the Digital Output Standby Manual device in the **ON** position.
6	Toggle the momentary **ACTIVE STANDBY** switch on the Digital Output Standby Manual device. The **STANDBY ACTIVATED** LED should illuminate. This allows the Digital Output Standby Manual device's switch settings to control the Digital Output FTA and also send a status signal to the IOP to indicate that the connected Digital Output Standby Manual device is armed and possibly controlling FTA outputs.
7	While the Digital Output Standby Manual device is controlling outputs, the IOP can be placed in the idle mode or removed/replaced for servicing, and the FTA outputs will be held by the Digital Output Standby Manual device. After servicing the IOP, proceed to the **Normal IOP Control** procedure to restart the IOP.

ATTENTION

While the Digital Output Standby Manual device and the FTA's associated IOP are both present and controlling outputs (they are connected in parallel to the FTA), either can override an "off" output from the other, but not an "on" output. Until the IOP is removed or reset, the Digital Output Standby Manual device's output LEDs indicate the resultant outputs actually delivered to the FTA's switching elements.

Normal IOP control procedure

After using the Digital Output Standby Manual device to maintain FTA digital output states while servicing the associated Digital Output IOP, proceed with the following steps in the following table to return FTA output control to the IOP.

Step	Action
1	Use the HPM Status display to restore the IOP database, then restart the IOP.
2	Activate the outputs on the IOP Slot Summary display at the Universal Station. Select the slot, and then select the slot's "**SO**." Toggle the output by depressing the **ENTER** key. Ensure that the outputs agree with the 16 output switch settings on the Digital Output Standby Manual device. This allows the IOP to regain FTA output control and provide the same output states, if so desired, that existed before the Digital Output Standby Manual device established control.
3	Set the **ENABLE STANDBY** switch on the Digital Output Standby Manual device to the **OFF** position. The **STANDBY ACTIVATED** LED should be "off," indicating that the Digital Output Standby Manual device is no longer controlling the FTA digital outputs. Control has been returned exclusively to the IOP.
4	Remove the Digital Output Standby Manual device connection to the FTA, if desired.

> **ATTENTION**
>
> When a digital output point indicates Standby Manual mode (**STDBYMAN**) on an operating display, such as Group or Detail, the output cannot be changed using that display. To set the point output to match the Digital Output Standby Manual device setting, the output point must be set using the IOP Slot Summary display.

6.7   HPMM or IOP Card Case Replacement

Handling and installing HPM components

ESD HAZARD

It is extremely important that you wear a properly connected Electrostatic Discharge (ESD) wrist strap while removing, handling, and installing these High-Performance Process Manager components. Follow the guidelines discussed in "ESD Guidelines for HPMM and IOP Cards" ("Removal and Replacement" section).

Disassembly/assembly procedure

To replace the plastic case on a card assembly, use the procedure in the following table.

Step	Action
1	Remove the card assembly from the card file. Place the card on a static free work surface.
2	Remove the two screws at the corners near the connector edge of the card as illustrated in Figure 206.
3	Lift the connector end of the card to approximate 30 degree angle with the case.
4	Lift the card from the plastic pins at the front left corners of the circuit board. If the card has a daughter board attached, the plastic pins are hidden under the daughter circuit board.
5	To insert the card in the new case, place the front of the card on the plastic pins while holding the card at approximately a 30 degree angle. If a daughter board is attached, the two alignment studs at the front edge of the case must fit between the two circuit boards. See Figure 206.
6	Lay the card flat on the work surface and replace the two screws removed in Step 2.
7	Check the alignment of the LEDs with the openings in the front of the plastic case for visibility.
8	Reinstall the card in the card file.

Card case illustration

Figure 206 Replacing HPMM or IOP Card Case
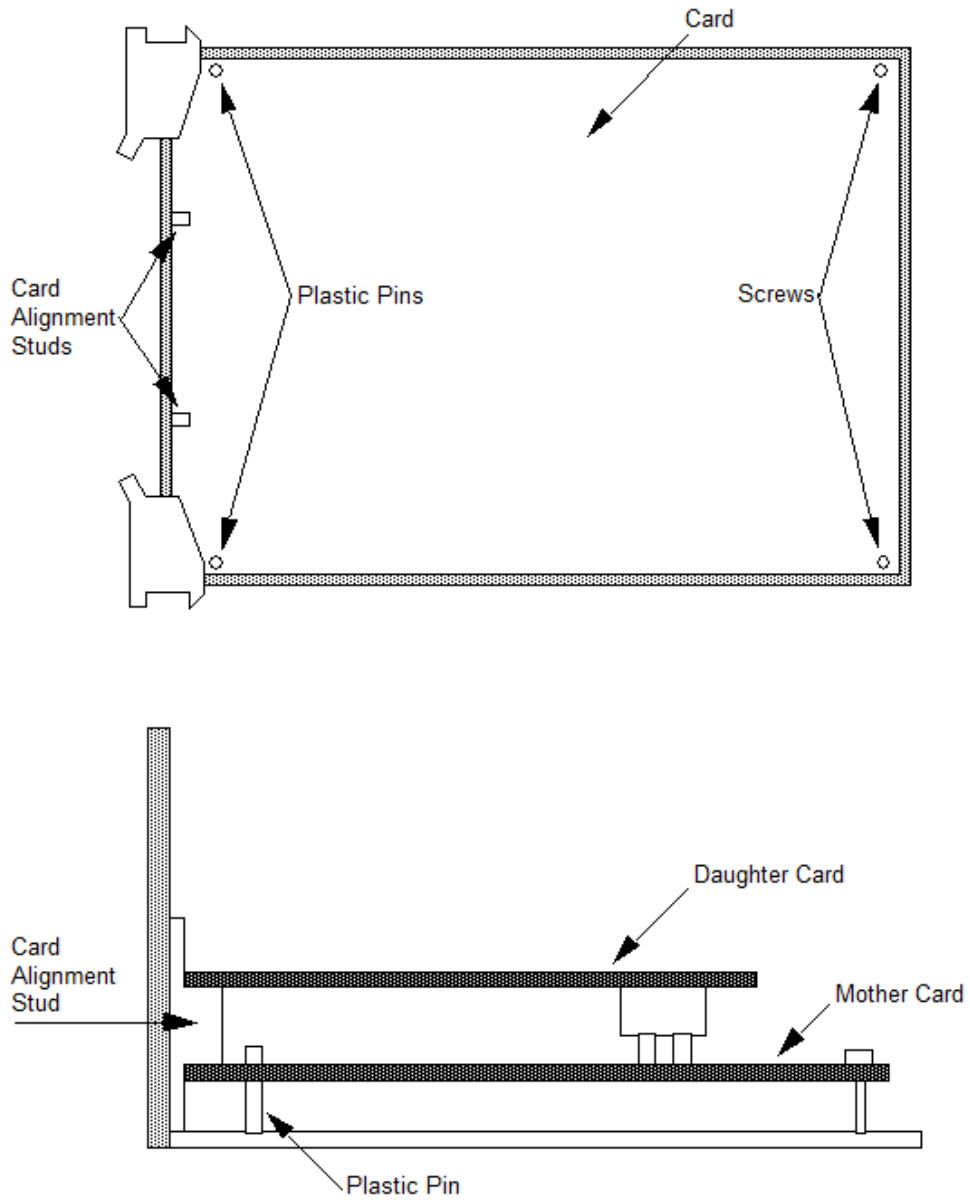
6.8   IOP to FTA Cable Replacement

Nonredundant IOP cable replacement

All outputs or inputs carried by the IOP to FTA cable, as well as 24 Vdc from the IOP that powers the FTA, will be disconnected when the cable is removed. The use of an Analog Output or Digital Output Standby Manual device may be appropriate to maintain the present outputs of an output type FTA. See the following subsections of the "Removal and Replacement" section for further discussion.

- AO Standby Manual Device Operation

Step	Action
1	Use the HPM Status display to restore the Checkpoints to the replacement IOP, to select RUN STATES, and to STARTUP the IOP.
2	For the IOP's first point that controls the channel 1 output level of the IOP, use the point's Detail or Group display to place the point in the Manual mode.
3	Use the IOP's slot summary display to adjust the first IOP output to match that of the Analog Output Standby Manual device as follows: (NOTE: the keyswitch access level must be in the SUPERVISORY position or the ENGINEER's position to perform this function); Select the slot, then select the slot's "OP", type in a value equal to the current output from the Standby Manual device for that slot, press the ENTER key. This allows the IOP to regain FTA output control and provide the same output level, if so desired, that existed before the Analog Output Standby Manual device established control.
4	When the output level for channel 1 matches the output level of the Analog Output Standby Manual device, place the **OUTPUT SOURCE SELECT** switch for channel 1 in the **PM** position. The IOP will now be controlling channel 1.
5	Use the point's Detail or Group display to select the Normal mode for the point.
6	Repeat steps 2 through 5 for IOP channels 2 through 8.
7	Disconnect the Analog Output Standby Manual device cable from the **STANDBY MANUAL** connector on the FTA, if desired.

- DO Standby Manual Device Operation.

Redundant IOP cable replacement

Before removing an IOP to FTA cable from a redundant IOP configuration, be sure that the FTA cable to be removed is not controlling analog output field terminals on the FTA or providing inputs. When the green **DS1** LED on an AO redundancy FTA is illuminated, the "B" FTA cable can be removed, since the "A" FTA cable is controlling the FTA output field terminals. When the green DS1 LED on an AO redundancy FTA is not illuminated, the "A" FTA cable can be removed, since the "B" FTA cable is controlling the FTA output field terminals. The HPM Status display at the Universal Station can also be used to determine whether the "A" or "B" FTA cable is controlling the FTA output field terminals.

For critical analog outputs, it is recommended that the "A" AO IOP be removed before the "A" FTA cable is removed. It is also recommended that the "B" AO IOP be removed before the "B" FTA cable is removed.

When removing FTA cables from High Level Analog Input (HLAI) IOPs, use the HPM Status display at the Universal Station to determine whether or not the cable being removed is being used to provide subsystem inputs.

FTA Replacement

> **ATTENTION**
>
> Remove power from the FTA by unplugging the IOP to FTA cable before disconnecting the process wiring.

Replacement procedure

Use the procedure in the following table to replace an FTA.

Step	Action
1	Unplug the cable(s) from the associated IOP card connector to the FTA at the FTA. Remove the field power serving the FTA to be replaced. Unplug the field wiring terminal-strip from the FTA. It is not necessary to unscrew the field wiring if compression terminals are used.
2	Remove the screws that hold the FTA to the mounting channel. Carefully remove the FTA.
3	Compare the replacement FTA with the removed FTA. Be sure any 250 ohm or zero-ohm resistors that have been clipped on the removed FTA are also clipped on the replacement FTA. Be sure all fuses are in place and jumpers are properly positioned.
4	Install the replacement FTA with the screws that were removed in step 2. Rotate them counterclockwise until they fall into the original threads, then tighten them clockwise. Reconnect the field wiring terminal connector and the cable from the associated IOP card(s).

ATTENTION

Connecting the HPMM's High-Performance I/O Link card to an FTA through its backpanel connector causes continuous I/O Link errors to occur.

Connecting the HPMM's High-Performance Comm/Control card to an FTA through its backpanel connector could cause damage to the HPMM card set as well as the backpanel.

Inserting an HPM UCN Interface module in slot 1 (slot 9 in a Right 7-Slot card file) with an IOP present in the slot and configured as IOP A causes an IOP Configuration Mismatch status. IOP A erroneously determines that it is connected to the FTA B connector.

6.9   FTA Module and Relay Replacement

Replacement procedure

> ⚠ **SHOCK HAZARD**
>
> Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Modules and relays plug into the FTA circuit boards and are held in place by a retaining screw(s). Use the procedure in the following table to replace a module or relay.

Step	Action
1	Remove the screw(s) holding the module or relay to the circuit board and then firmly lift it straight away until it is free.
2	Align the replacement module or relay with the holes and connector on the FTA circuit board before inserting it. Replace the retaining screw(s).

LLAI Module replacement

The LLAI plug-in module can be replaced while power is applied to the FTA. After replacement, power initialize the LLAI IOP. The initialization will initiate a background diagnostics. Allow at least two (2) minutes for it to complete before analyzing the results.

AO redundancy switching module replacement

Before removing the Analog Output (AO) Redundancy Switching Module from an AO Redundancy FTA for testing or replacement, be sure that the associated "A" AO IOP is controlling the FTA outputs. When the green **DS1** LED on the FTA is illuminated, the associated "A" AO IOP is controlling the FTA's output. The HPM Status display at the Universal Station also can also be used to determine if the "A" AO IOP is controlling the FTA output.

For critical analog outputs, it is recommended that the "B" AO IOP be removed, or an Analog Output Standby Manual device be connected before removing the Analog Output Redundancy Switching Module.

SDI/SI module and fuse replacement

Before attempting to replace any components on a Serial Device Interface (SDI) or Serial Interface (SI) FTA, remove power from the FTA by loosening the captive screws on the connector J1 and removing the connector. After power has been removed from the FTA, module M1 and fuses F1 and F2 can be removed and replaced as applicable.

When the removal/replacement process is complete, reconnect J1 and tighten the captive screws. As power is applied to the FTA, the FTA will initiate background diagnostics, followed by normal FTA operation.

Galvanic isolation module replacement

If the field device, controlled by a Galvanic Isolation Module that must be replaced, is an output device, be sure the loss of control is acceptable. Also, when the environment is Division 2, be sure the atmosphere is nonhazardous.

The module can be removed and replaced while power is applied to the FTA. Remove the module's pluggable field connector. Loosen the screws that retain the module. Lift the module from its connector on the FTA and replace it. Reinstall the pluggable field connector.

6.10 Card File Replacement

Replacement procedure

Use the procedure in the following table to replace a card file.

⚠️ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Step	Action
1	Disconnect all cables attached to the card file.
2	Remove the side plates connecting the card file to the card file above and/or below by first removing the two screws at the inside of the panel.
3	Loosen, but do not remove, the four screws holding the card file to its supports.
4	Grasp the card file firmly and lift it about 1 cm (1/2 inch) to release the card file into your hands.
5	Install the replacement card file in a reverse manner, making sure it is engaged by all four mounting screws. Tighten the screws when the card file is in place. Reconnect the cables that were disconnected in step 1.

6.11 Power System

Introduction

The subsections that follow describe the removal and replacement of major assemblies in the Power System.

If all options are installed, most of the major assemblies in the Power System can be removed and replaced while the HPM remains in operation because of Power Supply Module redundancy and battery backup power. Observe all precautions mentioned in this text when replacing the Power System components.

⚠️ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

⚠️ **CAUTION**

Batteries may contain toxic materials that are not biodegradable. Batteries should be disposed of safely in accordance with local laws and regulations.

6.12 CMOS Battery Replacement

NiCad batteries

The three NiCad batteries that are installed in the Standard Power System to provide standby power for the CMOS memory have a tendency to age over a period of time. Aging occurs even if the batteries have been regularly recharged throughout their lifetime. For this reason, the NiCad batteries should be replaced after every two years of operation.

Alkaline batteries

The alkaline batteries that are installed in the AC Only Power System are not rechargeable and, therefore, must be replaced more often. A six month replacement cycle is suggested, unless an equipment power failure has occurred for a prolonged period. Then, the batteries should be replaced.

Replacement procedure

To replace the NICad batteries, use the procedure in the following table.

Step	Action
1	Remove the old batteries from the battery holder and replace them with fresh ones. It is not necessary to remove power from the batteries while they are being replaced.
2	Observe and match the polarity marked on the case of each battery and the holder. After all the batteries are in place, rotate each one slightly with your finger to assure it makes good contact with the holder.

6.13 48 V Backup Battery Replacement

Battery operational and service life

The lead acid batteries provide 20 minutes of standby power for the HPM Power System and have a normal stand-by service life of 4 to 5 years. However, usage and high environmental temperatures will reduce the service life. For this reason, environmental temperature, battery storage time, and battery usage should be monitored and recorded. In the absence of this attention, it is recommended the battery performance be checked on a yearly basis, or be replaced every 3 years to insure proper performance.

Battery performance

All batteries of the same capacity, rating, and specifications, do not provide equivalent performance or reliability. For optimum system backup realization, use only Honeywell recommended and approved batteries.

48 V Battery Pack end-of-life

The battery end-of-life is defined as the time when the battery capacity, meaning its ability to accept and hold a charge, has decayed to 60% of the original capacity. There are several factors that determine useful service life. The standby service life is reduced by events other than a continual 20 degrees C standby condition and is defined as follows.

- Standby (float) service life means that the batteries are connected to a charger and only occasionally discharged. Honeywell 48-volt batteries are designed to operate in standby (float) service for 4 to 5 years at 20 degrees C. The service life of a battery can be shortened by an improper charging voltage. The charging voltage from the Power Supplies should be checked every 6 months for the proper voltage level. See subsection "Power Supply Module Replacement" ("Removal and Replacement" section) for the recommended procedure.

- As shipped from Honeywell, the batteries are fully charged. However, if a system is stored in a nonpowered state, the batteries will self-discharge and can become unusable. The time required for this to happen is a function of storage temperature.

0 degrees to 20 degrees C	12 months
21 degrees to 30 degreesC	9 months
31 degrees to 40 degreesC	5 months
41 degrees to 50 degreesC	2.5 months

- Batteries should not be left in a discharged condition for extended periods of time, as this strongly affects the ability of the battery to accept a charge thereafter. The batteries should be charged periodically if they are stored or in an nonpowered system.

- The HPM provides proper charging current to the batteries while the subsystem is powered up and running. Whenever ac power is removed from the subsystem, the Power System automatically draws power from the batteries to maintain the subsystem's 24 Vdc power. Anytime the system is intentionally shutdown and left nonpowered, the **BATTERY** switch at the front of the Power System assembly should be placed in the **OFF** position to prevent discharge of the batteries.

- Service life is directly reduced by high ambient temperature. Heat destroys batteries. While the operating temperature range is -15 degrees C to 50 degrees C, maximum service life will be realized when the batteries are operated in an ambient of 20 degrees C. Brief usage, that is, a few days, at higher temperatures will have no adverse effect on the service life. However, if such usage is over extended periods of time or occurs repetitively (such as a environment that is not air-conditioned), the service life will be reduced. This reduction may be as much as 20% of service life (1 year) for each 10 degrees C above the reference ambient of 20 degrees C.

48 V Battery Pack service life

- Service life is reduced by the number of discharges and the depth of each discharge. The batteries can provide 200 cycles at 100% depth of discharge, 550 cycles at 50% depth of discharge, 1200 cycles at 30% depth of discharge, or 2000 cycles at 10% depth of discharge. This effect is superimposed on the standby aging effect stated above.

- With an expected 5 year life, 200 cycles would represent one power outage approximately every 9 days, or approximately 2000 ampere-hours of 24 Vdc subsystem backup.

Battery charge voltage check procedure

Use the procedure in the following table to verify that the output voltage to the 48 Volt Battery Pack is proper.

Step	Action
1	Locate the test points marked "**COMMON**" (-) and "**BATTERY**" (+) at the front of the primary Power Supply Module and connect a dc voltmeter with an accuracy of +/- 0.05 volts across the test points.
2	The voltage should read between 54.0 volts minimum to 55.2 volts maximum at 20 degrees C. For each degree the battery enclosure temperature deviates from 20 degrees C, the following adjustments in Power Supply Module's battery charge output voltage are applicable. Above 20 degrees C, the battery charge voltage limits are decreased by 72 mv/deg C. Below 20 degrees C, the battery charge voltage limits are increased by 72 mv/deg C. If the charge voltage is outside of these limits, replace the module.
3	This step and step 5 should be performed during plant shutdowns since it requires disconnecting the battery pack and placing the redundant Power Supply Module's power switch in the **OFF** position. Disconnect the battery pack. With the voltmeter connected to the primary Power Supply Module's battery test points, place the redundant Power Supply Module's power switch in the **OFF** position. The voltage should not fall below the minimum voltage specified in step 3. If it does, replace the redundant Power Supply Module.
4	Place the redundant Power Supply Module's power switch in the **ON** position. Move the test leads to the battery test points on the redundant Power Supply Module and place the primary Power Supply Module's power switch in the **OFF** position. The voltage should not fall below the minimum voltage specified in step 3. If it does, replace the redundant Power Supply Module.
5	Reconnect the battery pack to the Power System.

End of Battery Pack life check

The battery pack can be checked for the end of its life by using the procedure in the following table.

Step	Action
1	Set the **BATTERY** switch on the power system control panel in the **OFF** position. Remove the Power System's lower cover. You can use either a screwdriver or a coin to remove the two screws holding it in place.
2	Release the Power System cord connector at the battery.
3	Disconnect the battery pack from the subsystem.
4	Attach two pairs of leads to the battery pack terminals. One pair of leads are for attaching a load resistor and must be a minimum of 1.0 mm^2 (18 AWG) wire. The second pair is for attaching a voltmeter and can be a smaller gauge.
5	Select a voltmeter range of 60 Vdc for monitoring the battery voltage. Attach the voltmeter to the smaller gauge leads.
6	The battery load for the test must be 5 ohms and rated at 500 watts. Five 1-ohm, 100-watt resistors placed in series is recommended.
7	Attach the resistors to the larger test leads. Note the time of attachment.
8	The battery voltage must remain above 40 Vdc for a minimum of 20 minutes. If the battery voltage is not maintained, the battery is considered at the end of its life and must be replaced.
9	All batteries of the same capacity, rating, and specifications, do not provide equivalent performance or reliability. For optimum battery backup performance, use only Honeywell recommended and approved batteries.

Battery pack removal

Using the following procedure will cause alarms to go off, so be sure to notify Plant Operations in advance that an alarm will occur.

Use the procedure in the following table to remove the battery pack.

Step	Action
1	Set the **BATTERY** switch on the power system control panel to the **OFF** position. Remove the Power System's lower cover. You can use either a screwdriver or a coin to remove the two screws holding it in place.
2	Release the Power System cord connector at the battery.
3	Remove two screws holding the front lip of the battery pack to the base of the Power system chassis.
4	Move the Power System cord out of the way so it will not be damaged when the battery pack is removed.
5	Slowly slide the battery pack out into your hands, but be careful, the pack is heavy.

Battery Pack installation

Use the procedure in the following table to install a Battery Pack.

Step	Action
1	Slide the new battery pack into the Power System chassis, being careful not to damage the battery pack connector cord within the compartment.
2	Secure the pack by replacing the two screws through the front lip of the pack into the base of the chassis.
3	Connect the pack to the system by inserting the polarized battery pack plug into the polarized connector cord in the compartment. Carefully dress the cord and connectors to prevent damage.
4	Replace the metal cover.
5	Apply power to the battery by switching the **BATTERY** switch to the on position. Unless it is already in a charged condition, the battery pack may need to be initially charged for 16 hours before it will be capable of sustaining power to the High-Performance Process Manager.

6.14 Power Supply Module Replacement

Introduction

Provided the optional redundant Power Supply Module is installed, the HPM will remain in operation while replacing a Power Supply Module. Be sure to notify Plant Operations that you will cause alarms during the replacement process.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

CAUTION   If the system is operational, do not remove both Power Supply Modules at the same time**.**

The batteries will not power the system unless at least one Power Supply Module is present.

If one of the Power Supply Modules fails, the batteries will not be drained.

ATTENTION

If the primary (left side) Power Supply Module is removed from the system or turned off, the 6 Vac is not provided to the card files because the redundant Power Supply Module does not provide 6 Vac. This can cause a Soft Failure Alarm Notification for any LLAI card that is present.

Replacement procedure

Use the procedure in the following table to replace a Power Supply Module. The procedure assumes that redundant Power Supply Modules are in use.

Step	Action
1	If the Power Supply Modules have ac present (**AC In** LED on), the **BATTERY** switch can be placed in the **OFF** position. Place the **BATTERY** switch in the **OFF** position before removing the Power Supply Module. Set the recessed toggle switch on one, and only one, Power Supply Module in the down (**OFF**) position. Remove two screws at the bottom of the module that hold it to the shelf of the Power System chassis.
2	Pull the Power Supply Module straight out of the housing.
3	Before installing the replacement Power Supply Module, be sure the recessed toggle switch is in the **OFF** position.
4	Carefully slide the replacement module into the Power System chassis. Don't slam it into its housing. Be careful and be sure that the contacts at the back of the module mate properly with the fixed contacts at the back of the Power System backpanel.
5	Secure the replacement module with two screws at the bottom of the module, then set the recessed toggle switch to the **ON** position. Check that the green indicators on the supply are operating satisfactorily and that alarms can be reset.
6	Place the **BATTERY** switch in the **ON** position.

6.15 CMOS Backup Assembly Replacement

Introduction

Replacement of the CMOS Backup Assembly requires the removal of the redundant (right side) Power Supply Module. See subsection "Power Supply Module Replacement" ("Removal and Replacement" section) for removal of the Power Supply Module.

Figure 33 and Figure 34 are illustrations of the CMOS Battery Backup assembly, and Figure 31 and Figure 32 illustrate the layout of the Standard Power System backpanel with the location of the CMOS Battery Backup assembly connector.

Replacement procedure

Use the procedure in the following table to replace the CMOS Backup assembly.

Step	Action
1	Remove the screw located at the front middle of the CMOS Backup Assembly.
2	Extract the circuit board from the Power System backpanel assembly.
3	Insert the replacement circuit board in the connector on the Power System backpanel assembly and fasten the screw.

6.16 Cabinet

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Cabinet side panels (Markhon)

To remove the cabinet side panels, either for cabinet complexing or for service requirements, remove the two external Phillips screws, lift up on the side panel approximately 1 to 2 inches, and pull the panel outwardly. If the panel does not release, additional lifting of the panel may be required.

Cabinet side panels (Rittal)

To remove the cabinet side panels, either for cabinet complexing or for service requirements, remove the six internal Phillips screws, lift up on the side panel approximately 1 to 2 inches, and pull the panel outwardly. If the panel does not release, additional lifting of the panel may be required.

6.17 I/O Link Extender Optical Coupler Module Replacement

Introduction

Before removing a defective fiber Optical Coupler module, it is necessary to remove its associated I/O Link Extender card to prevent the transmission of erroneous signals on the I/O Link.

Replacement procedures

There are two replacement procedures. They depend upon whether the Fiber Optic Coupler module is mounted in a non-CE Compliant card file or a CE Compliant card file. The CE Compliant card file requires an adapter kit because of the IOP connector ground plate.

Select the appropriate procedure from the two procedures that follow.

Non-CE Compliant replacement procedure

Use the procedure in the following table to replace the I/O Link Extender Coupler when it is installed in a non-CE Compliant card file.

Step	Action
1	Grasp the upper and lower extractors on the I/O Link Extender card and pull them outward in unison. Move the card toward you until the card is disengaged from the card file backpanel connector. It is not necessary to remove the card from the card file.
2	Disconnect the fiber optic cables from the Fiber Optic Coupler module. Be sure the cables are properly labeled.
3	Using a screwdriver with a small blade, loosen the two screws that secure the Fiber Optic Coupler module to the backpanel connector. Grasp the module firmly in your hand and pull it towards you. Place the module on an antistatic surface or in an antistatic container.
4	Replace the defective module by reversing step 3.
5	Reconnect the fiber optic cables to the module.
6	Reinstall the I/O Link Extender card by reversing step 1.
7	When you replace a Standard I/O Link Extender Fiber Optic Coupler module, you must initialize both ends of the link(s) by manually resetting the I/O Link Extender cards using the upper card extractor on the card. When a Long Distance I/O Link Extender Fiber Optic Coupler module is replaced, reinstalling either I/O Link Extender card produces initialization at both ends of the link.

CE Compliant replacement procedure

Use the procedure in the following table to replace the Fiber Optic Coupler module when the coupler is installed in a CE Compliant card file.

| Step	Action
1	Grasp the upper and lower extractors on the I/O Link Extender card and pull them outward in unison. Move the card toward you until the card is disengaged from the card file backpanel connector. It is not necessary to remove the card from the card file.
2	Disconnect the fiber optic cables from the Fiber Optic Coupler module. Be sure the cables are properly labeled.
3	Using a screwdriver with a small blade, loosen the two screws that secure the fiber optic coupler to the backpanel connector. Grasp the module firmly in your hand and pull it towards you. The adapter connector that is between the Fiber Optic Coupler module and the backpanel connector may remain in place in the backpanel connector or disengage with the module. See Figure 207 for an illustration of the Fiber Optic Coupler module components. Remove the adapter connector from the module and place the module on an antistatic surface or in an antistatic container.
4	Replace the defective module by reversing step 3.
5	Reconnect the fiber optic cables to the module.
6	Reinstall the I/O Link Extender card by reversing step 1.
7	When you replace a Standard I/O Link Extender Fiber Optic Coupler module, you must initialize both ends of the link(s) by manually resetting the I/O Link Extender cards using the upper card extractor on the card. When a Long Distance I/O Link Extender Fiber Optic Coupler module is replaced, reinstalling either I/O Link Extender card produces initialization at both ends of the link.

Coupler adapter kit

The following figure is a pictorial of the Fiber Optic Coupler module adapter kit.

Figure 207 I/O Link Extender Fiber Optic Coupler Module Adapter Kit Pictorial
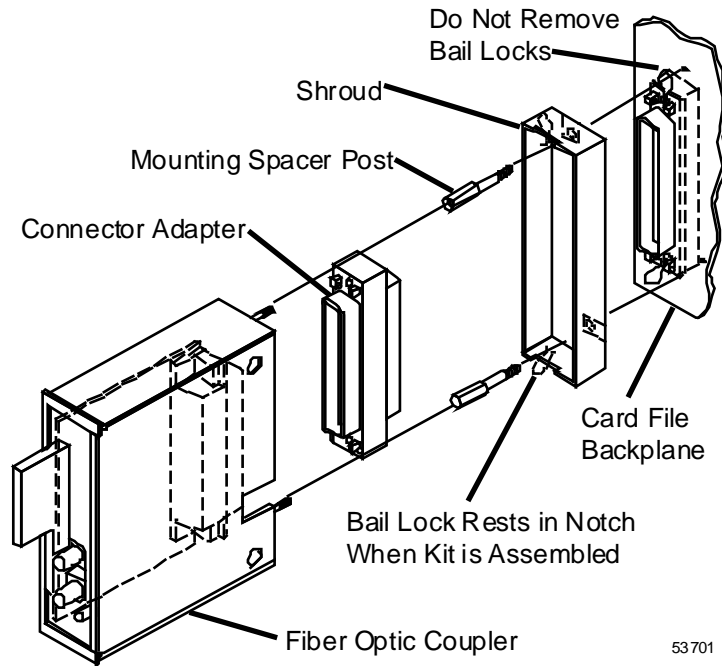
6.18 Power Backup Module Replacement

	SHOCK HAZARD
⚡	Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

	SHOCK HAZARD
⚡	Residual voltage may be present on the Power Backup Module after it is removed from the card file.

Use the procedure in the following table to remove and replace the Power Backup Module.

Step	Action
1	When removing the Power Backup Module, first connect your ESD wriststrap to the cabinet's ground bar.

2   Power Backup Module can be removed by simultaneously pulling on the upper and lower extractor levers. When the upper extractor is first moved, power is disconnected from the card. Further operation of both extractors moves the card away from its backpanel connector.

3   After the card is free from the connector, carefully slide it out on the card rails and into your hands. Immediately place the module in a static-safe pouch for transport.

4   When installing the Power Backup Module, first connect your ESD wrist strap, then remove the card from its pouch.

5   Before installing the Power Backup Module, ensure that C300PM module is fully inserted in the first slot of card file.

6   Power Backup Module is always installed in the second slot of card file adjacent to C300PM. Carefully slide the Power Backup Module onto the card rails, checking to be sure that the card is inserted in both rails.

7   Slide the module into the card file until it has made contact with the backpanel connectors. Then firmly press on the front of the card with the heel of your hand. Do not use excessive force! If the card does not slip easily into its connectors, remove the card, and locate the source of the obstruction. Check for bent contacts at the backpanel connectors.

7. IOP Calibration Procedures

7.1 Overview

Introduction

This section describes the calibration procedures used to calibrate the High-Performance Process Manager's (HPM's) IOPs.

⚡ SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Calibration may require more than one switch to deenergize units before calibration.

No manual adjustments

There are no manual adjustments, such as Power Supply Module settings in the HPM. However, there are some semiautomatic calibration procedures for the Low Level Analog Input (LLAI), High Level Analog Input (HLAI), and Analog Output (AO) subsystems that may be required periodically.

CAUTION   Do not attempt recalibration without the proper equipment and a working knowledge of the equipment.

7.2 LLAI, HLAI, and AO IOP Calibration

Common Calibration Procedures

Each LLAI, AO, and HLAI subsystem maintains on-board calibration constants for each analog channel that is stored in nonvolatile memory. Field calibration can probably be an annual event or more often during a plant or unit shutdown, if necessary.

IOP or FTA substitution

Honeywell recommends that if possible, substitution be used when it is suspected that an IOP or FTA is out of calibration, rather than recalibrate the IOP or FTA in an on-line HPM.

7.3   Equipment Required

Precision equipment is a necessity

You will need precision equipment to accurately recalibrate these subsystems.

CAUTION	Do not attempt recalibration without proper equipment and working knowledge of the equipment.

The following table lists typical precision test equipment that can be used.

Table 85 Typical Precision Test Equipment

Item	Tolerance	Vendor	Model
Programmable Voltage Source: **(with 10 V and 100 mV range)**	±(0.002% setting + .0005% range +3 μV)	Electronic Development Co. 11 Hamlin Street Boston, MA 02127	501 J1 (with option D)
Precision Resistors: **100 ohm** **500 ohm** **2000 ohm**	± 0.005% ± 0.005% ± 0.005%	C. T. Gamble 605 Perkins Lane Delanco, NJ 08075	1608AL or 1608PC for each
Digital Multimeter with **10 V range (1 μV/count) and** **100 mV range (0.1 μV/count)**	± 0.0025 reading + 40 counts	John Fluke Mfg. Co., Inc. PO Box C9090 Everett, WA 98206	8505A

Equipment requirements

The following equipment requirements are recommended.

- A precision voltage source and a Digital Multimeter is required for thermocouple, voltage, and current calibration.

- A precision thermocouple simulator is required to verify the accuracy of the thermocouple inputs.

- A precision resistor of the appropriate value is required for each RTD input to be calibrated.

7.4   LLAI IOP Calibration Procedure

CAUTION

There is a risk of electric shock when performing the procedures in this section.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Seven ranges

The Low Level Analog Input has seven different ranges that require calibration on a per slot basis, and a special range type for its reference junction calibration. At any one time, only one of the given gain ranges is being used by a given slot. Each range usage is independent from another slot's usage (for example, performing a calibration for one range does not affect the calibration constants of another range).

Calibration affects eight slots

Although the LLAI performs calibration on an individual slot basis, only calibration affecting all eight slots can be performed.

Range type selection

Calibration of a slot assumes that the range type selected is applied to the slot. The range type is internally derived from the slot's current configuration of sensor type (**SENSRTYP**), PV character (**PVCHAR**), and thermocouple range option (**TCRNGOPT** for a thermocouple input).

ATTENTION

The user is responsible for reconfiguration of the slots so that the input voltage or resistor applied to each channel is appropriate for the configuration. Any violation, due to a configuration mismatch during calibration, will result in calibration abort errors.

CAUTION   Although mixed ranges of calibration are allowed, never configure slot 1 as an RTD input if there is at least one slot configured for a thermocouple. This is because the reference junction for a thermocouple input is connected to slot 1.

Select RTD or TC calibration

When performing RTD calibration, all eight points must be configured as RTD. The same is true when performing thermocouple calibration. All eight points must be configured as thermocouple.

Performing calibration sequences

CAUTION   When performing the following calibration sequences, be sure to use only high-quality solid copper wire for all the wire jumpers and voltage source wires to the FTA's inputs. Failure to use high-quality solid copper wire can result in calibration errors and reduced accuracy.

An excellent source of high-quality solid copper wire is the copper wire conductor of type-T thermocouple wire (usually color-coded blue).

Calibration procedure

To calibrate, perform the following steps.

Step	Action
1	Each LLAI IOP card and FTA has been calibrated at the factory for all input types. If recalibration must be performed in the field, power must be applied to the LLAI for at least 30 minutes for temperature stabilization before starting the calibration. The calibration procedure calibrates all channels on one FTA simultaneously, rather than each channel singularly. Have the operator place the IOP card in an Idle state using the HPM Detail Status display.
2	If the FTA has screw terminal strips, temporarily remove the plastic cover. Remove the field wiring from the FTA and substitute "zero input" sources for all channels. These inputs are short <u>copper</u> wire jumpers across the input terminals. Refer to Figure 208 Zero Calibration Circuit – TC and All Linear Zero Circuits and Figure 209 Zero Calibration Circuit – RTD ZeroCu: 10 Ohm, Pt: 100 Ohm, Ni: 120 Ohm as appropriate.

Figure 208 Zero Calibration Circuit – TC and All Linear Zero Circuits

Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs
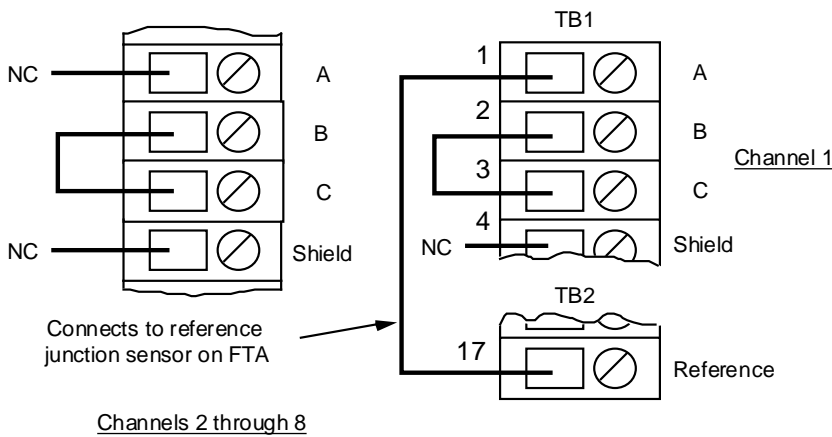
Model MU/MC-TAIL03 FTA

Figure 209 Zero Calibration Circuit – RTD ZeroCu: 10 Ohm, Pt: 100 Ohm, Ni: 120 Ohm

Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs

A

B

C

Shield

NC

Channels 1 through 8

TB2
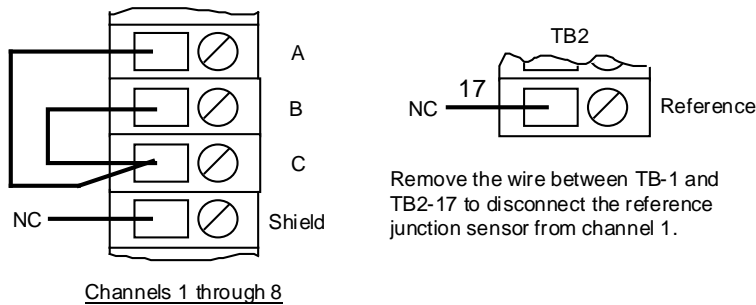
NC ─ 17 ─ Reference

Remove the wire between TB-1 and TB2-17 to disconnect the reference junction sensor from channel 1.

Model MU/MC-TAIL03 FTA

A

B

C

Shield

NC

Channels 1 through 8

P1

1   2   3
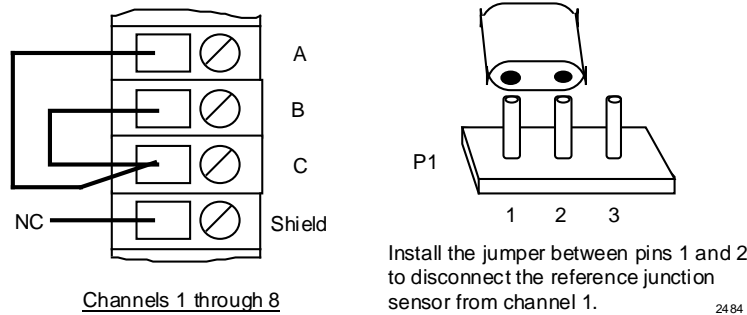
Install the jumper between pins 1 and 2 to disconnect the reference junction sensor from channel 1.

2484

Step	Action
3	Select the **ENABLE CALIBRATION** (or **ENABLE RJ CALIBRATION** if an RJ calibration is being performed) target on the Detail Status display for the LLAI. The **ENABLE CALIBRATION** target changes to the **DISABLE CALIBRATION** target.
4	Momentarily short the two square calibrate pads in the upper-left corner of the FTA under test, as shown in **Figure** 210**. Now check the** STATUS **indicator (DS1) on the associated LLAI FTA. You will find it extinguishes immediately, then comes back on in approximately 30 seconds. During this time, the IOP card has performed its "zero input" calibration.**

Figure 210 LLAI FTA Showing DS1 Status Indicator and Calibration Pads
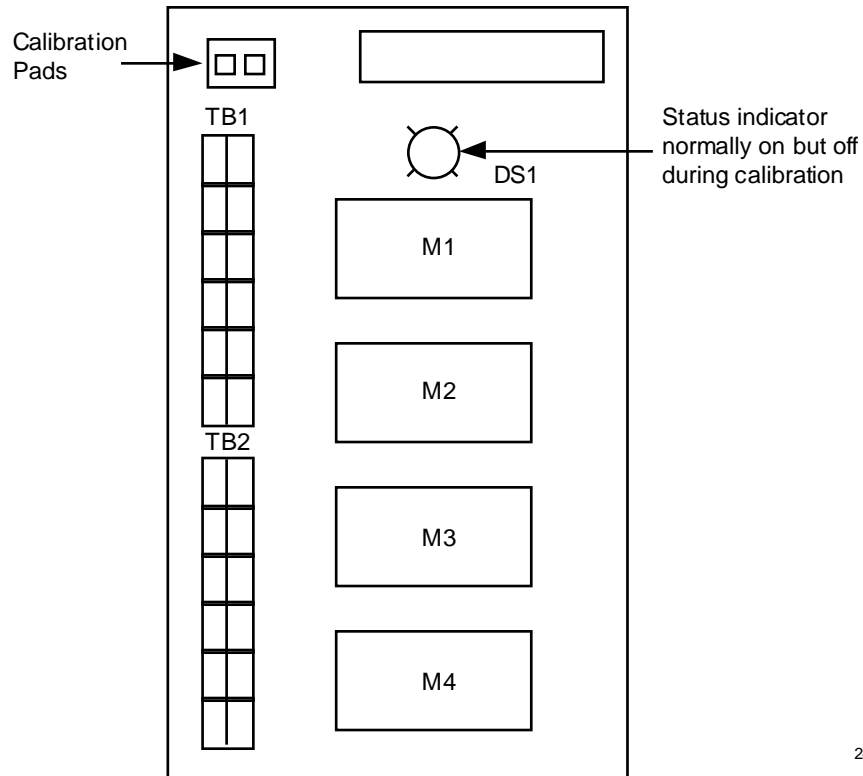
Step	Action
5	Remove the "zero inputs" and replace them with full-scale signals. Refer to **Figure 211 and Figure 212 for the full scale input value and the connection to the screw or compression terminals.**

Figure 211 Full Scale Calibration Circuit – TC and All Linear Full Scale Circuits

Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs

Model MU/MC-TAIL03 FTA
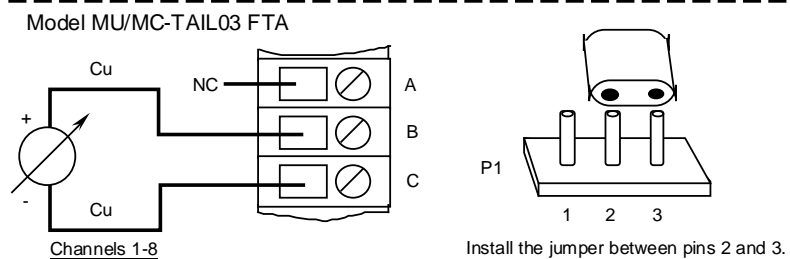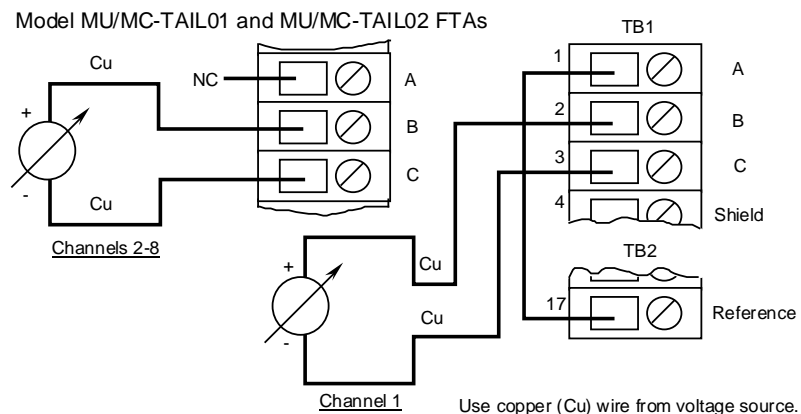
User Input Device		Full-Scale Calibration Values	
		Normal Range	Extended Range
Input Voltage:	0-100 mVdc	100 mV	N/A
	0-5 volt	5 V	N/A
Current Input:	4-20 mA	20 mA (5 V)	N/A
	10-50 mA	50 mA (5 V)	N/A
Themocouple:	ANSI J	40 mV	100 mV
	ANSI K	40 mV	40 mV
	ANSI E	40 mV	100 mV
	ANSI T	40 mV	40 mV
	ANSI B	20 mV	20 mV
	ANSI S	20 mV	20 mV
	ANSI R	20 mV	20 mV
	Japanese Type R	20 mV	20 mV

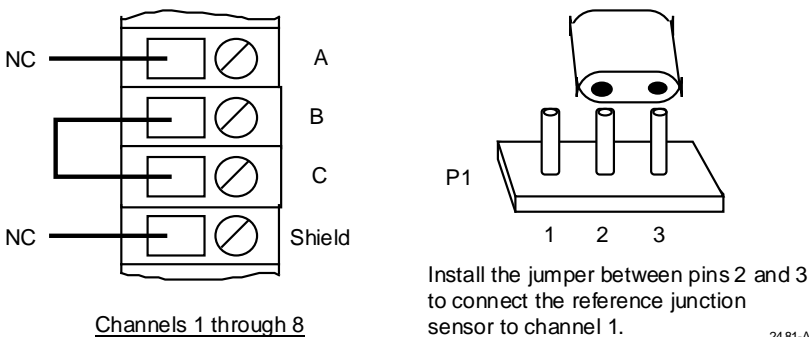**Figure 212 RTD Full Scale Calibration Circuit Cu: 10 Ohm, Pt: 100 Ohm, Ni: 120 Ohm**
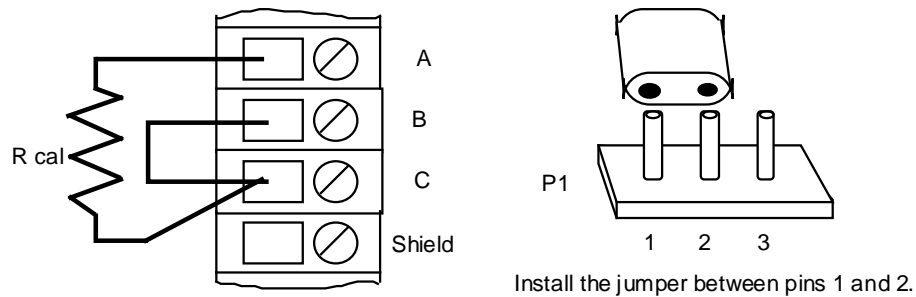
Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs

Remove the wire between TB-1 and TB2-17.

Model MU/MC-TAIL03 FTA

Install the jumper between pins 1 and 2.

Note:

Be sure there is one wire connected to the "A" terminal and one wire connected to the "B" terminal. There should be two wires connected to the "C" terminal.

RTD Input Type	Precision Resistor (R cal) Value
Cu: 10 Ohm	100 Ohm
Pt: 100 Ohm	500 Ohm
Ni: 120 Ohm	500 Ohm 2485

Step	Action
6	Again, momentarily short the calibration pads at the upper-left corner of the FTA under test, then check the **STATUS** indicator (DS1) on the LLAI. The **STATUS** indicator remains extinguished for approximately 30 seconds while the IOP card performs its "full-scale" calibration.
7	If a thermocouple input is connected to the LLAI subsystem, it is recommended that you recalibrate the Reference Junction (RJ) input each time the thermocouple is recalibrated. Only channel 1 requires a zero ohm jumper connected to it.
	Connect a zero-ohm jumper to channel 1 as illustrated in Figure 213. Repeat steps 3 and 4.
	Connect a 2 kohm resistor jumper to channel 1 as illustrated in Figure 214. Repeat step 6.

RJ calibration circuit for RJ zero

Figure 213 RJ Calibration Circuit – RJ Zero

Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs
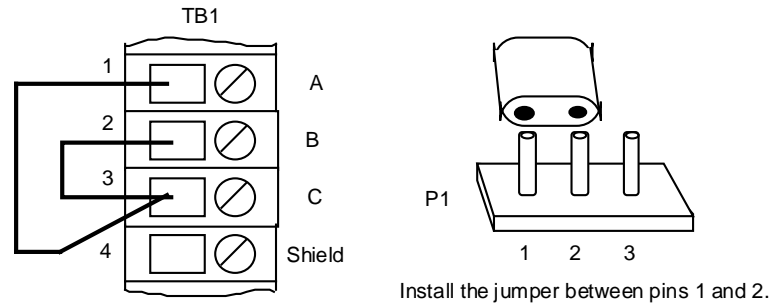
Remove the wire between TB-1 and TB2-17.

Model MU/MC-TAIL03 FTA

Install the jumper between pins 1 and 2.

Note:

Be sure there is one wire connected to the "A" terminal and one wire connected to the "B" terminal.   There should be two wires connected to the "C" terminal.

Calibrate any time the thermocouple calibration is done. Make the connections to the terminals for channel 1 only.   2486

RJ calibration circuit for RJ full scale

Figure 214 RJ Calibration Circuit – RJ Full Scale

Model MU/MC-TAIL01 and MU/MC-TAIL02 FTAs
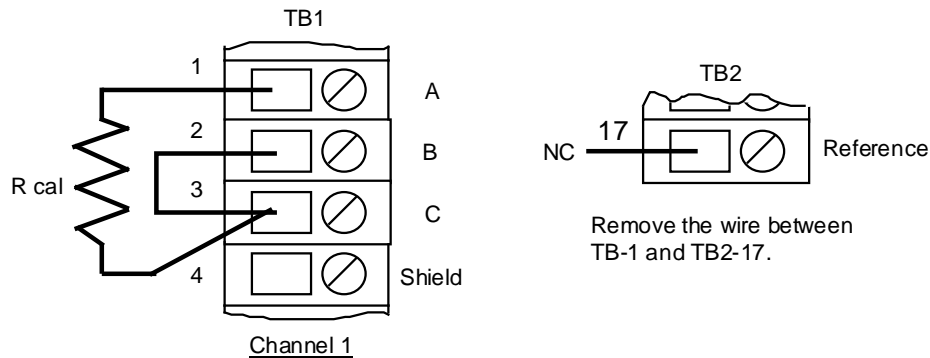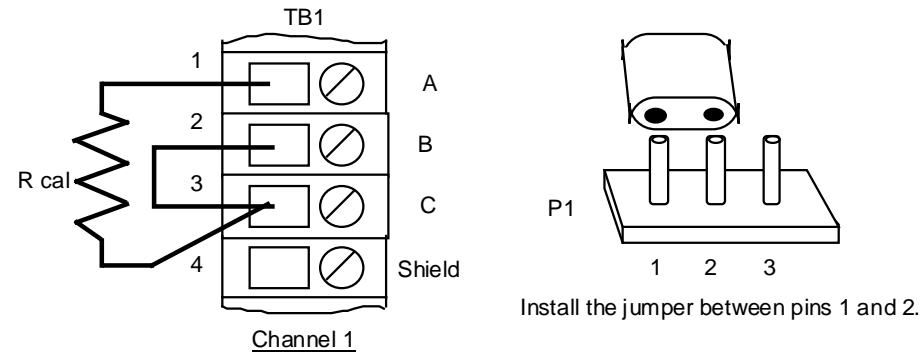
Model MU/MC-TAIL03 FTA

Note:

Be sure there is one wire connected to the "A" terminal and one wire connected to the "B" terminal. There should be two wires connected to the "C" terminal.

Calibrate any time the thermocouple is done calibrated.

R cal = 2 kohm precision resistor. Be sure the connection is made to only the terminals for channel 1.

2487

Step	Action
8	Ensure that the calibration target on the LLAI Detail Status display has changed back to **ENABLE CALIBRATION**, indicating that the zero and span calibration process has completed.
9	Check the LLAI IOP card for Soft failures. If a Soft failure occurred, find the source of the failure, correct it, and repeat the calibration procedure. If none occurred, remove the test equipment from the FTA and reconnect the field wiring. If the FTA has screw terminal strips, replace the plastic cover over the strips.
10	Inform the operator that the LLAI subsystem can be returned to on-line operation.

7.5   Nonredundant HLAI IOP Calibration Procedure

CAUTION

There is a risk of electric shock when performing the procedures in this section.

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Introduction

The following calibration procedure is written for the nonredundant model MU-TAIH02 or MU-TAIH03 HLAI FTA, but the procedure can also be used for the redundant model MU-TAIH12, MU-TAIH13, MU-TAIH22, MU-TAIH23, MU-TAIH52, MU-TAIH53, MU-TAIH62, MU-GAIH12/82, MU-GAIH13/83, MU-GAIH14/84, and MU-GAIH22/92 FTAs.

Galvanic isolation FTA connection points

The connection points for the calibration voltage source and the shorting location that starts the calibration differs for the model MU-GAIH12/82, MU-GAIH13/83, and MU-GAIH14/84 Galvanically Isolated FTAs. Because of circuit density on the FTA board assembly, IOP calibration terminals, similar to those on a standard FTA, could not be added to the assembly. Instead, unused pins in the FTA's 50-pin auxiliary connector, J19, provide a calibration interface for the Galvanic Isolation HLAI Calibration tool, Honeywell part number 51201450-100. The following table lists the voltage input pins and calibration start pins.

Table 86 Galvanically Isolated HLAI Calibration Connector Pins

Description	Pins
Primary IOP Voltage Source	19 (+) and 44 (-)
Secondary IOP Voltage Source	20 (+) and 45 (-)
Calibration Start (Short together)	21 and 46

Calibration terminals

The signals required for calibration of the HLAI IOP are provided at the screw terminals at the end of the tool's cable when the cable is connected to the auxiliary connector on the HLAI FTA. The calibration procedure is the same procedure used for the standard HLAI FTA.

Galvanic Isolation HLAI Calibration Tool

The following figure is an illustration of the Galvanic Isolation HLAI Calibration tool.

Figure 215 Galvanic Isolation HLAI Calibration Tool (51201450)
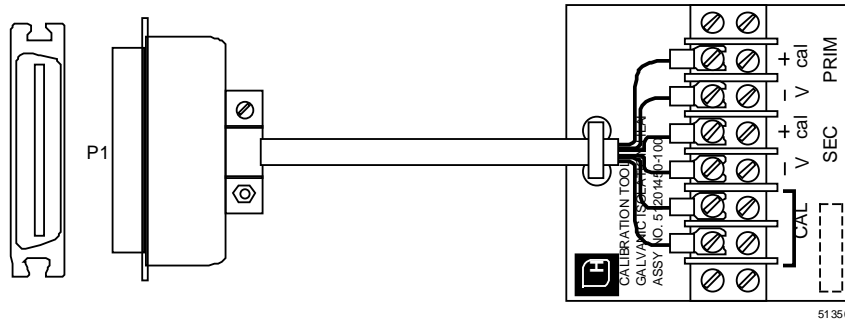
Calibration procedure

Use the following procedure to calibrate a nonredundant HLAI IOP.

Step	Action
1	Have the operator ensure that the IOP card is placed into the Idle state through the HPM Detail Status display.
	This calibration procedure calibrates all channels simultaneously, rather than each channel singularly.
2	Select the **ENABLE CALIBRATION** target on the Detail Status display for this HLAI. The **ENABLE CALIBRATION** target changes to the **DISABLE CALIBRATION** target.
3	If the voltage source is connected before idling the IOP and enabling calibration, the HLAI will report a Soft failure. Connect the calibration voltage source to the FTA and adjust the voltage to 5 Vdc (4.9995 – 5.0005 Vdc). See
	Figure 216 **for the assembly layout of the nonredundant model MU-TAIH02 FTA. The assembly layout of the redundant model MU-TAIH12 FTA is illustrated in Figure 217. The assembly layouts of all the HLAI FTAs are illustrated in the** *Process Manager I/O Installation* **manual.**

Figure 216 Nonredundant HLAI Calibration Connections
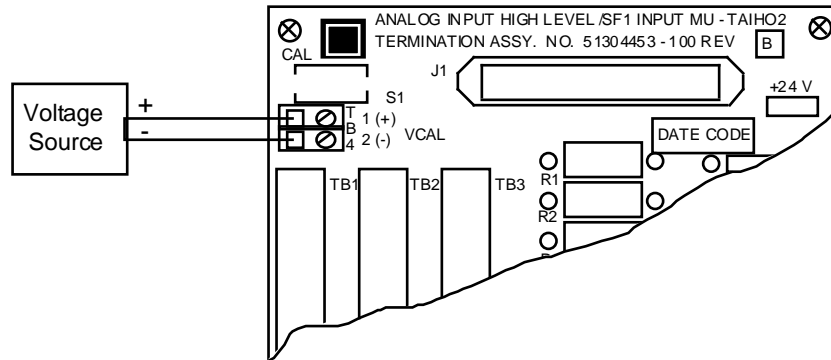
User Input Device		VCAL Voltage Source
Voltage Input:	0-5 volt	5 V
	1-5 volt	5 V
Current Input:	4-20 mA	5 V
	10-50 mA	5 V

Step	Action
4	Short the two calibration pads at the upper-left corner of the HLAI FTA as shown in Figure 215 to start the calibration. For the Galvanically Isolated FTAs, two pins in the Marshalling Panel connector are shorted together.
5	Ensure that the calibration target on the HLAI Detail Status display has changed back to **ENABLE CALIBRATION**, indicating that the zero and span calibration process has completed. Check for the Soft failure **CALIB ABORT**, which indicates bad calibration.
6	Disconnect the calibration voltage source wiring.
7	Inform the operator that the HLAI can be returned to on-line operation.

7.6   Redundant HLAI IOP Calibration Procedure

CAUTION

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Simultaneous IOP calibration

Recalibrate each HLAI IOP separately in an off-line HPM or follow the nonredundant High Level Analog Input FTA calibration procedure in subsection "Nonredundant HLAI IOP Calibration Procedure" ("IOP Calibration Procedures") to simultaneously calibrate both IOPs. The calibration voltage source must be connected to both sets of calibration terminals on the redundant model FTA simultaneously with parallel wiring as shown in Figure 217 for the model MU-TAIH12 FTA. Refer to the *Process Manager I/O Installation* manual for the assembly layout and calibration terminal locations for all the HLAI FTA models.

Calibration connections

The following figure is an illustration of the redundant HLAI FTA connections necessary to calibrate an HLAI IOP.

Figure 217 Redundant HLAI Calibration Connections
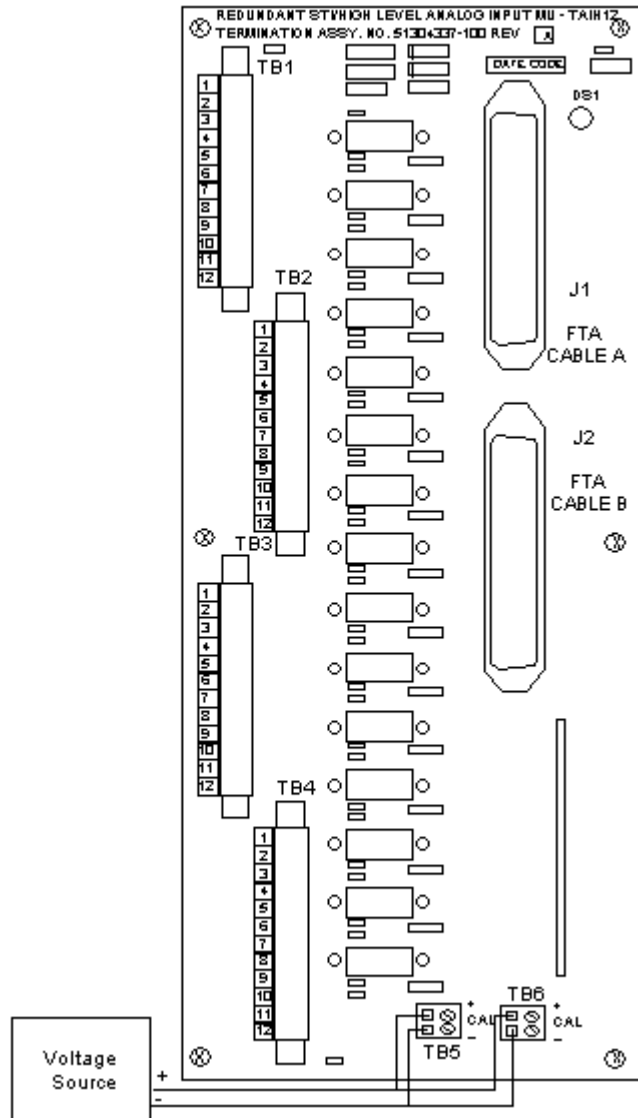
7.7   Nonredundant AO IOP Calibration Procedure

Calibration procedure

This calibration procedure is written with the nonredundant model MU-TAOX02 as an example, but the procedure can also be used for the nonredundant model MU-GAOX02, and MU-GAOX72 FTAs, and the redundant model MU-TAOX12, MU-TAOX52, MU-GAOX12, and MU-GAOX82 FTAs. Perform the following steps.

Step	Action
1	Isolate the AO IOP outputs. Use an Analog Standby Manual device to control the devices connected to the FTA. The Analog Standby Manual device provides isolation from the IOP outputs.
2	Have the operator ensure that the AO IOP card is placed in the Idle state using the HPM Status display.
3	Isolate the AO IOP outputs. Use an Analog Standby Manual device discussed in subsection "AO Standby Manual Device Operation" ("Removal and Replacement" section) to control the devices connected to the FTA. The Analog Standby Manual device provides isolation from the IOP outputs.
4	Have the operator select the **ENABLE CALIBRATION** target on the IOP Detail Status display. The target label changes to **DISABLE CALIBRATION**, indicating that the Start Calibration signal from the FTA will be accepted.
5	Connect an adjustable floating voltage source to the FTA output terminals as shown in Figure 218 for the nonredundant model MU-TAOX02 FTA, and adjust the source to between 4.9995 and 5.0005 Vdc. The layouts of the redundant model MU-TAOX12 and MU-TAOX52 FTAs are illustrated in the *Process Manager I/O Installation* manual, while the layout of the model MU-GAOX02 and MU-GAOX72 FTAs are also illustrated in the manual. The AO IOP uses this precision voltage reference to do a very accurate short term calibration of the internal loopback ADC. The circuitry is then used to calibrate each output channel.
6	Short together the calibration pads at the upper-left corner of the FTA. The procedure takes approximately 5 seconds. See Figure 218. The **DISABLE CALIBRATION** target changes to **ENABLE CALIBRATION** when the procedure is complete.
7	Disconnect the calibration source.
8	Inform the operator that the AO IOP can be placed in control.

The following figure is an illustration of the redundant Analog Output FTA connections necessary to calibrate an Analog Output IOP.

Figure 218 Nonredundant AO Calibration FTA Connections
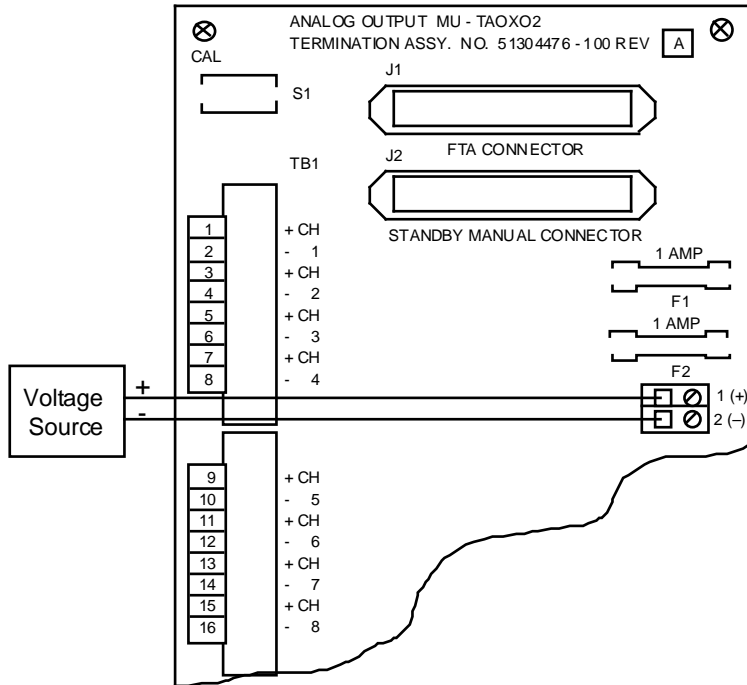
7.8   Redundant AO IOP Calibration Procedure

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Simultaneous IOP calibration

Follow the Analog Output FTA calibration procedure in subsection "Nonredundant AO IOP Calibration Procedure" ("IOP Calibration Procedures" section) to simultaneously calibrate both IOPs. The calibration voltage source must be connected to both sets of calibration terminals on the redundant model FTA simultaneously with parallel wiring as shown in the following figure. Refer to the *Process Manager I/O Installation* manual for the assembly layout and calibration terminal locations for the model MU-TAOX12, MU-TAOX52, MU-GAOX12, or MU-GAOX82 FTAs.

Calibration connections

The following figure is an illustration of the redundant Analog Output FTA connections necessary to calibrate an Analog Output IOP.

Figure 219 Redundant Analog Output Calibration Connections
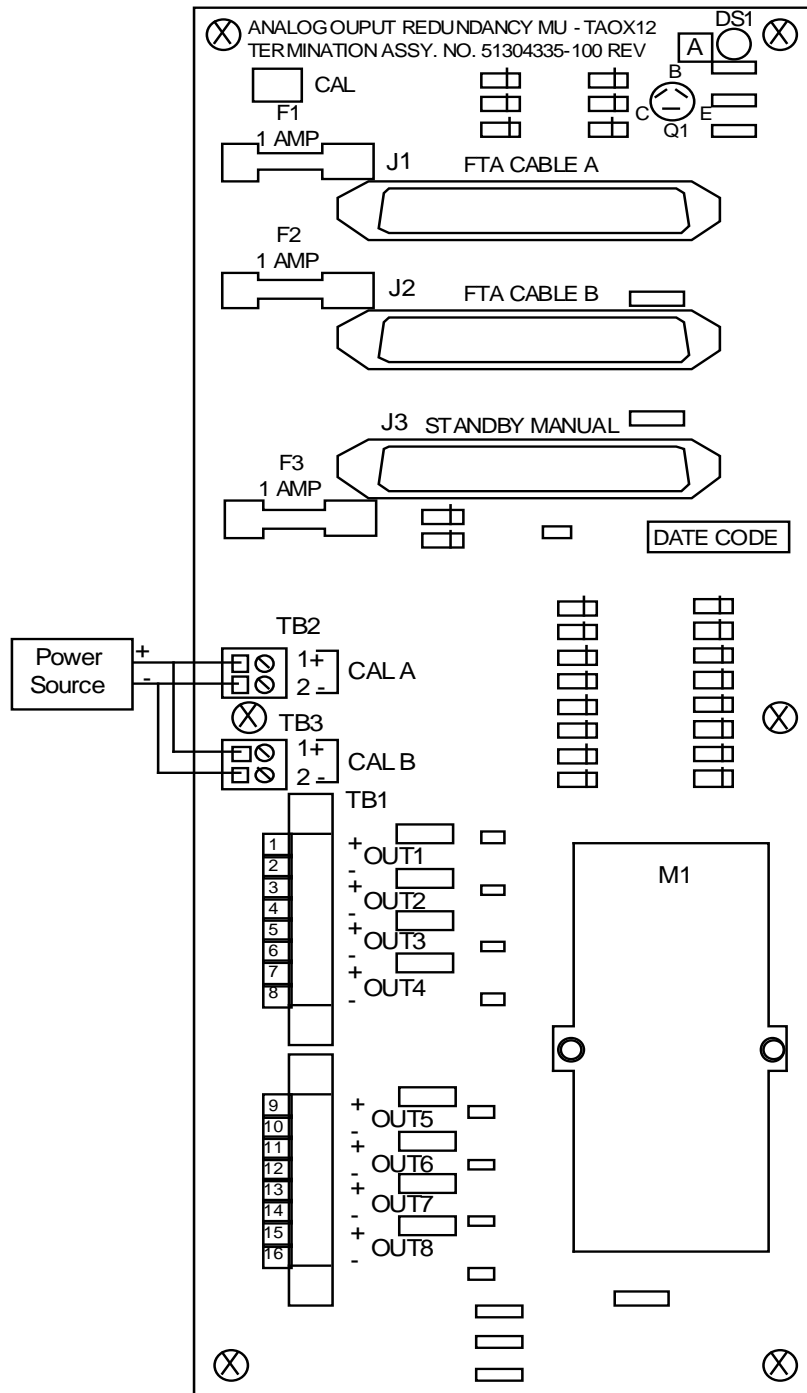
7.9   LLMux IOP Calibration Procedure

CAUTION

There is a risk of electric shock when performing the procedures in this section.

⚡ **SHOCK HAZARD**

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Introduction

The LLMux FTA daughter board can only be calibrated when it is mounted on a Thermocouple (TC) FTA. After calibration, the daughter board can be moved to any LLMux FTA and maintain the calibration. However, a TC daughter board is not interchangeable with an RTD daughter board.

Calibration procedure

Use the following procedure to calibrate a LLMux IOP.

Step	Action
1	Connect a precision voltage source to point zero, terminals T1A and T1B of terminal strip J1 as shown in Figure 220, and set the voltage to 100 millivolts (99.995 - 100.005 millivolts).
2	Remove the two jumpers, JRA and JRB, located between J2 and J3.
3	Connect the precision resistor (three lead 100 ohm ± .005 ohm) to the remote CJR terminals, J5. Apply power for 5 minutes.
4	Calibration is initiated by a single command for each FTA. Have the operator put the IOP in the Idle state and then select the **CALIBRATION** target. The calibration procedure is automatic and completes in less than one second.
5	Remove the voltage source. Disconnect the precision resistor from J5 and reconnect the jumpers removed from JRA and JRB in step 2.

LLMux FTA calibration connections

Figure 220 LLMux FTA Calibration Connections
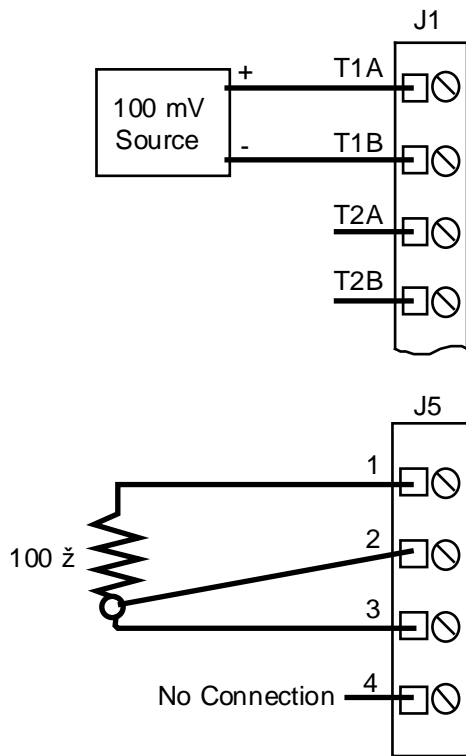
7.10 RHMUX IOP Calibration Procedure

Introduction

The main calibration constants for the Remote Hardened Low Level Multiplexer (RHMUX) IOP are determined during factory calibration and are used to calibrate the gain block error and the A/D reference.

A subsequent field calibration calibrates only the A/D reference and is done only for the 100 mV range which results in the field calibration factor being set to a ratio of the original factory calibration gain to the field calibration gain. This factor is then used to modify the original factory calibration constants such that the original factory calibration gain constants still exist.

Calibration method

The input to the RHMUX IOP is calibrated by using two input voltages for each scale, one at 20% of full range, and on at 80% of full scale. The RHMUX IOP will check to see if the voltage that is present is within 20% of what is expected for each step in the calibration procedure.

If the input voltage is out of the expected voltage range, a signal with the led and in the the case of automated factory calibration is generated. When the input voltage is digitized, the firmware will take 34 readings, eliminate the highest and lowest readings, and average the remaining readings. The gain can then be computed from the factor: Delta Input/Delta Expected. The resultant gain constants are stored in nonvolatile memory within the RHMUX IOP microprocessor. The field calibration factor is also set to 1.

If field calibration is performed at 50 hertz, rather than 60 hertz, the calibration coefficients have a ratio of 545/655 prior to storage. This figure is not the exact ratio of 50 hertz to 60 hertz because of a peculiarity in the A/D converter in the RHMUX IOP. Since calibration coefficients are stored just for 60 hertz, the firmware compensates accordingly when 50 hertz operation for the RHMUX IOP is selected.

In all cases, millivolts are computed as:

(A/D Counts - ZERO Counts) x GAIN.

GAIN is determined at calibration time as:

Factory mV/Count) x (Field Calibration Factor) x (50 Hz/60 Hz Factor)

Field calibration overview

The field calibration procedure is designed with the assumption that the RHMUX FTA may be some distance from the control room and the console when calibration is performed. Therefore, the procedure provides for all the interaction between the person performing the calibration and the RHMUX FTA when the initial calibration command is executed at the console and the tasks that must be performed locally at the RHMUX FTA.

In addition, the RHMUX IOP will not exit the calibration sequence if it is unsuccessful, but rather remains at the failed step in the calibration sequence in order to allow it to be repeated. This means that in order to use the RHMUX IOP again, or restart the calibration sequence, power to the RHMUX IOP must be cycled off and then on again.

Calibration procedure

Use the following procedure to calibrate an RHMUX IOP.

Step	Action
1	Using the HPM Status display at the console, place the RHMUX IOP in the Idle state.
2	Verify on the LLMux (RHMUX) display that the RHMUX IOP is configured for the correct frequency.
3	Disconnect any field wires from channels 1 and 16.
4	On the LLMux (RHMUX) IOP display, place the RHMUX IOP in the Calibrate mode.
5	At the RHMUX FTA, verify that the voltage at the factory calibration pin is a logic one which indicates that field calibration is in process. Verify that the FTA's Status LED is off and not blinking randomly.
6	Connect the calibration device to the channel 1 input terminals. Set the voltage to 100 mV, +/- 5 uV.
7	Short the channel 16 input terminals for a minimum of 0.1 of a second and then remove the short. The firmware uses burnout to read the state of the channel 16 input. The multiplexer digitizes the input in about 4 seconds, turns on the Status LED for 0.2 seconds, and turns the Status LED off if the voltage is within 20% of the expected voltage. If not, the Status LED will blink twice.
8	Set the calibration voltage to 20 mV, +/- 5 uV. Short the channel 16 terminals again for a minimum of 0.1 of a second and then remove the short. The RHMUX IOP will do another conversion. The firmware extracts a new slope coefficient for the reference diode and overwrites the field the previous field calibration factor.
9	If the calibration is successful and complete, the Status LED returns to the normal blinking cycle. The RHMUX IOP will respond to a "Status" command with an "OK" status. If the calibration was not successful, the response will be "CALIBRATION FAILURE."

Calibration failure

If during the calibration procedure, the RHMUX IOP senses that the calibration voltage is off by more than 20%, the Status LED will blink twice (0.2 of a second on, 0.2 of a second off) to indicate a failure. This requires that the calibration voltage be checked and reset to the proper value. Again, the channel 16 input terminals must be shorted for a minimum of 0.1 of a second and then opened to cause the RHMUX IOP to retry the voltage. If the calibration sequence can not be successfully completed, power must be cycled off and then on again to exit the calibration sequence.

7.11 Thermocouple Input Accuracy Verification

Introduction

It is necessary to verify the accuracy of a thermocouple input. Verification is accomplished with the use of a precision Thermocouple Simulator, the instrument's operating procedure, and the procedure steps that follow.

Accuracy verification procedure

Perform the following steps to verify the accuracy of the thermocouple.

Step	Action
1	Be sure the equipment is properly installed in the cabinet.
2	Connect a reference grade thermocouple wire between the Thermocouple Simulator and one input of the process control system.
3	Install all equipment covers and close the cabinet doors.
4	Using the HPM Detail Status display at the Universal Station, disable the Open Thermocouple Detection mode for the control point.
5	Allow the equipment to operate normally for 2 hours while temperature gradients stabilize.
6	Verify the accuracy of the thermocouple using the Thermocouple Simulator and following its operating procedure.
7	Move the thermocouple reference wire to another thermocouple input from the process control system and repeat the above procedures, starting at step 3.

8. Periodic Redundancy Tests

8.1 Overview

Introduction

This section describes the recommended periodic verification of the equipment's redundancy where applicable.

At an appropriate time, such as during a annual period of scheduled plant maintenance, the High-Performance Process Manager subsystem's availability can be improved by performing specific tests on various hardware parts of the High-Performance Process Manager subsystem. During the tests, personnel should be prepared for either proper operation or improper operation of the hardware. The preparation for improper operation of the hardware during the tests yields the lowest Mean Time to Repair (MTR), which is important when maximizing subsystem availability.

Even though fault coverage is high in the High-Performance Process Manager (HPM) during normal operation, periodic redundancy testing provides additional fault coverage by exercising any hardware that is not in use during normal operation.

8.2 HPMM Redundancy

Introduction

The ability of redundant HPMMs to swap positions, primary to secondary and secondary to primary, can be confirmed by using display commands on the Universal Station.

HPMM swap verification

Perform the following steps to verify that redundant HPMMs will swap their primary and secondary positions.

Step	Action
1	Select the **<SYST STATS>** (SYSTEM STATUS) key on the console and then select the **PROCESS NETWORK STATUS** target on the display for the network that contains the High-Performance Process Manager of interest. The UCN Status display is produced on the console screen.
2	Choose the status box containing the High-Performance Process Manager of interest and then select the **DETAIL STATUS** target on the UCN Status display. The HPM Detail Status display is produced on the screen.
3	Select the **RUN STATES** target on the HPM Detail Status display. The **SWAP PRIMARY** target along with other targets appear at the bottom of the display.
4	Select the **SWAP PRIMARY** target. This produces the **ENTER** and **CANCEL** targets to the right of the **SWAP PRIMARY** target.
5	Note the status of the two HPMMs status boxes on the display and then choose one. One status box should contain an "**OK**" label and the other status box should contain a "**BACKUP**" label. Choose one of these status boxes. Then, select the **ENTER** target. The "**OK**" and "**BACKUP**" labels in the HPMM status boxes should switch positions in 45 seconds or less, depending on the network size, and indicate the HPMM redundancy is functional.
	In addition, the Alphanumeric display on the High-Performance Comm/Control card will also confirm to swap by switching the primary and secondary indications appropriately.
	The orientation of the HPMMs can be returned to their original positions by selecting the **ENTER** target a second time.

8.3 IOP Redundancy

Introduction

The ability of a redundant pair of IOPs to swap positions, primary to secondary and secondary to primary is confirmed by using display commands on the Universal Station.

IOP redundancy terminology

- IOP A: IOP A is the physical primary IOP. It is the IOP that is physically connected by cable to the "A" cable connector on a redundant FTA.

- IOP B: IOP B is the physical primary IOP. It is the IOP that is physically connected by cable to the "B" cable connector on a redundant FTA.

- Primary IOP IOP B is the physical primary IOP. It is the IOP that is physically connected by cable to the "B" cable connector on a redundant FTA.

- Secondary IOP: The secondary IOP is the logical secondary IOP. It can be either IOP A or IOP B that is not controlling the FTA's field terminals or providing the process variable.

- IOP Swap: An IOP swap reverses the status of the physical IOPs, A and B. The present primary IOP becomes the secondary IOP, and the present secondary IOP becomes the primary IOP.

- IOP Bias: For the 8-channel Analog Output IOP only, operation with the IOP A as the primary IOP and IOP B as the secondary IOP is with the basis, the preferred condition. Operation with the IOP B as the primary IOP and IOP A as the secondary IOP is against the basis, the nonpreferred condition.

IOP redundancy test procedure

Perform the following steps for each redundant IOP configuration.

Step	Action
1	Select the **<SYST STATS>** (SYSTEM STATUS) key on the console and then select the **PROCESS NETWORK STATUS** target on the display for the network that contains the High-Performance Process Manager (HPM) or Process Manager (PM) of interest. The UCN Status display is produced on the console screen.
2	Choose the status box containing the HPM of interest and then select the **DETAIL STATUS** target on the UCN Status display. The HPM Detail Status display is produced on the screen.
3	Select the **RUN STATES** target on the HPM Detail Status display. The **SWAP PRIMARY** target along with other targets appear at the bottom of the display.
4	Select the **SWAP PRIMARY** target. This produces the **ENTER** and **CANCEL** targets to the right of the **SWAP PRIMARY** target.
5	Note the status in the IOP status box on the display for the redundant pair of IOPs that are of interest. The status box should contain an "**OK/BKP**" label. Choose the IOP status box of interest. Then, select the **ENTER** target. The "**OK/BKP**" label in the IOP status box should switch to "**BKP/OK**," respectively after approximately 5 seconds, indicating the IOP redundancy is functional. The orientation of the redundant IOPs should be returned to their original positions by selecting the **ENTER** target a second time.
6	Repeat step 5 for any other redundant pairs of IOPs.

8.4   Redundant 8-Channel Analog Output IOPs

Introduction

Redundancy for the 8-channel Analog Output IOPs is biased toward the IOP A to maximize reliability. Hardware bias is preferred because IOP B (the physical secondary) is connected to the Analog Output FTA through a switching module on the FTA, while IOP A (the physical primary) is connected directly to the FTA circuitry that interfaces the FTA's field wiring output terminals. Use of the procedure in this subsection tests a redundant pair of Analog Output IOPs for proper operation.

Hardware identification

Locate the following components.

- Analog Output IOP A
- Analog Output IOP B
- The redundant Analog Output FTA
- An Analog Output Standby Manual device
- Devices that are being controlled by the analog output of the FTA
- Control algorithms that are driving the analog outputs

Status check

Using the IOP Detail Status display, check that the IOPs are currently operating normally, as indicated by a status of **OK/BKP**. In addition, be sure the following is true.

- The outputs are being controlled by IOP A

- IOP A and IOP B are synchronized

- IOP A is operating normally without Soft failures

- IOP B is operating normally without Soft failures

Test procedure

Perform the following steps to test for proper IOP redundancy operation.

Step	Action
1	Begin the test at a convenient time. Disrupt power to IOP B by toggling the IOP's upper extractor. The IOP Detail Status display should indicate a status of **OK/NR [S]** briefly, and then return to a status of **OK/BKP** for the IOPs. Confirm that the field devices are operating properly by observing the operation of the process, or measure the output currents reaching the devices.
2	Disconnect the cable to IOP B. The IOP Detail Status display should indicate a status of **OK/BSF** for the IOPs. Confirm that the field devices are operating properly by observing the operation of the process, or measure the output currents reaching the devices.
3	Reconnect the cable to IOP B. The IOP Detail Status display should return to an **OK/BKP** status for the IOPs.
4	Execute a swap so that IOP B has control of the FTAs outputs. The IOP Detail Status display should indicate a **BKP/OK** status for the IOPs. Check that the IOP Detail Status display continues to indicate **BKP/OK** status for a period of at least two minutes to allow the Redundancy Diagnostics to complete with IOP B now controlling the FTA outputs. Confirm that the output devices are operating properly by observing the operation of the process, or measuring the output currents reaching the field devices before and after executing the swap command.
5	Disrupt power to IOP A by toggling the IOP's upper extractor. The IOP Detail Status display should indicate a **[S] NR/OK** status briefly, and then return to **BKP/OK**. Confirm that the output devices are operating properly by observing the operation of the process, or measuring the output currents reaching the field devices.
6	Disconnect IOP A's FTA cable. The IOP Detail Status display should indicate a status of **BSF/OK** for the IOPs. Confirm that the output devices are operating properly by observing the operation of the process, or measuring the output currents to the field devices.
7	Connect IOP A's FTA cable. The IOP Detail Status display should return to a **BKP/OK** status for the IOPs.
8	Allow the subsystem to operate against the bias with IOP B controlling the outputs for a period of time, such as 4 hours. During this period of time, the IOP Detail Status display should continue to indicate a **BKP/OK** status for the IOPs. Ensure that no Soft failures are logged into the System Status Real Time Journal. Continue to monitor that the output devices are operating properly by observing the operation of the process, or measuring the output currents reaching the field devices
9	Execute a swap command so that IOP A has control of the FTAs outputs. The IOP Detail Status display should indicate an **OK/BKP** status for the IOPs. Continue to monitor operation of the output devices with the bias for a period of time, such as 2 hours.

8.5 Power Cable Redundancy

Introduction

Card files, the Digital Input Power Distribution assembly, and the Galvanic Isolation Power Distribution assembly are provided with redundant power cables to enhance power distribution reliability within the High-Performance Process Manager. You should be able to disconnect either end of one of the two power cables providing power to the card file, Digital Input Power Distribution assembly, or Galvanic Isolation Power Distribution assembly without affecting equipment operation.

CAUTION	Power cable redundancy testing should be performed during a plant shutdown

SHOCK HAZARD

Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Test procedure

Perform the following steps for each card file, Digital Input Power Distribution assembly, and Galvanic Isolation Power Distribution assembly.

Step	Action
1	Disconnect one of the pair of power cables for a card file, Digital Input Power Distribution assembly, or Galvanic Isolation Power Distribution assembly at either the Power System connection or the other end of the cable. Determine if the operation of the equipment is impaired by observing the operation of the affected IOPs and/or HPMM cards.
2	Replace the cable connection and then disconnect the other cable in the pair. Determine if the operation of the equipment is impaired.
3	Repeat steps 1 and 2 for all card files, Digital Input Power Distribution assemblies, and Galvanic Isolation Power Distribution assemblies.

8.6   Power Supply Module Redundancy

Power System redundancy introduction

A Power System with redundant Power Supply Modules should continue to provide power to the High-Performance Process Manager without interruption when one of the Power Supply Modules fails or looses ac power.

CAUTION   Power cable redundancy testing should be performed during a plant shutdown.

SHOCK HAZARD
Troubleshooting, opening this equipment and removing any panels or covers will expose the **user** to the risk of a shock hazard. There are no **user** serviceable parts inside this equipment. Refer all servicing only to **qualified service personnel**.

Power System redundancy test procedure

Perform the following steps to test the Power System's redundancy power capability.

Step	Action
1	With the both Power Supply Modules of a redundant Power System operating, place the **ON/OFF** switch of the <u>right</u> Power Supply Module in the **OFF** position. Observe that the HPMM and IOP cards continue to operate normally (their **Status** and **Power** indicators are illuminated). Return the **ON/OFF** switch to the **ON** position if operation continues normally. Should the HPMM and IOP cards not continue to operate normally, follow the troubleshooting and replacement procedures for the Power Supply Module in the "Fault Isolation" and "IOP Calibration Procedures" sections.
2	With both Power Supply Modules of a redundant Power System operating, place the **ON/OFF** switch of the <u>left</u> Power Supply Module in the **OFF** position. Observe that the HPMM and IOP cards continue to operate normally. Return the **ON/OFF** switch to the **ON** position if operation continues normally. Should the HPMM and IOP cards not continue to operate normally, follow the troubleshooting and replacement procedures for the Power Supply Module in the "Fault Isolation" and "IOP Calibration Procedures" sections.
	When the left Power Supply Module's **ON/OFF** switch is placed in the **OFF** position, all Low Level Analog Input IOPs should report a Soft failure at the Universal Station, but they will continue to operate normally.

9. Spare Parts

9.1 Overview

Introduction

The parts listed in the following tables are periodic maintenance items and Optimum Replaceable Units (ORU) for the High-Performance Process Manager (HPM). All the listed parts reference the Honeywell part number. For additional or optional equipment part numbers not listed, contact your Honeywell Sales Representative.

9.2 Periodic Maintenance Parts

Periodic maintenance parts list

Table 87 HPM Periodic Maintenance Parts lists items that may be required during the life of the High-Performance Process Manager.

Table 87 HPM Periodic Maintenance Parts

Name	Description		Part Number
BATTERIES			
NiCad Rechargeable Batteries	One AA-size NiCad battery		51190422-100
	One C-size NiCad battery		51192060-100
Alkaline Batteries	One AA-size Alkaline battery		51190467-100
FUSES			
<u>Assembly</u>	<u>Quantity</u>	<u>Description</u>	
Left 7-Slot Card File (51401626)	8	2.0 A Subminiature fuse (F1-8)	30754661-021
Right 7-Slot Card File (51401629)	8	2.0 A Subminiature fuse (F1-8)	30754661-021
15-Slot Card File (51401629)	16	2.0 A Subminiature fuse (F1-16)	30754661-021
IOP Card File (51402599)	15	2.0 A Subminiature fuse (F1-15)	30754661-021
	1	0.5 A Subminiature fuse (F16)	30754661-014
3-30 Vdc SS DO FTA (51304423)	16	5.0 A Time-delay fuse 5 x 20 mm	51190584-250
3-30 Vdc SS DO FTA (51304650, 51309153)	16	2.5 A Time-delay fuse 5 x 20 mm	51190584-225
31-200 Vdc SS DO FTA (51304428, 51309154)	16	1.0 A Time-delay fuse 5 x 20 mm	51190584-210
24-240 Vac SS DO FTA (51304408)	16	3.0 A Time-delay fuse 5 x 20 mm	51190584-230
120/240 Vac SS DO FTA (51304648)	16	2.5 A Time-delay fuse 5 x 20 mm	51190584-225
120 Vac Relay DO FTA (51304443, 51309148)	16	6.0 A Time-delay fuse 5 x 20 mm	51190584-260
240 Vac Relay DO FTA (51304427, 51309150)	16	3.0 A Time-delay fuse 5 x 20 mm	51190584-230

Table 87 HPM Periodic Maintenance Parts

Name	Description		Part Number
24 Vdc Nonisolated DO FTA (51304446)	16	0.2 A Fast-action fuse 5 x 20 mm (F1-16)	51190582-120
	1	2.0 A Fast-action fuse 5 x 20 mm (F17)	51190582-220
24 Vdc Isolated DO FTA (80364013)	4	1.6 A Fast-action fuse MP16 (F1-4)	83957061-004
24 Vdc Isolated DO FTA (80366183)	16	1.6 A Fast-action fuse MP16 (F1-16)	83957061-004
LLAI FTA (51304437, 51309202)	4	0.5 A Subminiature fuse (F1-4)	30754661-014
DI FTA (80364010, 80366180)	2	0.5 A Fast-action fuse MP05 (F1, F3)	83957061-002
DI FTA (80364010, 80366180)	1	1.0 A Fast-action fuse MP10 (F2)	83957061-003
DI Power Distribution Assy (51304425)	12	1.0 A Fast-action fuse 5 x 20 mm (F1-12)	51190582-210
SI/SDI FTA (51303932)	2	0.25 A Subminiature fuse (F1-2)	30754661-011
Nonredundant AO FTA (51304476)	2	1.0 A Fast-action fuse 5 x 20 mm (F1-2)	51190582-210
Redundant AO FTA (51304335)	3	1.0 A Fast-action fuse 5 x 20 mm (F1-3)	51190582-210
Redundant AO FTA (80364007, 80366177, 80366481, 80366484)	1	1.0 A Fast-action fuse MP10 (F1)	83957061-003
Pulse Input FTA (51304084)	8	0.25 A Fast-action fuse 5 x 20 mm (F1-8)	51190582-125
Galvanic AO FTA (51304638)	3	1.0 A Subminiature fuse (F1-3)	30754661-019
GI Power Distribution Assy (51304644)	8	4.0 A Fast-action fuse 5 x 20 mm (F1-8)	51190582-240
H-P I/O Link Card	1	3.0 A Fast-action fuse (F1)	30754661-022
Fuseholder Puller	Fuseholder extractor		51190586-100
FILTERS			
Filter Kit (Rittal cabinet)	Louvered cover and filter, 20 /8 x 20 /8 (cm/in.)		51109488-100
Filter (Rittal cabinet)	Replacement filter only, 20 /8 x 20 /8 (cm/in.)		51109488-200
Filter (Markhon cabinet)	Replacement filter only, 39 /15.5 x 61 /24 (cm/in.)		51109541-100

ORU parts List

This subsection identifies the assemblies that may be required for maintenance during the life of the High-Performance Process Manager. Maintenance procedures are found in this manual. Additional information can be found in the *High-Performance Process Manager Installation* manual and the *Process Manager I/O Installation* manual.

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description		Part Number
CABLES			
Power Cable – Nonshielded (For internal cabinet use)	Power System to card file cable (Set of two when ordered by model number)		
	MU-KDPR01	1 meter	51201397-001
	MU-KDPR02	1.5 meters	51201397-915
		2 meters	51201397-002
		3 meters	51201397-003
	MU-KDPR04	4 meters	51201397-004
	MU-KDPR05	5 meters	51201397-005
		6 meters	51201397-006
		8 meters	51201397-008
	MU-KDPR10	10 meters	51201397-010
	MU-KDPR15	15 meters	51201397-015
	MU-KDPR20	20 meters	51201397-020
	MU-KDPR25	25 meters	51201397-025
	MU-KDPR30	30 meters	51201397-030
	MU-KDPR35	35 meters	51201397-035
	MU-KDPR40	40 meters	51201397-040
	MU-KDPR45	45 meters	51201397-045
	MU-KDPR50	50 meters	51201397-050
Power Cable – Nonshielded (For internal cabinet use)	Power System to card file cable – Set of two (With surge protection network for I/O Link cable)		
		1.0 meter	51204126-001
		1.5 meters	51204126-915
		2 meters	51204126-002
		3 meters	51204126-003
		4 meters	51204126-004
		5 meters	51204126-005

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description		Part Number
		6 meters	51204126-006
Power Cable Adapter Cable – Nonshield (For internal cabinet use)	Power cable I/O Link protector adapter – Set of two (Provides I/O Link protector for 51201397-xxx cable)		51204127-100
Power Cable – Shielded (For external cabinet use)	Power System to Power Distribution Assembly cable (Set of two when ordered by model number)		
	MU-KSPR05	5 meters	51204037-005
	MU-KSPR10	10 meters	51204037-010
	MU-KSPR15	15 meters	51204037-015
	MU-KSPR20	20 meters	51204037-020
	MU-KSPR30	30 meters	51204037-030
	MU-KSPR40	40 meters	51204037-040
	MU-KSPR50	50 meters	51204037-050
Power Cable – Shielded (For external cabinet use)	Power System to card file cable – Set of two (With surge protection network for I/O Link cable)		
		1.0 meter	51204138-001
		1.5 meters	51204138-915
		2 meters	51204138-002
		3 meters	51204138-003
		4 meters	51204138-004
		5 meters	51204138-005
		6 meters	51204138-006
Power Cable Adapter Cable – Shielded (For external cabinet use)	Power cable I/O Link protector adapter – Set of two (Provides I/O Link protector for 51204037-xxx cable)		51204140-100
Galvanic Isolation FTA Power Cable (For internal cabinet use)	GI Power Distribution assembly to FTA cable		
		0.50 meter	51109620-020
		0.75 meter	51109620-030
		1.00 meter	51109620-040
		1.25 meters	51109620-050
		2.00 meters	51109620-080
		3.00 meters	51109620-120

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description		Part Number
		4.00 meters	51109620-160
	MU-KGPR05	5.00 meters	51109620-195
	MU-KGPR10	10.00 meters	51109620-390
Bridge Cable	Bridge cable for model MU/MC-TDOY23 and MU/MC-TDOY63 FTAs		
		1.0 meter	80366198-100
		2.0 meters	80366198-200
Power Adapter Cable (Non-CE Comply Applications)	Power Adapter to LLMux/SDI/SI FTA cable (External to the cabinet for LLMux/SDI/SI)		
		Special order	51190696-xxx
		76 meters	51190696-076
		152 meters	51190696-152
		305 meters	51190696-305
Power Adapter Cable (CE Compliant Applications)	Power Adapter to LLMux/RHMUX/SDI/SI FTA cable (External to the cabinet for LLMux/SDI/SI) (Internal to the cabinet for RHMUX)		
		Special order	51192139-104
	MU-KLX076	76 meters	51192139-114
	MU-KLX152	152 meters	51192139-124
	MU-KLX305	305 meters	51192139-134
RHMUX Power Adapter Cable (CE Compliant Applications)	RHMUX Power Adapter to RHMUX FTA cable (External to the cabinet)		
		Special order	51197597-100
	MU-KLO305	305 meters	51197597-305
Power Adapter Cable (Non-CE Comply Applications)	Power Adapter to LLMux/SDI/SI FTA cable (Internal to the cabinet)		
	MU-KLAM01	30 centimeters	51304465-100
	MU-KLAM02	66 centimeters	51304465-200
	MU-KLAM03	100 centimeters	51304465-300
	MU-KLAM04	200 centimeters	51304465-400
	MU-KLAM05	300 centimeters	51304465-500
I/O Link Interface Cable (Set of two)	HPMM to IOP card file communication cable		

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description		Part Number
		Two drop in cabinet	51195479-100
		Three drop in cabinet	51195479-200
		Four drop in cabinet	51195479-300
		Five drop in cabinet	51195479-400
		Six drop in cabinet	51195479-500
I/O Link Interface Cable (Set of two, shielded – for use in Europe)	HPMM to IOP card file communication cable		
		Two drop in cabinet	51204042-100
		Three drop in cabinet	51204042-200
		Four drop in cabinet	51204042-300
		Five drop in cabinet	51204042-400
		Six drop in cabinet	51204042-500
HPMM Redundancy Cable IOP to FTA Cable	HPMM redundancy interconnect cable (2 m) IOP to FTA cable		51201667-100
		1 meter	51201420-001
		1.5 meters	51201420-915
	MU-KFTA02	2.0 meters	51201420-002
	MU-KFTA03	3.0 meters	51201420-003
	MU-KFTA04	4.0 meters	51201420-004
	MU-KFTA05	5.0 meters	51201420-005
		6.0 meters	51201420-006
	MU-KFTA08	8.0 meters	51201420-008
	MU-KFTA10	10.0 meters	51201420-010
	MU-KFTA15	15.0 meters	51201420-015
	MU-KFTA20	20.0 meters	51201420-020
	MU-KFTA25	25.0 meters	51201420-025
	MU-KFTA30	30.0 meters	51201420-030
	MU-KFTA35	35.0 meters	51201420-035
	MU-KFTA40	40.0 meters	51201420-040
	MU-KFTA45	45.0 meters	51201420-045
	MU-KFTA50	50.0 meters	51201420-050

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description		Part Number
IOP to FTA Cable (Shielded – for external cabinet use)	IOP to FTA cable		
		1 meter	51204033-001
		1.5 meters	51204033-915
	MU-KFTS02	2.0 meters	51204033-002
	MU-KFTS03	3.0 meters	51204033-003
	MU-KFTS04	4.0 meters	51204033-004
	MU-KFTS05	5.0 meters	51204033-005
		6.0 meters	51204033-006
	MU-KFTS08	8.0 meters	51204033-008
	MU-KFTS10	10.0 meters	51204033-010
	MU-KFTS15	15.0 meters	51204033-015
	MU-KFTS20	20.0 meters	51204033-020
	MU-KFTS25	25.0 meters	51204033-025
	MU-KFTS30	30.0 meters	51204033-030
	MU-KFTS35	35.0 meters	51204033-035
	MU-KFTS40	40.0 meters	51204033-040
	MU-KFTS45	45.0 meters	51204033-045
	MU-KFTS50	50.0 meters	51204033-050
POWER SYSTEM COMPONENTS			
Power Supply Module	Standard 20 A Power Supply Module (Replaced by 51198651-100)		51109456-200 (obsolete)
Power Supply Module	AC Only 8 A Power Supply Module		51190465-100
Power Supply Module	AC Only 16 A Power Supply Module		51190465-200
48 V Battery Backup	48 V Battery Pack assembly		51303948-100
Power System Backpanel Assy	PM/APM Power System backpanel		51401166-100
Power System Backpanel Assy	HPM Power System backpanel		51404172-100
AC/DC Distribution Assembly	AC Only power control and distribution board 115 Vac dual PSMs		51401135-100
AC/DC Distribution Assembly	AC Only power control and distribution board 115 Vac single PSM		51401135-200

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
AC/DC Distribution Assembly	AC Only power control and distribution board 230 Vac dual PSMs	51401135-300
AC/DC Distribution Assembly	AC Only power control and distribution board 230 Vac single PSM	51401135-400
CMOS Battery Backup Assembly	PM/APM PS Charger/monitor for CMOS memory	51303968-100
	HPM PS Charger/monitor for CMOS memory	51309206-100
HPMM CARDS/MODULE		
High-Performance Comm/Control	HPMM Communications/Control card	51401635-100 (obsolete) 51403988-150
High-Performance I/O Link	HPMM I/O Link Interface card	51309276-150 51307190-150
HPM UCN Interface	HPMM UCN Interface module	51402573-100 (obsolete) 51402573-250 (obsolete) 51402573-450
IOP CARDS		
HLAI IOP (MU-PAIH02)	High Level Analog Input card (Replaced by 51304754-100)	51304489-100
HLAI IOP (MU-PAIH03)	High Level Analog Input card	51304754-100
LLAI IOP (MU-PAIL02)	Low Level Analog Input card	51304481-100
LLMux IOP (MU-PLAM02)	Low Level Multiplexer card	51304362-100
RHMUX (MU-PRHM01)	Remote Hardened Low Level Multiplexer card	51404109-125
DI IOP (MU-PDIX02)	Digital Input card	51304485-100
DI IOP (MU-PDIY22)	Digital Input card	80363972-100
AO IOP (MU-PAOX02)	Analog Output	51304483-100
AO IOP (MU-PAOX03)	Analog Output card (Replaced by 51309152-175)	51304672-100
AO IOP (MU-PAOX03)	Analog Output card (Conformally Coated)	51309152-175
AO IOP (MU-PAOY22)	Analog Output card	80363969-100
DO IOP (MU-PDOX02)	Digital Output card	51304487-100
DO IOP (MU-PDOY22)	Digital Output card	80363975-100
STI IOP (MU-PSTX02)	Smart Transmitter Interface card (Replaced by 51304516-200)	51304516-100

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
STIM (MU-PSTX03)	Smart Transmitter Interface Multivariable	51304516-200
PI IOP (MU-PPIX02)	Pulse Input card	51304386-100
SDI IOP (MU-PSDX02)	Serial Device Interface card	51304362-200
SI IOP (MU-PSIM11)	Serial Interface card	51304362-300
DISOE IOP (MU-PDIS11)	Digital Input Sequence Of Events card (Replaced by 51402625-125)	51304690-100
DISOE IOP (MU-PDIS12)	Digital Input Sequence Of Events card	51402625-125
FBUS IOP (MU-PFBS01)	Fieldbus card	51309510-125
Slot Filler	Empty IOP slot filler card	51304260-200
I/O LINK EXTENDER COMPONENTS		
Standard I/O Link Extender (MU-IOLM02)	Standard I/O Link Extender card Standard fiber optic Tx/Rx coupler (1) Standard fiber optic Tx/Rx coupler (3)	51304419-100 51201557-100 51201557-300
Long Distance I/O Link Extender (MU-ILDX02 – Replaced by MU-ILDX03)	Long Distance I/O Link Extender card Long Distance fiber optic Tx/Rx coupler (1)	51304532-100 51201616-100
Long Distance I/O Link Extender (MU-ILDX03)	Long Distance I/O Link Extender card Long Distance fiber optic Tx/Rx coupler (1)	51304532-100 51309208-100
I/O Link Extender Adapter Kit (MU-ILES01)	I/O Link Extender Adapter kit	51204043-100
STANDARD FTA COMPONENTS		
HLAI/STI FTA (MU-TAIH02)	HLAI/STI with compression terminals	51304453-100
HLAI/STI FTA (MU-TAIH12)	HLAI/STI with compression terminals	51304337-100
HLAI/STI FTA (MU-TAIH22)	HLAI/STI with compression terminals	80366195-100
	AI Adapter Module for the above FTA	80367163-001
HLAI/STI FTA (MU-TAIH52)	HLAI/STI with screw terminals	51304337-200
HLAI/STI FTA (MU-TAIH62)	HLAI/STI with screw terminals	80366192-100
	AI Adapter Module for the above FTA	80360713-001
HLAI FTA (MU-TAIH03)	HLAI with compression terminals	51309136-125
HLAI FTA (MU-TAIH13)	HLAI with compression terminals	51309138-125
HLAI FTA (MU-TAIH23)	HLAI with compression terminals	80369165-125
	AI Adapter Module for the above FTA	80367163-001
HLAI FTA (MU-TAIH53)	HLAI with screw terminals	51309138-225

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
STI FTA (MU-TSTX03)	STI with compression terminals	51309140-125
STI FTA (MU-TSTX13)	STI with compression terminals	51309142-125
STI FTA (MU-TSTX53)	STI with screw terminals	51309142-225
LLAI FTA (MU-TAIL02)	LLAI FTA with compression terminals (Replaced by MU-TAIL03)	51304437-100
	Daughter module for above FTA (Replaced by 51309280-100)	51304085-100
LLAI FTA (MU-TAIL03)	LLAI FTA with compression terminals	51309202-125
	Daughter module for above FTA	51309280-100
LLMux FTA (MU-TAMT02)	LLMux local TC with compression terminals (Replaced by MU-TAMT03)	51401491-100
	LLMux Analog board for above FTA	51401564-100
LLMux FTA (MU-TAMT03)	LLMux local TC with compression terminals	51409223-125
LLMux FTA (MU-TAMT12)	LLMux remote TC with compression terminals (Replaced by MU-TAMT13)	51401573-100
	LLMux Analog board for above FTA	51401564-100
	LLMux remote sensor board for above FTA	51304589-100
LLMux FTA (MU-TAMT13)	LLMux remote TC with compression terminals	51409213-125
LLMux FTA (MU-TAMR02)	LLMux RTD with compression terminals (Replaced by MU-TAMR03)	51304477-100
	LLMux daughter board for above FTA	51401364-100
LLMux FTA (MU-TAMR03)	LLMux RTD with compression terminals	51309218-125
RHMUX GI/IS Power Adapter (MU-GRPA01)	RHMUXGI/IS Power Adapter with compression terminals	51304724-125
RHMUX GI/NI Power Adapter (MU-TRPA01)	RHMUX GI/NI Power Adapter with compression terminals	51304722-125
AO FTA (MU-THAO11)	Analog Output with HART and comp. terminals	51309542-125
AO FTA (MU-TAOX02)	Analog Output with compression terminals	51304476-125
AO FTA (MU-TAOX12)	Analog Output with compression terminals	51304335-125
AO FTA (MU-TAOX52)	Analog Output with screw terminals	51304335-225
	Plug-in module for above FTAs	51304338-100
AO FTA (MU-TAOY22)	Analog Output with comp term, Stdby Manual	80366481-125
AO FTA (MU-TAOY23)	Analog Output with comp term, no Stdby Manual	80366177-200

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
AO FTA (MU-TAOY52)	Analog Output with screw term, Stdby Manual	80366484-125
AO FTA (MU-TAOY53)	Analog Output with screw term, no Stdby Manual	80364007-200
DI 120 Vac FTA (MU-TDIA12)	Digital Input 120 Vac with compression terminals	51304439-125
DI 120 Vac FTA (MU-TDIA52)	Digital Input 120 Vac with fixed-screw terminals	51304439-225
	Plug-in module for above FTAs	51190523-225
DI 120 Vac FTA (MU-TDIA72)	Digital Input 120 Vac with removable screw terminals	51303930-100
DI 240 Vac FTA (MU-TDIA22)	Digital Input 240 Vac with compression terminals	51304431-125
DI 240 Vac FTA (MU-TDIA62)	Digital Input 240 Vac with fixed-screw terminals	51304431-225
	Plug-in module for above FTAs	51190523-325
DI 24 Vdc FTA (MU-TDID12)	Digital Input 24 Vdc with compression terminals	51304441-125
DI 24 Vdc FTA (MU-TDID52)	Digital Input 24 Vdc with fixed-screw terminals	51304441-225
	Plug-in module for above FTAs	51190523-125
DI 24 Vdc FTA (MU-TDID72)	Digital Input 24 Vdc with removable screw term	51303928-100
DI 24 Vdc FTA (MU-TDIY22)	Digital Input 24 Vdc with compression terminals	80366180-125
DI 24 Vdc FTA (MU-TDIY62)	Digital Input 24 Vdc with screw terminals	80364010-125
DO 120/240 Vac FTA (MU-TDOA12)	Digital Output 120/240 Vac SS with fixed-comp term (Replaced by MU-TDOA13)	51304408-100
DO 120/240 Vac FTA (MU-TDOA52)	Digital Output 120/240 Vac SS with fixed-screw term (Replaced by MU-TDOA53)	51304408-200
	Solid-state relay plug-in module for above FTAs	51190516-325
DO 120/240 Vac FTA (MU-TDOA13)	Digital Output 24-240 Vac SS with removable compression terminals.	51304648-125
DO 120/240 Vac FTA (MU-TDOA53)	Digital Output 24-240 Vac SS with removable screw terminals	51304648-225
	Solid-state relay plug-in module for above FTAs	51190516-332
DO 3-30 Vdc FTA (MU-TDOD12)	Digital Output 3-30 Vdc SS with fixed-comp term (Replaced by MU-TDOD13)	51304423-100
DO 3-30 Vdc FTA (MU-TDOD52)	Digital Output 3-30 Vdc SS with fixed-screw term (Replaced by MU-TDOD53)	51304423-200
	Solid-state relay plug-in module for above FTAs	51190516-122
DO 3-30 Vdc FTA (MU-TDOD13)	Digital Output 3-30 Vdc SS with removable compression terminals	51304650-100
DO 3-30 Vdc FTA (MU-TDOD53)	Digital Output 3-30 Vdc SS with removable screw terminals	51304650-200

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	Solid-state relay plug-in module for above FTAs	51190516-132
DO 3-30 Vdc FTA (MU-TDOD14)	Digital Output 3-30 Vdc SS with fixed-compression terminals	51309153-125
DO 3-30 Vdc FTA (MU-TDOD54)	Digital Output 3-30 Vdc SS with fixed-screw terminals	51309153-225
	Solid-state relay plug-in module for above FTAs	51190516-134
DO 31-200 Vac FTA (MU-TDOD22)	Digital Output 31-200 Vdc SS with compression terminals	51304428-100
DO 31-200 Vac FTA (MU-TDOD62)	Digital Output 31-200 Vdc SS with screw terminals	51304428-200
	Solid-state relay plug-in module for above FTAs	51190516-402
DO 31-200 Vac FTA (MU-TDOD23)	Digital Output 31-200 Vdc SS with compression terminals	51309154-125
DO 31-200 Vac FTA (MU-TDOD63)	Digital Output 31-200 Vdc SS with screw terminals	51309154-225
	Solid-state relay plug-in module for above FTAs	51190516-404
DO 24 Vdc FTA (MU-TDON12)	Digital Output 24 Vdc nonisolated with comp term	51304446-100
DO 24 Vdc FTA (MU-TDON52)	Digital Output 24 Vdc nonisolated with screw term	51304446-200
DO 24 Vdc FTA (MU-TDOY22)	Digital Output 24 Vdc isolated with comp term	80366183-125
DO 24 Vdc FTA (MU-TDOY62)	Digital Output 24 Vdc isolated with screw terminals	80364013-125
DO 120 Vac Relay (MU-TDOR12)	DO 120 Vac/125 Vdc with compression terminals (Replaced by 51309148-125)	51304443-150
DO 120 Vac Relay (MU-TDOR52)	DO 120 Vac/125 Vdc with screw terminals (Replaced by 51309148-225)	51304443-250
	Relay plug-in module for above assemblies	51191945-100
DO 120 Vac Relay (MU-TDOR12)	DO 120 Vac/125 Vdc with compression terminals	51309148-125
DO 120 Vac Relay (MU-TDOR52)	DO 120 Vac/125 Vdc with screw terminals	51309148-225
	Relay plug-in module for above assemblies	51191945-100
DO 240 Vac Relay (MU-TDOR22)	DO 240 Vac/125 Vdc with compression terminals (Replaced by 51309150-125)	51304427-100
DO 240 Vac Relay (MU-TDOR62)	DO 240 Vac/125 Vdc with screw terminals (Replaced by 51309150-225)	51304427-200
	Relay plug-in module for above assemblies	51191945-100
DO 240 Vac Relay (MU-TDOR22)	DO 240 Vac/125 Vdc with compression terminals	51309150-125
DO 240 Vac Relay (MU-TDOR62)	DO 240 Vac/125 Vdc with screw terminals	51309150-225
	Relay plug-in module for above assemblies	51191945-100

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
DO 240 Vac Relay (MU-TDOY23)	DO 240 Vac/125 Vdc with compression terminals	80366189-125
DO 240 Vac Relay (MU-TDOY63)	DO 240 Vac/125 Vdc with screw terminals	80366186-125
	Relay (NT1) for above assemblies	83970001-110
	Jumper for above assemblie	51190610-101
Pulse Input FTA (MU-TPIX12)	Pulse Input with compression terminals	51304084-125
Pulse Input FTA (MU-TPIX52)	Pulse Input with screw terminals	51304084-225
	Plug-in module for above FTAs	51201602-100
Serial Device Interface FTA (MU-TSDT02)	Serial Device Interface (Toledo 8142) FTA	51303932-201
	Plug-in module for above FTA	51303934-201
Serial Device Interface FTA (MU-TSDM02)	Serial Device Interface (Manual/Auto Station)	51303932-202
	Plug-in module for above FTA	51303934-202
Serial Device Interface FTA (MU-TSDU02)	Serial Device Interface (UDC 6000)	51303932-203
	Plug-in module for above FTA	51303934-203
Serial Interface (MU-TSIM12)	Serial Interface (Modbus)	51303932-401
	Plug-in module for above FTA	51303934-401
Serial Interface (MU-TSIA12)	Serial Interface (Allen-Bradley)	51303932-403
	Plug-in module for above FTA	51303934-403
Power Adapter (MU-TLPA02)	Power Adapter (Used with LLMux, SDI, and SI)	51309204-125
DI Power Dist Assy MU-TDPR02)	Digital Input Power Distribution Assembly	51304425-125
Fieldbus FTA (MU-TFBS01)	Fieldbus FTA with Power Supply Module	51309254-125
	Plug-in module (MTL4995) for above FTA	51192538-100
	Bus terminator enable jumper for above FTA	30731549-002
Fieldbus FTA (MU-TFBS11)	Fieldbus FTA without Power Supply Module	51309254-325
DO Standby Manual (MU-SMDC02)	Digital Output Standby Manual Device with case	51304526-100
DO Standby Manual (MU-SMDX02)	Digital Output Standby Manual Device with case and cable	51304527-100
AO Standby Manual (MU-SMAC02)	Analog Output Standby Manual Device Assy with cable	51401277-100
Manual/Auto Station (MU-MASX02)	Honeywell Manual/Auto Station (part number PC6001-U-2MO-40-A0)	
GALVANICALLY ISOLATED FTA COMPONENTS		

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
HLAI FTA (MU-GAIH12)	HLAI FTA with GI Modules (Compress terminals) (Replaced by MU-GAIH13 – 51304718-125)	51304636-100
HLAI FTA (MU-GAIH82)	HLAI FTA with GI Modules (Crimp terminals) (Replaced by MU-GAIH83 – 51304718-325)	51304636-300
	HLAI Galvanic Isolation Module (MTL4041)	51191697-100
HLAI FTA (MU-GAIH13)	HLAI FTA with GI Modules (Compress terminals)	51304718-125
HLAI FTA (MU-GAIH83)	HLAI FTA with GI Modules (Crimp terminals)	51304718-325
	HLAI Galvanic Isolation Module (MTL4041B) (Replaced by Individual Module Replacement Kit number MTL4541B – 51202951-100)	51191697-200
HLAI FTA (MU-GAIH14)	HLAI FTA with GI Modules (Compress terminals)	51304730-125
	HLAI Galvanic Isolation Module MTL4041P) (Replaced by Individual Module Replacement Kit number MTL4541P – 51202952-100)	51191928-100
HLAI FTA (MU-GAIH84)	HLAI FTA with GI Modules (Crimp terminals)	51304730-325
	HLAI Galvanic Isolation Module MTL4041P) (Replaced by Individual Module Replacement Kit number MTL4541P – 51202952-100)	51191928-100
HLAI FTA (MU-GAIH22)	HLAI FTA with GI Modules (Compress terminals)	51304748-125
HLAI FTA (MU-GAIH92)	HLAI FTA with GI Modules (Crimp terminals)	51304748-325
	HLAI Galvanic Isolation Module (MTL4041B) (Replaced by Individual Module Replacement Kit number MTL4541B – 51202951-100)	51191697-200
HLAI Calibration Tool	HLAI calibration tool	51201450-100
24 Vdc DI FTA (MU-GDID12)	24 Vdc DI FTA with GI Modules (Compress Term)	51304640-125
24 Vdc DI FTA (MU-GDID82)	24 Vdc DI FTA with GI Modules (Crimp Terminals)	51304640-325
	24 Vdc DI Galvanic Isolation Module (MTL4016) (Replaced by Individual Module Replacement Kit number MTL4516 – 51202954-100)	51191699-100
24 Vdc DI FTA (MU-GDID13)	24 Vdc DI FTA with GI Modules (Compress Term)	51304728-125
24 Vdc DI FTA (MU-GDID83)	24 Vdc DI FTA with GI Modules (Crimp Terminals)	51304728-325
	24 Vdc DI Galvanic Isolation Module (MTL4013) (Replaced by Individual Module Replacement Kit number MTL4513 – 51202955-100)	51191926-100
AO FTA (MU-GHAO11)	AO redun FTA with HART and Comp Term	51309540-125

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	AO Galvanic Isolation Module (MTL4046C) (Replaced by Individual Module Replacement Kit number MTL4546Y – 51202953-100)	51192565-200
AO FTA (MU-GAOX02)	AO nonredun FTA with GI Modules (Comp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11/MU-GHAO21 with MTL 4546Y-51202953-100)	51304638-125
AO FTA (MU-GAOX72)	AO nonredun FTA with GI Modules (Crimp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11/MU-GHAO21 with MTL 4546Y-51202953-100)	51304638-325
AO FTA (MU-GAOX12)	AO redundant FTA with GI Modules (Comp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11 with MTL 4546Y- 51202953-100)	51304638-525
AO FTA (MU-GAOX82)	AO redundant FTA with GI Modules (Crimp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11 with MTL 4546Y- 51202953-100)	51304638-725
	AO Galvanic Isolation Module (MTL4045C)	51192097-200
	AO Galvanic Isolation Module (MTL4046P)	51192565-100
	Redundancy Module for FTA	51304338-100
DO FTA (MU-GDOD12)	DO FTA with GI Modules (Compression Terminals)	51304642-125
DO FTA (MU-GDOD82)	DO FTA with GI Modules (Crimp Terminals)	51304642-325
	DO Galvanic Isolation Module (MTL4021) (Replaced by Individual Module Replacement Kit number MTL4525 – 51202957-100)	51191698-100
DO FTA (MU-GDOL12)	DO FTA with GI Modules (Compression Terminals)	51304736-125
DO FTA (MU-GDOL82)	DO FTA with GI Modules (Crimp Terminals)	51304736-325
	DO Galvanic Isolation Module (MTL4023) (Replaced by Individual Module Replacement Kit number MTL4523 – 51202956-100)	51191927-100
LFD Combiner Panel (MU-GLFD02)	Line Fault Detection Combiner Panel	51304732-125
Power Distribution Assembly (MU-GPRD02)	Galvanic Isolation Power Distribution Assembly	51304644-125
Marshalling Panel (MU-GMAR52)	Marshalling Panel	51309156-125
FBUS (MU-GTBS01)	Fieldbus FTA with GI/IS PS module (Comp Term)	51309254-225
	Plug-in GI/IS module (MTL4053) for above FTAs	51192537-100
	Bus terminator enable jumper for above FTAs	30731549-002

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
GI Module Connector	Comp-type terminal connector for GI Modules	51191738-100
	Crimp-type terminal connector for GI Modules	51191737-100
	14-20 AWG wire crimp pins for above connector	51191737-201
MISCELLANEOUS COMPONENTS		
Card Case	Plastic case for IOP cards	51304072-100
	Plastic case for HPMM cards	51304072-200
Card Label	Label for HPM UCN Interface module	51109470-100
	Label for High-Performance Comm/Control card	51109604-100
	Label for High-Performance I/O Link card	51109605-100
	Label - Plain blue for IOP filler card	51109474-100
	Label for Low Level Analog Input IOP	51109475-100
	Label for High Level Analog Input IOP	51109476-100
	Label for Analog Output IOP	51109477-100
	Label for Digital Input IOP	51109478-100
	Label for Digital Output IOP	51109479-100
	Label for I/O Link Extender	51109480-100
	Label for Low Level Multiplexer IOP	51109486-100
	Label for Smart Transmitter Interface IOP	51109494-100
	Label for Serial Device Interface IOP	51109568-100
	Label for Serial Interface IOP	51109607-100
FTA Plug-in Terminal Block	8 Point terminal block	51190694-108
	12 Point terminal block	51190694-112
	8 Point terminal block, labeled 1-8, gold contacts, for LLAI	51190787-408
	8 Point terminal block, labeled 9-16, gold contacts, for LLAI	51190787-508
	11 Point terminal block, labeled 9-19, gold contacts, for LLAI	51190787-411
Terminal Block Cover	Cover for terminals on 8-channel LLAI FTA	51201569-100
Cabinet Fan Assembly	Cabinet fan assembly, 115 Vac without alarm	51304074-100
	Cabinet fan assembly, 230 Vac without alarm	51304074-200
Cabinet Fan	Fan, 115 Vac (replacement for 51304074-100)	68A8976P1

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	Fan, 230 Vac (replacement for 51304074-200)	68A8976P2
Cabinet Fan Assembly	Cabinet fan assembly, 115 Vac with alarm	51303940-100
	Cabinet fan assembly, 230 Vac with alarm	51303940-200
Cabinet Fan Assembly PWB	PWB, 115 Vac (replacement for 51303940-100)	51201475-100
	PWB, 230 Vac (replacement for 51303940-200)	51201475-200
Left 7- Slot Card File (MU-HPFH01)	Left 7-Slot HPMM/IOPcard file assy (slots 1-7)	51404125-100
Left 7- Slot Card File (MU-HPFH03)	Left 7-Slot HPMM card file assy (slots 1-7)	51404191-125
Left 7- Slot Card File (MU-HPFI03)	Left 7-Slot IOP card file assy (slots 1-7)	51404191-225
Left 7- Slot Card File Backpanel	Left 7-Slot card file backpanel assy (slots 1-7)	51401626-100
Right 7- Slot Card File (MU-HPFH11)	Right 7- Slot HPMM/IOP card file assy (9-15)	51404126-100
Right 7- Slot Card File (MU-HPFH13)	Right 7- Slot HPMM card file assy (slots 9-15)	51404192-125
Right 7- Slot Card File (MU-HPFI13)	Right 7- Slot IOP card file assy (slots 9-15)	51404192-225
Right 7- Slot Card File Backpanel	Right 7- Slot card file backpanel assy (slots 9-15)	51401629-100
15-Slot Card File (MU-HPFX02)	15-Slot HPMM/IOP card file assy (slots 1-15)	51404127-100
15-Slot Card File (MU-HPFX03)	15-Slot HPMM card file assy (slots 1-15)	51404193-125
15-Slot Card File (MU-HPFI23)	15-Slot IOP card file assy (slots 1-15)	51404193-225
15-Slot Card File Backpanel	15-Slot card file backpanel assy (slots 1-15)	51401632-100
IOP Only Card File (MU-IOFX02)	15 IOP Only card file assembly	51401546-100
IOP Only Card File Backpanel	15 IOP Only card file backpanel assembly	51402599-100
IOP Only Card File (MU-IOFX03)	15 IOP Only card file assembly	51404210-125
IOP Only Card File Backpanel	15 IOP Only card file backpanel assembly	51402599-125
Filler Plate	Filler plate between 7-Slot card files	51304720-100
Opto-Isolator	Solid-state opto-isolator for card files	51190516-202
Fuse Holder/Puller	Fuse holder/puller (15 IOP card file)	51190586-100
Fuse Holder/Puller	Fuse holder/puller (HPMM card files)	51309123-100
Jumper	Card file UCN node/I/O Link address plug jumper	51190624-900

Table 88 Non-Conformally Coated HPM ORU Parts List

Name	Description	Part Number
Range Resistor	100 ohm range resistor	51190102-100
	250 ohm range resistor	51190102-200
Zero Ohm Resistor	Zero ohm resistor for Power System backpanel when adding Battery Pack assembly	51190101-100

* Not an ORU part

Conformally coated ORU parts list

The following table is a parts list of confomally coated HPM ORU assemblies.

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
POWER SYSTEM COMPONENTS		
Power Supply Module	Standard 20 A Power Supply Module (Replaced by 51198651-100)	51109456-200 (obsolete)
Power Supply Module	AC Only 8 A Power Supply Module	51190465-150
Power Supply Module	AC Only 16 A Power Supply Module	51190465-250
48 V Battery Backup	48 V Battery Pack assembly	51303948-100
Power System Backpanel Assy	PM/APM Power System backpanel	51401166-150
Power System Backpanel Assy	HPM Power System backpanel	51404172-150
AC/DC Distribution Assembly	AC Only power control and distribution board 115 Vac dual PSMs	51401135-150
AC/DC Distribution Assembly	AC Only power control and distribution board 115 Vac single PSM	51401135-250
AC/DC Distribution Assembly	AC Only power control and distribution board 230 Vac dual PSMs	51401135-350
AC/DC Distribution Assembly	AC Only power control and distribution board 230 Vac single PSM	51401135-450
CMOS Battery Backup Assembly	PM/APM Charger/monitor for CMOS memory	51303968-150
CMOS Battery Backup Assembly	HPM PS charger/monitor for CMOS memory	51309206-150
HPMM CARDS/MODULE		
High-Performance Comm/Control	Communications/Control card	51401635-150 (obsolete) 51403988-150
High-Performance I/O Link	I/O Link Interface card	51309276-150
HPM UCN Interface	UCN Interface module	51402573-100 (obsolete) 51402573-250 (obsolete) 51402573-450
IOP CARDS		
HLAI IOP (MC-PAIH02)	High Level Analog Input card	51304489-150
HLAI IOP (MC-PAIH03)	High Level Analog Input card	51304754-150
LLAI IOP (MC-PAIL02)	Low Level Analog Input card	51304481-150
LLMux IOP (MC-PLAM02)	Low Level Multiplexer card	51304362-150

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
RHMUX IOP (MC-PRHM01)	Remote Hardened Low Level Multiplexer card	51404109-175
DI IOP (MC-PDIX02)	Digital Input card	51304485-150
DI IOP (MC-PDIY22)	Digital Input card	80363972-150
AO IOP (MC-PAOX02)	Analog Output card	51304483-150
AO IOP (MC-PAOX03)	Analog Output card (Replaced by 51309152-175)	51304672-150
AO IOP (MC-PAOX03)	Analog Output card	51309152-175
AO IOP (MC-PAOY22)	Analog Output card	80363969-150
DO IOP (MC-PDOX02)	Digital Output card	51304487-150
DO IOP (MC-PDOY22)	Digital Output card	80363975-150
STI IOP (MC-PSTX02)	Smart Transmitter Interface	51304516-150
STIM IOP (MC-PSTX03)	Smart Transmitter Interface Multivariable	51304516-250
PI IOP (MC-PPIX02)	Pulse Input card	51304386-150
SDI IOP (MC-PSDX02)	Serial Device Interface card	51304362-250
SI IOP (MC-PSIM11)	Serial Interface card	51304362-350
DISOE IOP (MC-PDIS11)	Digital Input Sequence Of Events card (Replaced by 51402625-175)	51304690-150
DISOE IOP (MC-PDIS12)	Digital Input Sequence Of Events card	51402625-175
FBUS IOP (MC-PFBS01)	Fieldbus card	51309510-175
Slot Filler Card	Slot filler card	51304260-250
I/O LINK EXTENDER COMPONENTS		
Standard I/O Link Extender (MC-IOLM02)	Standard I/O Link Extender card	51304419-150
	Standard fiber optic Tx/Rx coupler (1)	51201557-150
	Standard fiber optic Tx/Rx coupler (3)	51201557-350
Long Distance I/O Link Extender (MC-ILDX02) Replaced by (MC-ILDX03)	Long Distance I/O Link Extender card	51304532-150
	Long Distance fiber optic Tx/Rx coupler (1)	51201616-150
Long Distance I/O Link Extender (MC-ILDX03)	Long Distance I/O Link Extender card	51304532-150
	Long Distance fiber optic Tx/Rx coupler (1)	51309208-150
STANDARD FTA COMPONENTS		
HLAI/STI FTA (MC-TAIH02)	HLAI/STI with compression terminals	51304453-150
HLAI/STI FTA (MC-TAIH12)	HLAI/STI with compression terminals	51304337-150

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
HLAI/STI FTA (MC-TAIH22)	HLAI/STI with compression terminals	80366195-150
	AI Adapter Module for the above FTA	80367163-001
HLAI/STI FTA (MC-TAIH52)	HLAI/STI with screw terminals	51304337-250
HLAI/STI FTA (MC-TAIH62)	HLAI/STI with screw terminals	80366192-150
	AI Adapter Module for the above FTA	80360713-001
HLAI FTA (MC-TAIH03)	HLAI with compression terminals	51309136-175
HLAI FTA (MC-TAIH13)	HLAI with compression terminals	51309138-175
HLAI FTA (MC-TAIH23)	HLAI with compression terminals	80369165-175
	AI Adapter Module for the above FTA	80367163-001
HLAI FTA (MC-TAIH53)	HLAI with screw terminals	51309138-275
STI FTA (MC-TSTX03)	STI with compression terminals	51309140-175
STI FTA (MC-TSTX13)	STI with compression terminals	51309142-175
STI FTA (MC-TSTX53)	STI with screw terminals	51309142-275
LLAI FTA (MC-TAIL02)	LLAI FTA with compression terminals (Replaced by MC-TAIL03)	51304437-150
	Daughter module for above FTA (Replaced by 51309280-100)	51304085-150
LLAI FTA (MC-TAIL03)	LLAI FTA with compression terminals	51309202-175
	Daughter module for above FTA	51309280-100
LLMux FTA (MC-TAMT02)	LLMux local TC with compression terminals (Replaced by MC-TAMT03)	51401491-150
	LLMux Analog board for above FTA	51401564-150
LLMux FTA (MC-TAMT03)	LLMux local TC with compression terminals	51409223-175
LLMux FTA (MC-TAMT12)	LLMux remote TC with compression terminals (Replaced by MC-TAMT13)	51401573-150
	LLMux Analog board for above FTA	51401564-150
	LLMux remote sensor board for above FTA	51304589-150
LLMux FTA (MC-TAMT13)	LLMux remote TC with compression terminals	51409213-175
LLMux FTA (MC-TAMR02)	RTD with compression terminals (Replaced by MC-TAMR03)	51304477-150
	LLMux daughter board for above FTA	51401364-100
LLMux FTA (MC-TAMR03)	LLMux RTD with compression terminals	51309218-125
RHMUX FTA (MC-GRMT01)	RHMUX TC with screw terminals	51404106-175

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
RHMUX GI/IS Power Adapter (MC-GRPA01)	RHMUX GI/IS Power Adapter with compression terminals	51304724-175
RHMUX GI/NI Power Adapter (MC-TRPA01)	RHMUX GI/NI Power Adapter with compression terminals	51304722-175
AO FTA (MC-THAO11)	Analog Output with HART and comp. terminals	51309542-175
AO FTA (MC-TAOX02)	Analog Output with compression terminals	51304476-175
AO FTA (MC-TAOX12)	Analog Output with compression terminals	51304335-175
AO FTA (MC-TAOX52)	Analog Output with screw terminals	51304335-275
	Plug-in module for above FTAs	51304338-150
AO FTA (MC-TAOY22)	Analog Output with comp term, Stdby Manual	80366481-175
AO FTA (MC-TAOY23)	Analog Output with comp term, no Stdby Manual	80366177-250
AO FTA (MC-TAOY52)	Analog Output with screw term, Stdby Manual	80366484-175
AO FTA (MC-TAOY53)	Analog Output with screw term, no Stdby Manual	80364007-250
DI 120 Vac FTA (MC-TDIA12)	Digital Input 120 Vac with compression terminals	51304439-175
DI 120 Vac FTA (MC-TDIA52)	Digital Input 120 Vac with fixed-screw terminals	51304439-275
	Plug-in module for above FTAs	51190523-225
DI 120 Vac FTA (MC-TDIA72)	Digital Input 120 Vac with removable screw term	51303930-150
DI 240 Vac FTA (MC-TDIA22)	Digital Input 240 Vac with compression terminals	51304431-175
DI 240 Vac FTA (MC-TDIA62)	Digital Input 240 Vac with fixed-screw terminals	51304431-275
	Plug-in module for above FTAs	51190523-325
DI 24 Vdc FTA (MC-TDID12)	Digital Input 24 Vdc with compression terminals	51304441-175
DI 24 Vdc FTA (MC-TDID52)	Digital Input 24 Vdc with fixed-screw terminals	51304441-275
	Plug-in module for above FTAs	51190523-125
DI 24 Vdc FTA (MC-TDID72)	Digital Input 24 Vdc with removable screw term.	51303928-150
DI 24 Vdc FTA (MC-TDIY22)	Digital Input 24 Vdc with compression terminals	80366180-175
DI 24 Vdc FTA (MC-TDIY62)	Digital Input 24 Vdc with screw terminals	80364010-175
DO 120/240 Vac FTA (MC-TDOA12)	DO 120/240 Vac SS with fixed-compression term (Replaced by MC-TDOA13)	51304408-150
DO 120/240 Vac FTA (MC-TDOA52)	DO 120/240 Vac SS with fixed-screw terminals (Replaced by MC-TDOA53)	51304408-250
	Solid-state relay plug-in module for above FTAs	51190516-325
DO 120/240 Vac FTA (MC-TDOA13)	DO 24-240 Vac SS with removable comp term.	51304648-175
DO 120/240 Vac FTA (MC-TDOA53)	DO 24-240 Vac SS with removable screw term.	51304648-275

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	Solid-state relay plug-in module for above FTAs	51190516-332
DO 3-30 Vdc FTA (MC-TDOD12)	DO 3-30 Vdc SS with fixed-compression term (Replaced by MC-TDOD13)	51304423-150
DO 3-30 Vdc FTA (MC-TDOD52)	DO 3-30 Vdc SS with fixed-screw terminals (Replaced by MC-TDOD53)	51304423-250
	Solid-state relay plug-in module for above FTAs	
DO 3-30 Vdc FTA (MC-TDOD13)	DO 3-30 Vdc SS with removable comp terminals	51304650-150
DO 3-30 Vdc FTA (MC-TDOD53)	DO 3-30 Vdc SS with removable screw terminals	51304650-250
	Solid-state relay plug-in module for above FTAs	51190516-132
DO 3-30 Vdc FTA (MC-TDOD14)	DO 3-30 Vdc SS with fixed-compression term	51309153-175
DO 3-30 Vdc FTA (MC-TDOD54)	DO 3-30 Vdc SS with fixed-screw terminals	51309153-275
	Solid-state relay plug-in module for above FTAs	51190516-134
DO 31-200 Vac FTA (MC-TDOD22)	DO 31-200 Vdc SS with compression terminals	51304428-150
DO 31-200 Vac FTA (MC-TDOD62)	DO 31-200 Vdc SS with screw terminals	51304428-250
	Solid-state relay plug-in module for above FTAs	51190516-402
DO 31-200 Vac FTA (MC-TDOD23)	DO 31-200 Vdc SS with compression terminals	51309154-175
DO 31-200 Vac FTA (MC-TDOD63)	DO 31-200 Vdc SS with screw terminals	51309154-275
	Solid-state relay plug-in module for above FTAs	51190516-404
DO 24 Vdc FTA (MC-TDON12)	DO 24 Vdc 100 ma nonisolated with comp. term.	51304446-150
DO 24 Vdc FTA (MC-TDON52)	DO 24 Vdc 100 ma nonisolated with screw term.	51304446-250
DO 24 Vdc FTA (MC-TDOY22)	DO 24 Vdc isolated with compression terminals	80366183-175
DO 24 Vdc FTA (MC-TDOY62)	DO 24 Vdc isolated with screw terminals	80364013-175
DO 120 Vac Relay (MC-TDOR12)	DO 120 Vac/125 Vdc with compression terminals (Replaced by 51309148-125)	51304443-150
DO 120 Vac Relay (MC-TDOR52)	DO 120 Vac/125 Vdc with screw terminals (Replaced by 51309148-225)	51304443-250
	Relay plug-in module for above assemblies	51191945-100
DO 120 Vac Relay (MC-TDOR12)	DO 120 Vac/125 Vdc with compression terminals	51309148-175
DO 120 Vac Relay (MC-TDOR52)	DO 120 Vac/125 Vdc with screw terminals	51309148-275
	Relay plug-in module for above assemblies	51191945-100
DO 240 Vac Relay (MC-TDOR22)	DO 240 Vac/125 Vdc with compression terminals (Replaced by 51309150-125)	51304427-150
DO 240 Vac Relay (MC-TDOR62)	DO 240 Vac/125 Vdc with screw terminals (Replaced	51304427-250

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	by 51309150-225)	
	Relay plug-in module for above assemblies	51191945-100
DO 240 Vac Relay (MC-TDOR22)	DO 240 Vac/125 Vdc with compression terminals	51309150-175
DO 240 Vac Relay (MC-TDOR62)	DO 240 Vac/125 Vdc with screw terminals	51309150-275
	Relay plug-in module for above assemblies	51191945-150
DO 240 Vac Relay (MC-TDOY23)	DO 240 Vac/125 Vdc with compression terminals	80366189-175
DO 240 Vac Relay (MC-TDOY63)	DO 240 Vac/125 Vdc with screw terminals	80366185-175
	Relay (NT1) for above assemblies	83970001-110
	Jumper for above assemblies	51190610-101
Pulse Input FTA (MC-TPIX12)	Pulse Input with compression terminals	51304084-175
Pulse Input FTA (MC-TPIX52)	Pulse Input with screw terminals	51304084-275
	Plug-in module for above FTAs	51201602-100
Serial Device Interface FTA (MC TSDT02)	Serial Device Interface (Toledo 8142) FTA	51303932-251
	Plug-in module for above FTA	51303934-201
Serial Device Interface FTA (MCTSDM02)	Serial Device Interface (Manual/Auto Station)	51303932-252
	Plug-in module for above FTA	51303934-202
Serial Device Interface FTA (MC-TSDU02)	Serial Device Interface (UDC 6000)	51303932-253
	Plug-in module for above FTA	51303934-203
Serial Interface (MC-TSIM12)	Serial Interface (Modbus)	51303932-476
	Plug-in module for above FTA	51303934-401
Serial Interface (MC-TSIA12)	Serial Interface (Allen-Bradley)	51303932-478
	Plug-in module for above FTA	51303934-403
Power Adapter (MC-TLPA02)	Power Adapter (Used with LLMux, SDI, and SI)	51309204-175
DI Power Dist Assy (MC-TDPR02)	Digital Input Power Distribution Assembly	51304425-175
Fieldbus FTA (MC-TFBS01)	Fieldbus FTA with Power Supply Module	51309254-175
	Plug-in module (MTL4995) for above FTA	51192538-100
	Bus terminator enable jumper for above FTA	30731549-002
Fieldbus FTA (MC-TFBS11)	Fieldbus FTA without Power Supply Module	51309254-375
DO Standby Manual (MC-SMDC02)	Digital Output Standby Manual Device with case	51304526-150

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
DO Standby Manual (MC-SMDX02)	Digital Output Standby Manual Device with case and cable	51304527-150
AO Standby Manual (MC-SMAC02)	Analog Output Standby Manual Device Assy with cable	51401277-150
GALVANICALLY ISOLATED FTA COMPONENTS		
HLAI FTA (MC-GAIH12)	HLAI FTA with GI Modules (Compress terminals) (Replaced by MC-GAIH13 – 51304718-175)	51304636-150
HLAI FTA (MC-GAIH82)	HLAI FTA with GI Modules (Crimp terminals) (Replaced by MC-GAIH83 – 51304718-375)	51304636-350
	HLAI Galvanic Isolation Module (MTL4041)	51191697-100
HLAI FTA (MC-GAIH13)	HLAI FTA with GI Modules (Compress terminals)	51304718-175
HLAI FTA (MC-GAIH83)	HLAI FTA with GI Modules (Crimp terminals)	51304718-375
	HLAI Galvanic Isolation Module (MTL4041B) (Replaced by Individual Module Replacement Kit number MTL4541B – 51202951-100)	51191697-200
HLAI FTA (MC-GAIH14)	HLAI FTA with GI Modules (Compress terminals)	51304730-175
	HLAI Galvanic Isolation Module MTL4041P) (Replaced by Individual Module Replacement Kit number MTL4541P – 51202952-100)	51191928-100
HLAI FTA (MC-GAIH84)	HLAI FTA with GI Modules (Crimp terminals)	51304730-375
	HLAI Galvanic Isolation Module MTL4041P) (Replaced by Individual Module Replacement Kit number MTL4541P – 51202952-100)	51191928-100
HLAI FTA (MC-GAIH22)	HLAI FTA with GI Modules (Compress terminals)	51304748-175
HLAI FTA (MC-GAIH92)	HLAI FTA with GI Modules (Crimp terminals)	51304748-375
	HLAI Galvanic Isolation Module (MTL4041B) (Replaced by Individual Module Replacement Kit number MTL4541B – 51202951-100)	51191697-200
HLAI Calibration Tool	HLAI calibration tool	51201450-100
24 Vdc DI FTA (MC-GDID12)	24 Vdc DI FTA with GI Modules (Comp Term)	51304640-175
24 Vdc DI FTA (MC-GDID82)	24 Vdc DI FTA with GI Modules (Crimp Term)	51304640-375
	24 Vdc DI Galvanic Isolation Module (MTL4016) (Replaced by Individual Module Replacement Kit number MTL4516 – 51202954-100)	51191699-100
24 Vdc DI FTA (MC-GDID13)	24 Vdc DI FTA with GI Modules (Comp Term)	51304728-175
24 Vdc DI FTA (MC-GDID83)	24 Vdc DI FTA with GI Modules (Crimp Term)	51304728-375

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	24 Vdc DI Galvanic Isolation Module (MTL4013) (Replaced by Individual Module Replacement Kit number MTL4513 – 51202955-100)	51191926-100
AO FTA (MC-GHAO11)	AO redun FTA with HART and Comp Term	51309540-175
	AO Galvanic Isolation Module (MTL4046C) (Replaced by Individual Module Replacement Kit number MTL4546Y – 51202953-100)	51192565-200
AO FTA (MC-GAOX72)	AO FTA with GI Modules (Crimp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11/MU-GHAO21 with MTL 4546Y- 51202953-100)	51304638-375
AO FTA (MC-GAOX12)	AO FTA with GI Modules (Comp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11 with MTL 4546Y- 51202953-100)	51304638-575
AO FTA (MC-GAOX02)	AO nonredun FTA with GI Modules (Comp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11/MU-GHAO21 with MTL 4546Y- 51202953-100)	51304638-175
AO FTA (MC-GAOX82)	AO FTA with GI Modules (Crimp Term) (There is no replacement with MTL 4500 series, but you can use MU-GHAO11 with MTL 4546Y- 51202953-100)	51304638-775
	AO Galvanic Isolation Module (MTL4045C)	51192097-200
	AO Galvanic Isolation Module (MTL4046P)	51192565-100
	Redundancy Module for FTA	51304338-100
DO FTA (MC-GDOD12)	DO FTA with GI Modules (Compression Term)	51304642-175
DO FTA (MC-GDOD13)	DO FTA with GI Modules (Compression Term) (with Line Fault Detection Feature) (Replaced by Individual Module Replacement Kit number MTL4525 – 51202957-100)	51307049-175
DO FTA (MC-GDOD82)	DO FTA with GI Modules (Crimp Terminals)	51304642-375
	DO Galvanic Isolation Module (MTL4021) (Replaced by Individual Module Replacement Kit number MTL4525 – 51202957-100)	51191698-100
DO FTA (MC-GDOL12)	DO FTA with GI Modules (Compression Term)	51304736-175
DO FTA (MC-GDOL82)	DO FTA with GI Modules (Crimp Terminals)	51304736-375
	DO Galvanic Isolation Module (MTL4023) (Replaced by Individual Module Replacement Kit	51191927-100

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
	number MTL4523 – 51202956-100)	
LFD Combiner Panel (MC-GLFD02)	Line Fault Detection Combiner Panel	51304732-175
Power Distribution Assembly (MC-GPRD02)	Galvanic Isolation Power Distribution Assembly	51304644-175
Marshalling Panel (MC-GMAR52)	Marshalling Panel	51309156-175
FBUS (MC-GTBS01)	Fieldbus FTA with GI/IS PS module (Comp Term	51309254-275
FBUS (MC-GTBS71)	Fieldbus FTA with GI/IS PS module (Crimp Term)	51309254-475
	Plug-in GI/IS module (MTL4053) for above FTAs	51192537-100
	Bus terminator enable jumper for above FTAs	30731549-002
GI Module Connector	Comp-type terminal connector for GI modules	51191738-100
	Crimp-type terminal connector for GI modules	51191737-100
	14-20 AWG wire crimp pins for above connector	51191737-201
MISCELLANEOUS COMPONENTS (continued)		
Cabinet Fan Assembly	Cabinet fan assembly, 115 Vac without alarm	51304074-150
	Cabinet fan assembly, 230 Vac without alarm	51304074-250
Cabinet Fan	Fan, 115 Vac (replacement for 51304074-100)	68A8976P1
	Fan, 230 Vac (replacement for 51304074-200)	68A8976P2
Cabinet Fan Assembly	Cabinet fan assembly, 115 Vac with alarm	51303940-150
	Cabinet fan assembly, 230 Vac with alarm	51303940-250
Cabinet Fan Assembly PWB	PWB, 115 Vac (replacement for 51303940-150)	51201475-150
	PWB, 230 Vac (replacement for 51303940-250)	51201475-250
Left 7- Slot Card File (MC-HPFH01)	Left 7-Slot HPMM/IOPcard file assy (slots 1-7)	51404125-150
Left 7- Slot Card File (MC-HPFH03)	Left 7-Slot HPMM card file assy (slots 1-7)	51404191-175
Left 7- Slot Card File (MC-HPFI03)	Left 7-Slot IOP card file assy (slots 1-7)	51404191-275
Left 7- Slot Card File Backpanel	Left 7-Slot card file backpanel assy (slots 1-7)	51401626-150
Right 7- Slot Card File (MC-HPFH11)	Right 7- Slot HPMM/IOP card file assy (9-15)	51404126-150
Right 7- Slot Card File (MC-HPFH13)	Right 7- Slot HPMM card file assy (slots 9-15)	51404192-175
Right 7- Slot Card File (MC-HPFI13)	Right 7- Slot IOP card file assy (slots 9-15)	51404192-275
Right 7- Slot Card File Backpanel	Right 7- Slot card file backpanel assy (slots 9-15)	51401629-150
15-Slot Card File (MC-HPFX02)	15-Slot HPMM/IOP card file assy (slots 1-15)	51404127-150
15-Slot Card File (MC-HPFX03)	15-Slot HPMM card file assy (slots 1-15)	51404193-175

Table 89 Conformally Coated HPM ORU Parts List

Name	Description	Part Number
15-Slot Card File (MC-HPFI23)	15-Slot IOP card file assy (slots 1-15)	51404193-275
15-Slot Card File Backpanel	15-Slot card file backpanel assy (slots 1-15)	51401632-150
IOP Only Card File (MC-IOFX02)	15 IOP Only card file assembly	51401546-150
IOP Only Card File Backpanel	15 IOP Only card file backpanel assembly	51402599-150
IOP Only Card File (MC-IOFX03)	15 IOP Only card file assembly	51404210-175
IOP Only Card File Backpanel	15 IOP Only card file backpanel assembly	51402599-175
Filler Plate	Filler plate between 7-Slot card files	51304720-150

* Not an ORU part

9.3   UCN/EUCN Parts

UCN Parts list

The UCN spare parts are listed in Table 90 UCN Parts List for easy reference. This same list of spare parts can also be found in the *Logic Manager Service* and *Process Manager/Advanced Process Manager Service* manuals. Information about these parts can be found in the *High-Performance Process Manager Installation* and the *Universal Control Network (UCN) Planning* manuals.

Table 90 UCN Parts List

Name	Description		Part Number
UCN Drop Cable	RG-6 UCN drop cable (pair)		
		0.5 meter	51195153-900
		1.5 meters	51195153-901
	MU-NKD002	2.0 meters	51195153-002
		2.5 meters	51195153-902
		3.5 meters	51195153-903
		4.5 meters	51195153-904
	MU-NKD005	5.0 meters	51195153-005
	MU-NKD010	10.0 meters	51195153-010
	MU-NKD020	20.0 meters	51195153-020
	MU-NKD030	30.0 meters	51195153-030
	MU-NKD040	40.0 meters	51195153-040
	MU-NKD050	50.0 meters	51195153-050
UCN Trunk Cable	RG-11 UCN trunk cable (pair) – internal application		
	MU-NKT002	2.6 meters	51195199-002
	MU-NKT005	5.2 meters	51195199-005
	MU-NKT010	10.4 meters	51195199-010
	MU-NKT020	20.8 meters	51195199-020
	MU-NKT030	31.2 meters	51195199-030
	MU-NKT040	41.6 meters	51195199-040
	MU-NKT050	52.0 meters	51195199-050
	MU-NKT100	101.4 meters	51195199-100
	MU-NKT200	200.2 meters	51195199-200
	MU-NKT400	400.4 meters	51195199-400
	MU-NKT600	600.6 meters	51195199-600

Table 90 UCN Parts List

Name	Description		Part Number
UCN Trunk Cable	UCN trunk cable RG-11 – external application		
		152.4 meters	51191607-152
		304.9 meters	51191607-305
		762.4 meters	51191607-762
UCN Trunk Cable	UCN trunk cable RG-11 – internal application		51190899-xxx
		152.4 meters	51190899-152
		304.9 meters	51190899-305
		762.4 meters	51190899-762
UCN Trunk Tap Kit	2-Drop tap assembly kit (pair)	(MU-NTAP02)	51201394-100
	4-Drop tap assembly kit (pair)	(MU-NTAP04)	51201395-100
	8-Drop tap assembly kit (pair)	(MU-NTAP08)	51109485-100
UCN Tap Terminator	UCN tap terminator		51190782-200
Trunk Splice Kit	Splice kit for RG-11	(MU-NCSK01)	51195160-100
Trunk Cable Connector Kit	RG-6 drop cable connect kit W/O tool	(MU-NKDK01)	51195161-100
	RG-11 trunk cable connect kit W/O tool	(MU-NKTK01)	51195162-100
Connector Tool	RG-6 drop cable connector tool	(MU-NKDT01)	51190797-200
	RG-11 trunk cable connector tool	(MU-NKTT01)	51190795-200
Connector Torque Wrench	25 inch/pound torque wrench kit with three wrench heads for UCN connectors	(MU-NKTQ01)	51109612-100

EUCN Parts list

The EUCN spare parts are listed in Table 83 EUCN Parts List for easy reference. Information about these parts can be found in the *High-Performance Process Manager Installation* and the *Universal Control Network (UCN) Planning* manuals.

Table 83 EUCN Parts List

Name	Description	Part Number
Enhanced High-Performance Comm/Control	EHPM Communications/Control card	51454192-150
Enhanced High-Performance FTE Interface	EHPM FTE Interface	51454307-100
Control Firewall (CF9)	Control Firewall (8 ports + 1 uplink)	CC-PCF901
Control Firewall IOTA	Control Firewall IOTA	CC-TCF901
8-port switch	8-port switch	NE-SW508S
8-port copper expansion module	8-port copper expansion module	NE-SW58TM
8-port fiber expansion module	8-port fiber expansion module	NE-SW58FM
EPNI2	Enhanced Process Network Interface, EPNI2	51454196
EPNI2 I/O	Enhanced Process Network Interface I/O, EPNI2 I/O	51306816
HPM I/O Link	PWA,HPM I/O Link	51309276-150
HPM I/O Link	PWA,HPM I/O Link	51307190-150
FTE IF Module	FTE IF Module Assembly	51454307-100
Cross Over Cable with White Boots	100-Base- T Cross Over Cablewith White Boots, 2Mtr Length For FTE Redundancy	51305786-502
FTE Cable A	FTE Cable A (Yellow)	51305482-xxx
FTE Cable B	FTE Cable B (Green)	51305482-xxx

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