Honeywell

High-Performance Process Manager Planning

HP02-500

TotalPlant

Honeywell

System Site Planning - 2

High-Performance Process Manager Planning

HP02-500
Release 530
CE Compliant
3/98

TotalPlant

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About This Publication

This manual provides information necessary to properly plan the installation of a High-Performance Process Manager (HPM) subsystem at a TPS system site. The subsystem encompasses the High-Performance Process Manager and the Network Interface Module (NIM), which is resident on the Universal Control Network (UCN), a network associated with the TPS system Local Control Network (LCN). The amount of information that this publication provides depends on your personal experience and the process that the High-Performance Process Manager will control and monitor.

The experienced planner, a person involved in the installation of TPS system's Basic or LCN equipment, will find that some information is familiar. However, regardless of your past experience, you must read Section 4 in this manual to enhance your knowledge of the process control connections available, and also reference the *TPS System Site Planning*, *Universal Control Network Planning, and Universal Control Network Installation* manuals to prepare yourself for the connection of the High-Performance Process Manager to the Universal Control Network.

In some cases, control room expansion will be part of installing the High-Performance Process Manager. If this is the case, use the *LCN Planning* and *LCN Installation* manuals to plan for expansion of the network.

This publication supports **TotalPlant** Solution (TPS) system network software Release 530 or earlier software releases. TPS is the evolution of TDC 3000X.

The publication supports CE Compliant equipment. Any equipment designated as "CE Compliant" complies with the European Union EMC and its health and safety directives. All equipment entering the European countries after January 1, 1996 require this type of compliance, denoted by the "CE Mark."

Standard Symbols

Scope

The standard symbols used in this publication are defined as follows.

ATTENTION

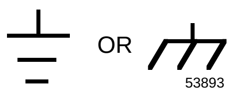
Notes inform the reader about information that is required, but not immediately evident.

CAUTION

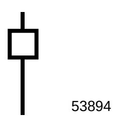
Cautions tell the user that damage may occur to equipment if proper care is not exercised.

WARNING

Warnings tell the reader that potential personal harm or serious economic loss may happen if instructions are not followed.

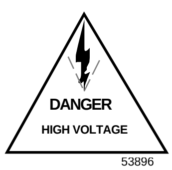


Ground connection to building safety ground.

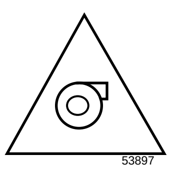


Ground stake for building safety ground.

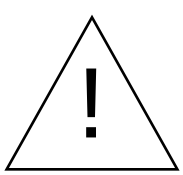
Electrical Shock Hazard—can be lethal.



Electrical Shock Hazard—can be lethal.



Rotating Fan—can cause personal injury.



Caution—refer to the appropriate installation document.

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Acronyms

AC .... Alternating Current
ANSI .... American National Standards Institute
AO .... Analog Output
AWG .... American Wire Gauge
CJR .... Cold Junction Reference
CMOS .... Complementary Metal Oxide Semiconductor
DC .... Direct Current
DISOE .... Digital Input Sequence of Events
DI .... Digital Input
DO .... Digital Output
EIA .... Electronic Industries Association
EMI .... Electromagnetic Interference
FM .... Factory Mutual Research, Inc.
FTA .... Field Termination Assembly
GI .... Galvanic Isolation
HLAI .... High Level Analog Input
HPM .... High-Performance Process Manager
HPMM .... High-Performance Process Manager Module
IS .... Intrinsic Safety
I/O .... Input/Output
IEC .... International Electrotechnical Commission
IEEE .... Institute of Electrical and Electronic Engineering
ISA .... Instrument Society of America
ISO .... International Standards Organization
LCN .... Local Control Network
LFD .... Line Fault Detection
LLAI .... Low Level Analog Input
LLMux .... Low Level Analog Input Multiplexer
MRG .... Master Reference Ground
NE .... National Electrical Code
NEMA .... National Electrical Manufacturer's Association
NFPA .... National Fire Protection Agency
NiCad .... Nickel Cadmium
NIM .... Network Interface Module
PI .... Pulse Input
PSM .... Power Supply Module
PS .... Power System
PVC .... Polyvinyl Chlorine
PV .... Process Variable
RHMUX .... Remote Hardened Low Level Analog Input Multiplexer
RTD .... Resistive Temperature Device
RTU .... Remote Terminal Unit
SDI .... Serial Device Interface
SI .... Serial Interface
STI .... Smart Transmitter Interface
STIM .... Smart Transmitter Interface Multivariable
TC .... Thermocouple
UCN .... Universal Control Network
UV .... Ultra Violet

References

Publication Title	Publication Number	Binder Title	Binder Number
High-Performance Process Manager Specification and Technical Data	HP03-500	System Summary - 2	TPS 3010-2
High-Performance Process Manager Installation	HP20-500	Implementation/ High-Performance Process Manager - 3	TPS 3066-3
High-Performance Process Manager Checkout	HP20-510	Implementation/ High-Performance Process Manager - 3	TPS 3066-3
High-Performance Process Manager Service	HP13-500	PM/APM/HPM Service - 1	TPS 3061-1
Process Manager I/O Specification and Technical Data	IO03-500	System Summary - 2	TPS 3010-2
Process Manager I/O Installation	PM20-520	Implementation/ High-Performance Process Manager - 3	TPS 3066-3
TPS System Site Planning	SW02-550	System Site Planning - 1	TPS 3020-1
Universal Control Network Specification and Technical Data	UN03-500	System Summary - 2	TPS 3010-2
Universal Control Network Planning	UN02-501	System Site Planning - 1	TPS 3020-1
Universal Control Network Installation	UN20-500	Installation/Universal Control Network	TPS 3041
Universal Control Network Guidelines	UN12-510	Installation/Universal Control Network	TPS 3041
Local Control Network Planning	SW02-501	System Site Planning - 1	TPS 3020-1
LCN System Installation	SW20-500	LCN Installation	TPS 3025
LCN System Checkout	SW20-510	LCN Installation	TPS 3025
LCN Guidelines - Implementation, Troubleshooting, and Service	LC09-510	LCN Installation	TPS 3025

Section 1 – Introduction

1.1 Overview

Section contents

The topics covered in this section are:

The manual's purpose

This manual is intended for planning the installation of a High-Performance Process Manager (HPM) subsystem at a TPS system site. The High-Performance Process Manager subsystem is a device on the Universal Control Network (UCN) that includes the Network Interface Module (NIM). Process Managers (PMs), Advanced Process Managers (APMs), and Logic Managers (LMs) may also be resident on the network.

The manual's contents

Planning includes the consideration of the High-Performance Process Manager cabinet layout, process wiring techniques, Division 2 environment equipment approval, conformal coating of the assemblies to protect against a corrosive environment, HPMM and IOP redundancy, and unique hardware features, such as fiber optic I/O Link Extenders, Low Level Analog Input Multiplexer FTAs, Serial Device Interface FTAs, Serial Interface FTAs, and Galvanically Isolated FTAs.

Information not covered

Neither installation, power on checkout, or service of the High-Performance Process Manager, nor planning for the Local Control Network (LCN) is addressed in this manual. See the related reference documentation for information about these topics.

Section 2 – HPM Description

2.1 Overview

Section contents

The topics covered in this section are:

HPM major assemblies

The High-Performance Process Manager subsystem (HPM) consists of major assemblies described in the following subsections. The major High-Performance Process Manager assemblies are

- High-Performance Process Manager Module (HPMM) card file
- Input/Output Processor (IOP) card file
- Input/Output Processor (IOP) card
- I/O Link Extender
- Field Termination Assembly (FTA)
- Power System

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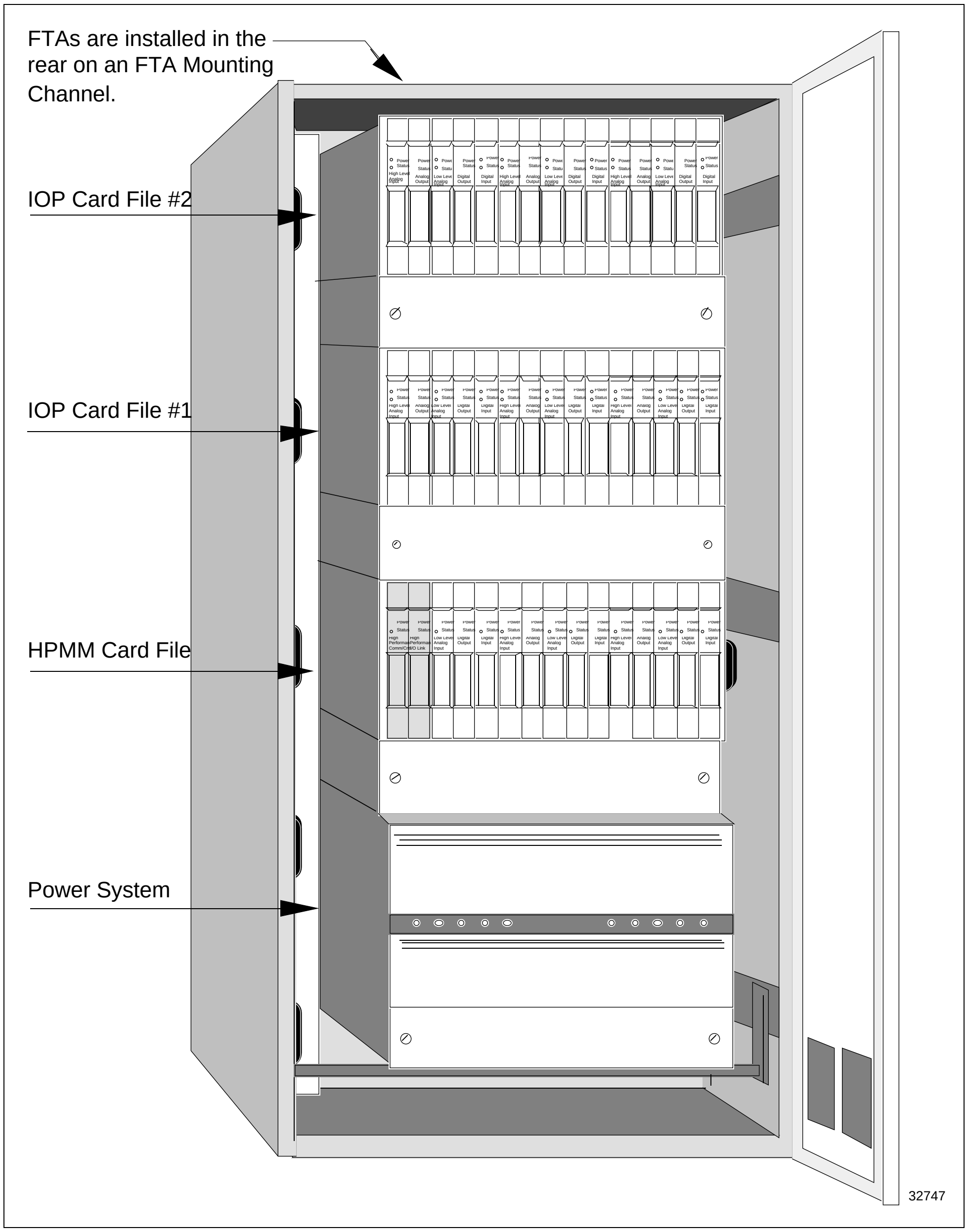
Nonredundant HPM cabinet layout

Figure 2-1 is an illustration of a single High-Performance Process Manager cabinet containing a nonredundant High-Performance Process Manager Module (HPMM) with supporting assemblies. The HPMM cards (2) and the IOPs cards are installed in 15-Slot HPMM card files. IOP cards occupy the IOP card files.

Figure 2-1 Nonredundant HPMM Cabinet Layout



2.2 Card Files

Introduction

There are nine card file models. Three models are not CE Compliant and six models are CE Compliant. Table 2-1 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 2-1 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

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.

2.2.1 HPMM Card Files

Three types of HPM card files

There are three types of HPMM card files. The two left-most slots of each type are populated by the three assemblies that comprise the HPMM. The remaining slots accommodate IOPs.

If the card file is a non-CE Compliant card file, the two left-most slots of each type can also accommodate IOPs with no alterations. The card file is then designated an IOP card file.

HPMM description

The High-Performance Process Manager Module (HPMM) is composed of two card assemblies that install in the two left-most slots in a 7-Slot or 15-Slot card file, and a UCN interface module that mounts and connects to the 50-pin connector that is directly below the left-most card.

The three HPMM assemblies are identified as follows:

- High-Performance Communications/Control (High-Performance Comm/Control) card
- High-Performance I/O Link Interface (High-Performance I/O Link) card
- High-Performance UCN Interface (HPM UCN Interface) module

The HPM UCN Interface module connects to the 50-pin connector below the High-Performance Comm/Control card.

Left 7-Slot HPMM card file description

The Left 7-Slot card file accepts the two HPMM cards and the HPM UCN Interface module that comprise the HPMM, and accommodates up to five IOP cards. The card slots are numbered 1 through 7, starting at the left-most position.

The High-Performance Comm/Control and High-Performance I/O Link cards occupy slots 1 and 2, while the HPM UCN Interface module mounts below slot 1 and connects to its 50-pin connector.

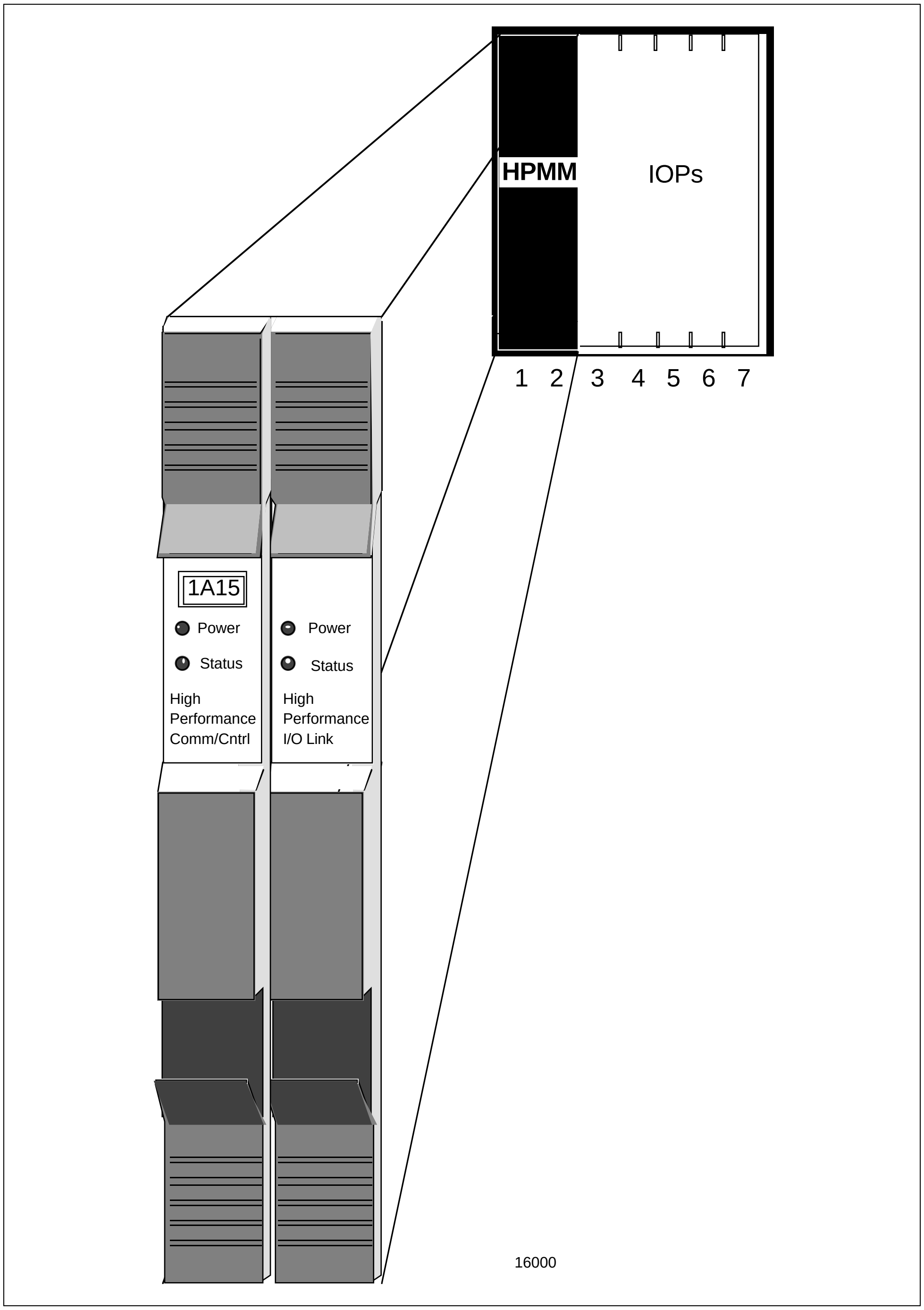
Slots 3 through 7 can accommodate IOP cards. The IOP card slots assume numerical I/O Link Interface addresses of 3 through 7 and binary I/O Link Interface addresses of 2 through 6.

Continued on next page

Left 7-Slot HPMM card file illustration

Figure 2-2 is an illustration of a Left 7-Slot HPMM card file and the two HPMM cards that occupy slots 1 and 2.

Figure 2-2 Left 7-Slot HPMM Card File



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2.2.1 HPMM Card Files, Continued

Right 7-Slot HPMM card file description

The description of the Right 7-Slot HPMM card file is identical to the Left 7-Slot HPMM card file, except the two HPMM cards and the UCN interface module occupy slots 9 and 10. The card slots are numbered 9 through 15.

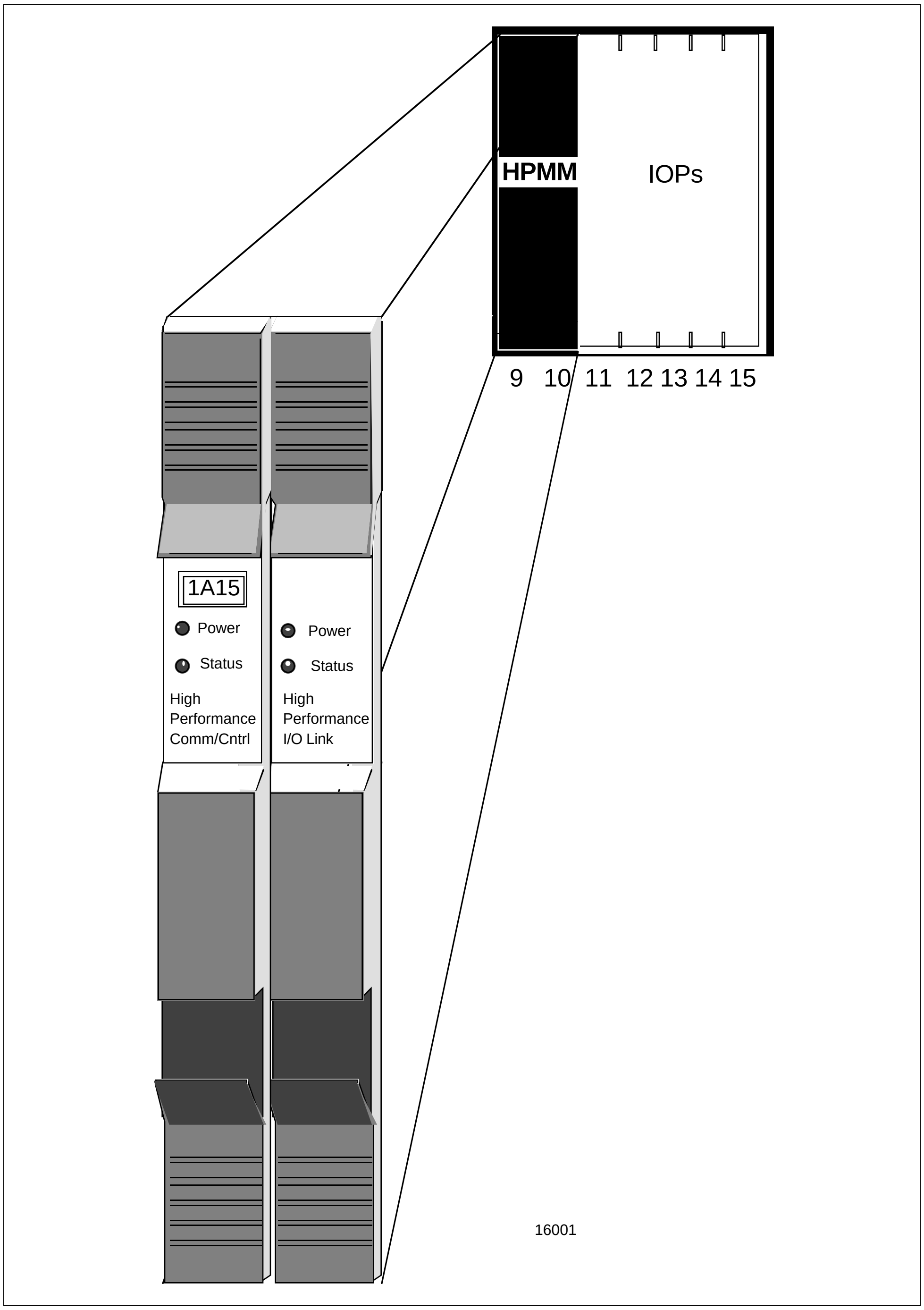
Slots 11 through 15 accommodate IOP cards. The IOP card slots assume numerical I/O Link Interface addresses of 11 through 15 and binary I/O Link Interface addresses of 10 through 14.

Continued on next page

Right 7-Slot HPMM card file illustration

Figure 2-3 is an illustration of a Right 7-Slot HPMM card file and the two HPMM cards that occupy slots 9 and 10.

Figure 2-3 Right 7-Slot HPMM Card File



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15-Slot HPMM card file description

The 15-Slot card file accepts the two HPMM cards and the UCN interface module that comprise the HPMM, and accommodates up to thirteen IOP cards. The card slots are numbered 1 through 15, starting at the left-most position.

The High-Performance Comm/Control and High-Performance I/O Link cards occupy slots 1 and 2, while the HPM UCN Interface module mounts below slot 1 in its 50-pin connector.

Slots 3 through 15 can accommodate IOP cards. The IOP card slots assume numerical I/O Link Interface addresses of 3 through 15 and binary I/O Link Interface addresses of 2 through 14.

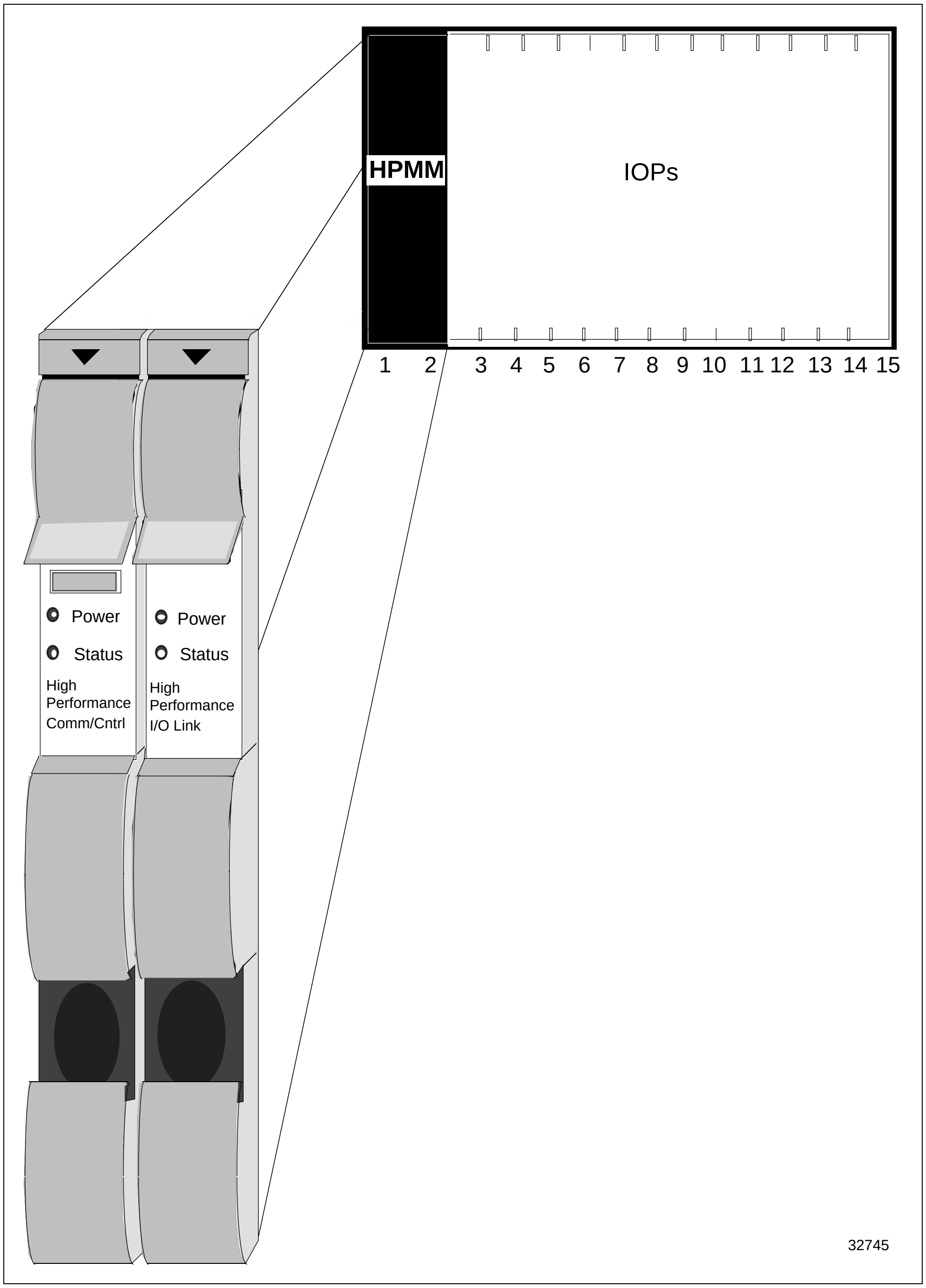
When populated with the HPMM cards, the card file is designated a 15-Slot HPMM card file.

Continued on next page

15-Slot HPMM card file illustration

Figure 2-4 is an illustration of a 15-Slot HPMM card file and the two HPMM cards that occupy slots 1 and 2.

Figure 2-4 15-Slot HPMM Card File



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2.2.1 HPMM Card Files, Continued

7-Slot HPMM card file usage

The two types of 7-Slot HPMM card files are intended to be used in a small HPM subsystem.

When the subsystem consists of nonredundant HPMMs, a Left 7-Slot HPMM card file must be installed. For a subsystem that requires redundant HPMMs, Left and Right 7-Slot HPMM card files are installed. Both card files are assigned the same the same I/O Link Interface address. There is no slot 8 because the card file slots are numbered 1 through 7 and 9 through 15.

15-Slot HPMM card file usage

The 15-Slot HPMM card file is intended for use in a larger HPM subsystem, either with nonredundant or redundant HPMMs. Unlike the 7-Slot HPMM card file, there is no “loss” of a card slot.

HPMM functionality

The HPMM provides the following functions:

- 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 (Intel 80C32) with SRAM
- HPMM redundancy control

2.2.2 Input/Output Processor (IOP) Card Files

IOP card file descriptions

The 7-Slot and 15-Slot IOP card files are electrically identical to the HPMM card files, except that an HPMM card set is not installed in the card file. IOPs can be installed in the two left-most card slots.

Non-CE Compliant card files

Non-CE Compliant HPMM and IOP card files differ only in the application. Electrically and mechanically, their backpanels are the same. The card file model numbers are the same.

CE Compliant card files

CE Compliant HPMM and IOP card files differ mechanically. IOP card files have filtered IOP connectors and connector ground plates. Electrically, their backpanels are the same. The card file model numbers are different.

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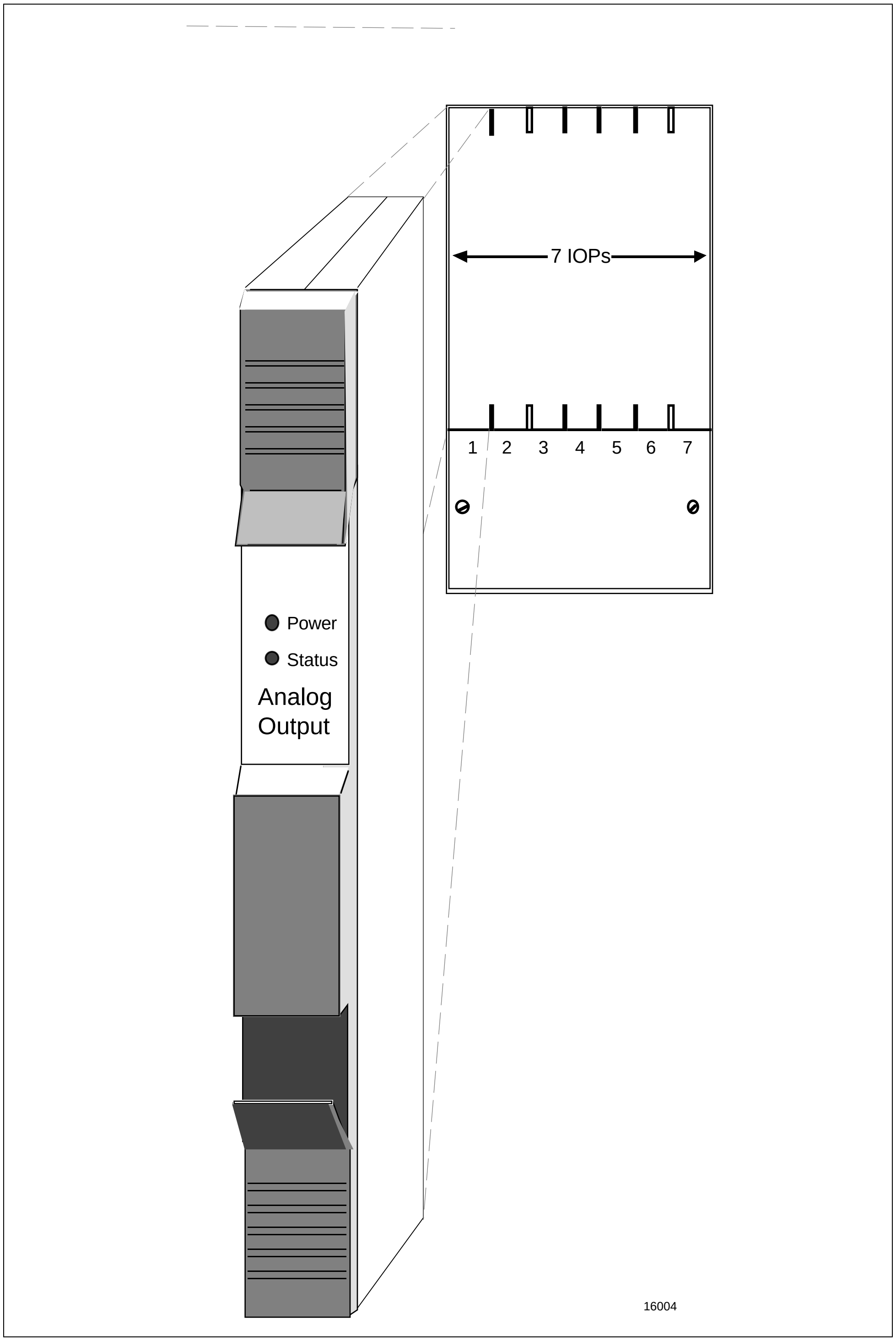
Left 7-Slot IOP card file

Figure 2-5 illustrates a Left 7-Slot IOP card file.

Figure 2-5 Left 7-Slot IOP Card File



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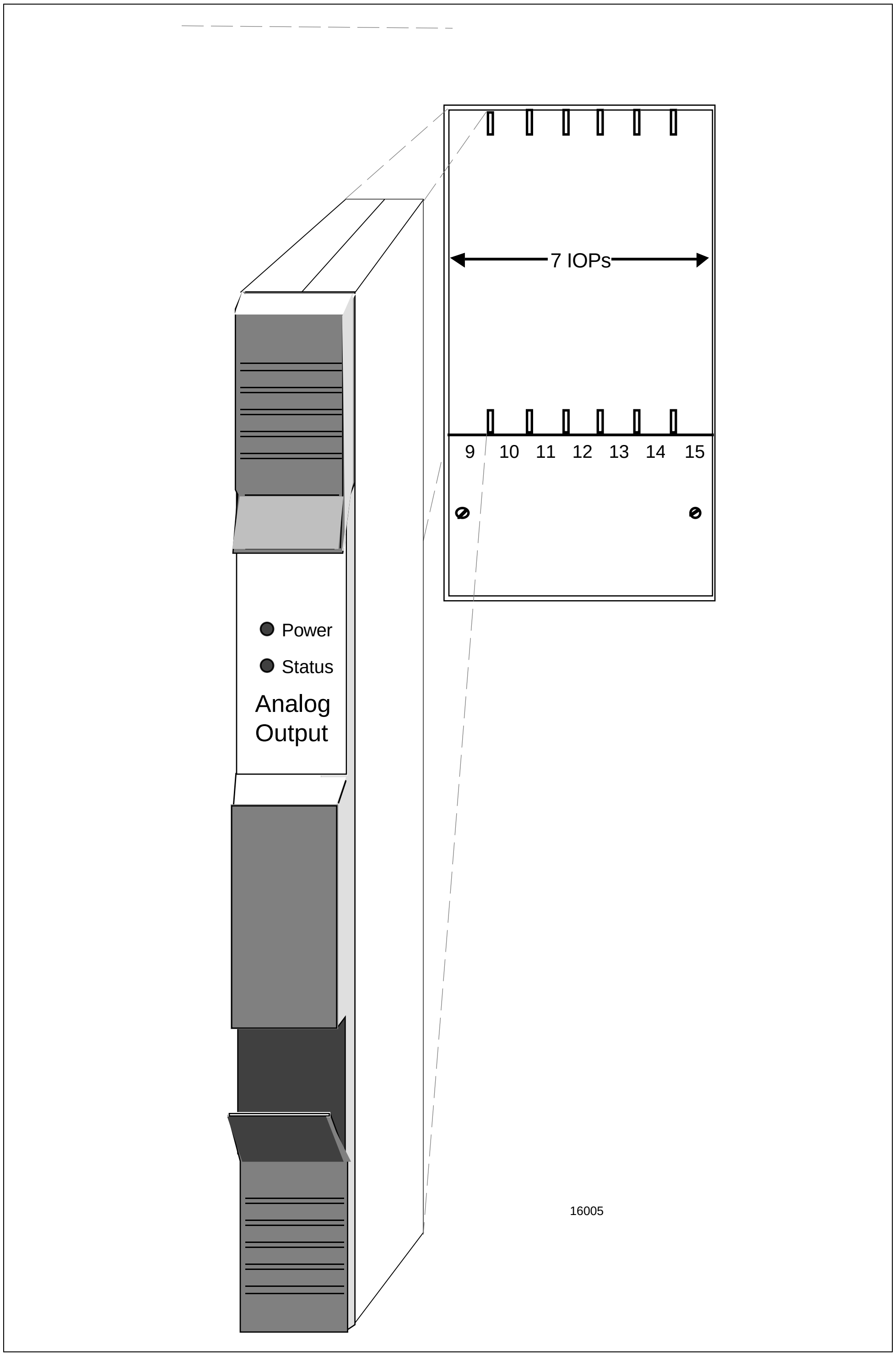
Right 7-Slot IOP card file

Figure 2-6 illustrates a Left 7-Slot IOP card file.

Figure 2-6 Right 7-Slot IOP Card File



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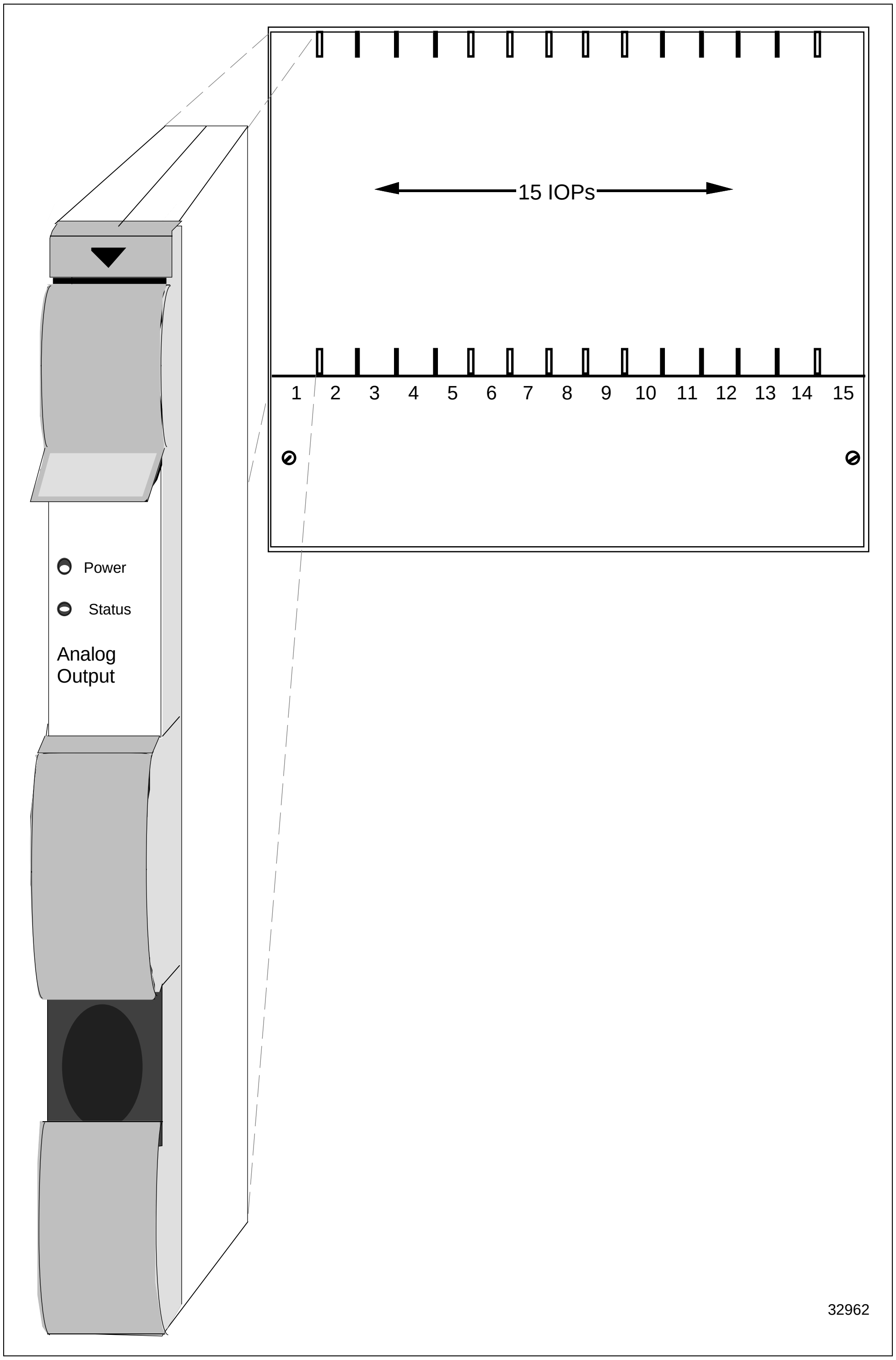
2.2.2 Input/Output Processor (IOP) Card Files, Continued

15-Slot IOP card file

Figure 2-7 illustrates a 15-Slot IOP card file.

Figure 2-7 15-Slot IOP Card File



2.3 Input/Output Processor (IOP) Cards

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)

Card file configurations

Additional IOP card file slots can be added to any High-Performance Process Manager subsystem. Each IOP card file accommodates up to 7 or 15 IOPs as illustrated in Figures 2-5 through 2-7. A total of eight 15-Slot card files or 7-Slot card file pairs (Left and Right), including HPMM card files, can exist in a High-Performance Process Manager subsystem. However, the limit is eight because each 15-Slot card file and pair of 7-Slot card files must be assigned an I/O Link Interface address between 0 and 7.

IOP card files can be installed at remote locations with the use of fiber optic I/O Link Extenders, as well as locally in the cabinet or cabinet complex containing the HPMM card file(s).

A total of 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 High-Performance Process Manager subsystem.

2.3.1 IOP Redundancy

IOP redundancy

The HPM subsystem supports IOP redundancy for the following types of IOPs:

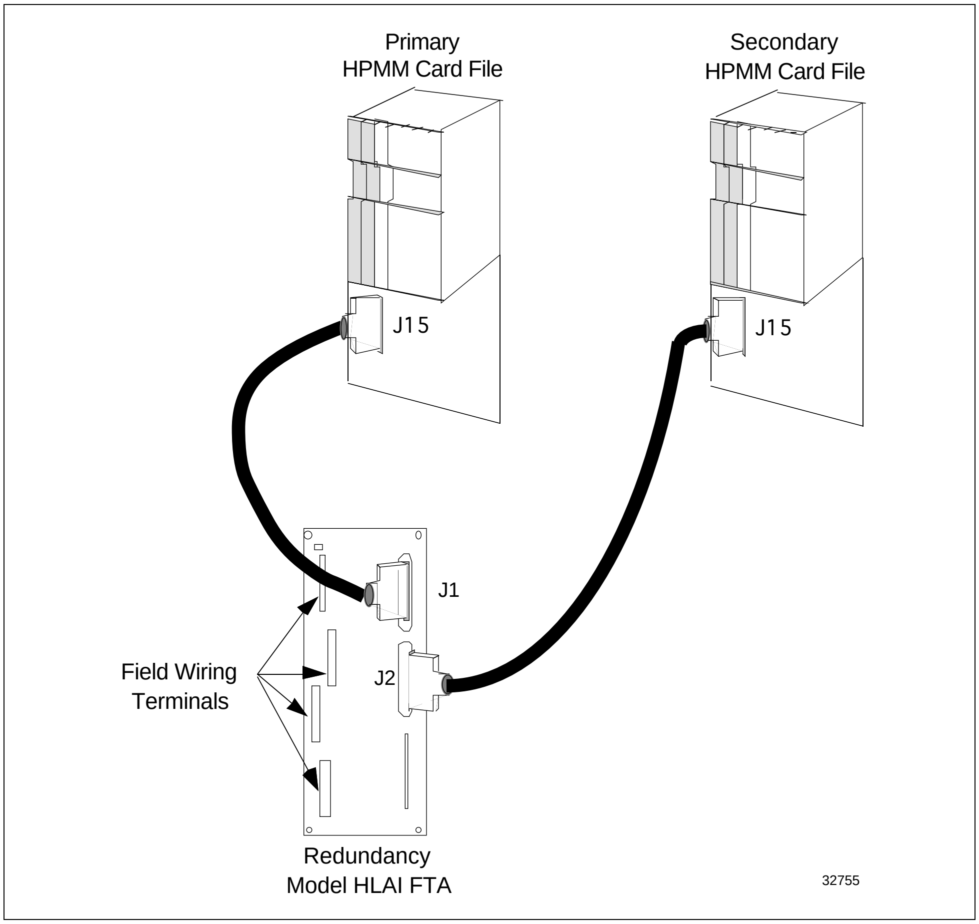
- High Level Analog Input (HLAI)
- Smart Transmitter Interface (STI or STIM)
- Analog Output (AO)
- Digital Input (DI)
- Digital Input Sequence of Events (DISOE)
- Digital Output (DO)

Presently, not all Digital Input and Digital Output IOP models support redundancy.

Redundant HLAI IOPs

A pair of IOPs can be connected in a redundant configuration with both IOPs connected by separate cables to the same FTA. Figure 2-8 illustrates an HLAI FTA that interfaces with a pair of HLAI IOPs that are installed in separate card files.

Figure 2-8 HLAI FTA with Redundant HLAI IOPs



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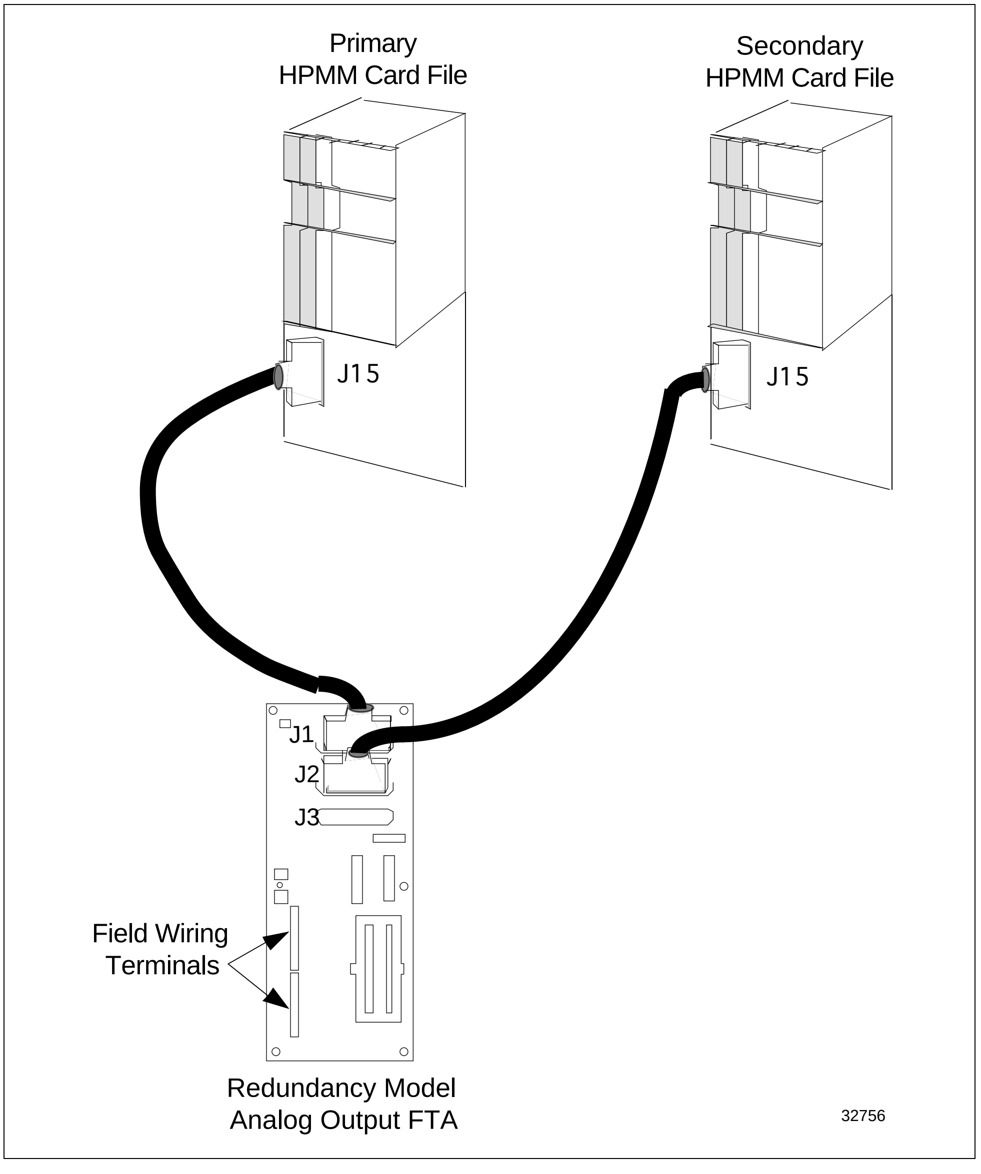
Redundant AO IOPs

Output type FTAs can also interface with two IOPs with separate cables, and an automatic selector switch on the FTA selects which IOP's output drives the field wiring terminal connectors on the FTA. Figure 2-9 is an illustration of an Analog Output (AO) FTA interface with two Analog Output IOPs.

Figure 2-9 Analog Output FTA with Redundant Analog Output IOPs



2.4 I/O Link Extender (Fiber Optic Link)

Introduction

The I/O Link Extender provides the ability to locate 7-Slot or 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 optic couplers are available, the “Standard” I/O Link Extender that provides up to a 1.3 kilometer (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 optic coupler that mates with the connector located directly below the card file slot in which the I/O Link Extender card is installed.

Features

An I/O Link Extender consists of two pairs I/O Link Extender cards, one for Link A and one for Link B, and associated fiber optic couplers at each end of the fiber optic link. The I/O Link Extender cards and their fiber optic couplers occupy two slots in an HPMM or IOP card file.

Remote card files

Every remote card file, or complex of IOP card files, requires two I/O Link Extender cards and two fiber optic couplers, one for Link A and one for Link B.

Fiber optic cable length

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.

I/O Link Extender planning

I/O Link Extender planning can be found in Section 11 in this manual.

Standard I/O Link Extender

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

The Standard I/O Link Extender card will drive and terminate Link A or Link B, depending upon the card file number and slot number number. If the card file number and slot number number are both odd or both even, the card will drive Link A. If the card file number and slot number number are not both odd or both even, the card will drive Link B.

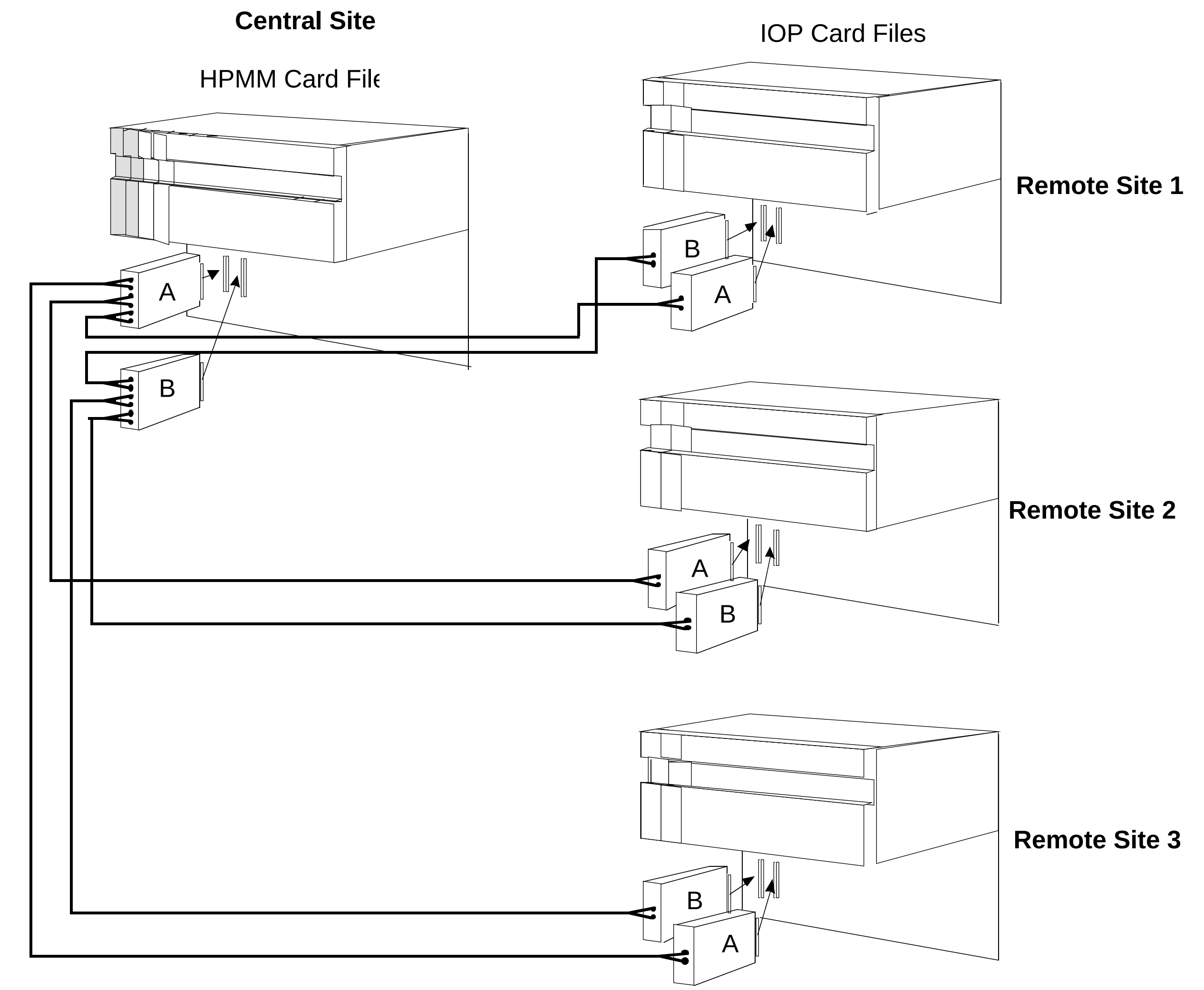
Two Standard I/O Link Extender cards, connecting up to six remote card files, can be installed in a HPMM card file, but the maximum number of primary IOPs is still 40 (plus 40 redundant IOPs).

Continued on next page

Standard I/O Link Extender connections nonredundant HPMM

Figure 2-10 illustrates the interconnections for a Standard I/O Link Extender in a High-Performance Process Manager that contains a nonredundant HPMM.

Figure 2-10 Standard I/O Link Extender Interconnections with Nonredundant HPMM



NOTE

The following High-Performance Process Manager subsystem configuration is assumed.

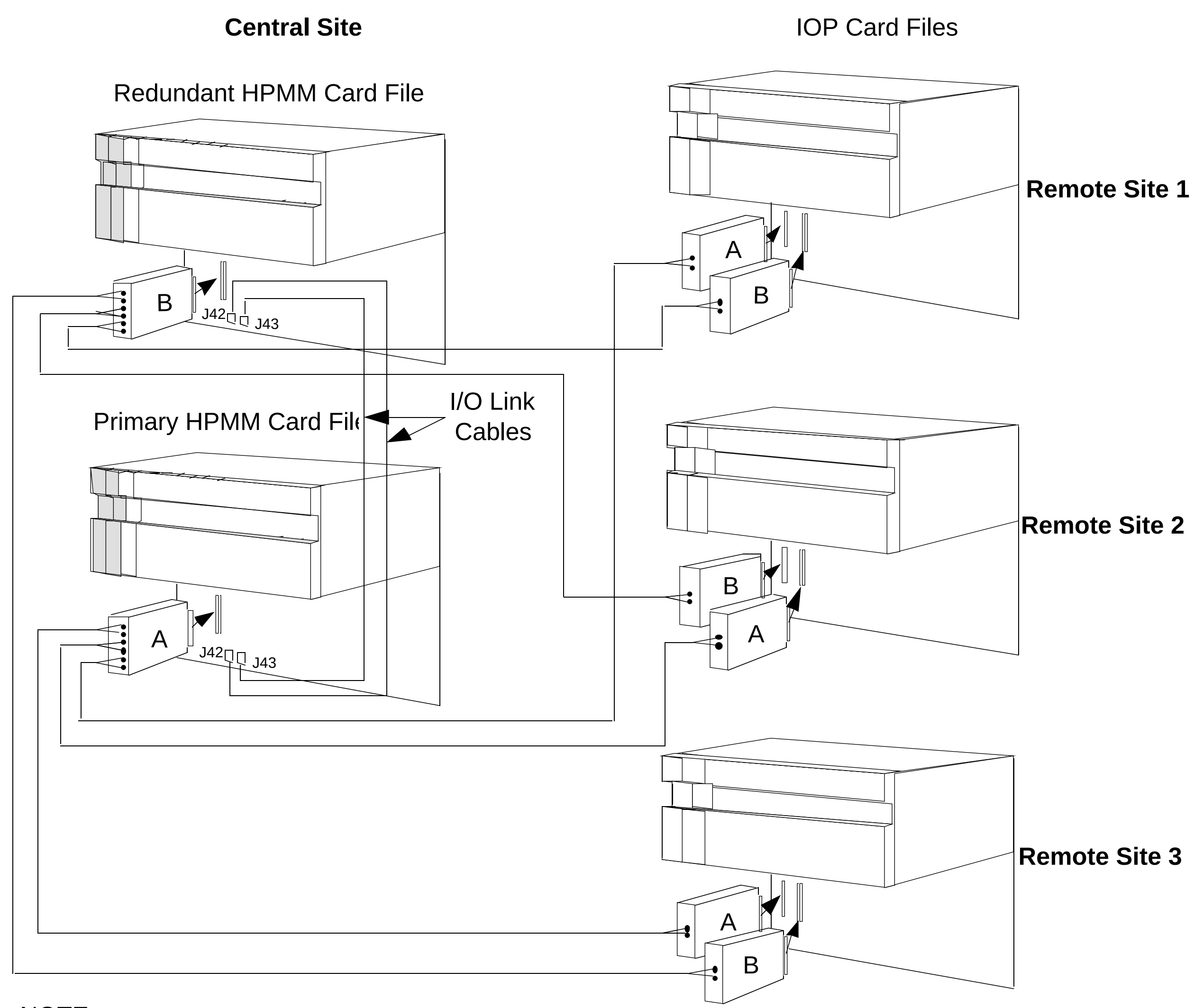
1. The HPMM card file is configured as card file #1 (I/O Link address of 0).
2. Remote Site #1's IOP card file is configured as card file #2 (I/O Link address of 1).
3. Remote Site #2's IOP card file is configured as card file #3 (I/O Link address of 2).
4. Remote Site #3's IOP card file is configured as card file #4 (I/O Link address of 3).

Continued on next page

Standard I/O Link Extender connections redundant HPMMs

Figure 2-11 illustrates the interconnections for a Standard I/O Link Extender in a High-Performance Process Manager that contains redundant HPMMs.

Figure 2-11 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

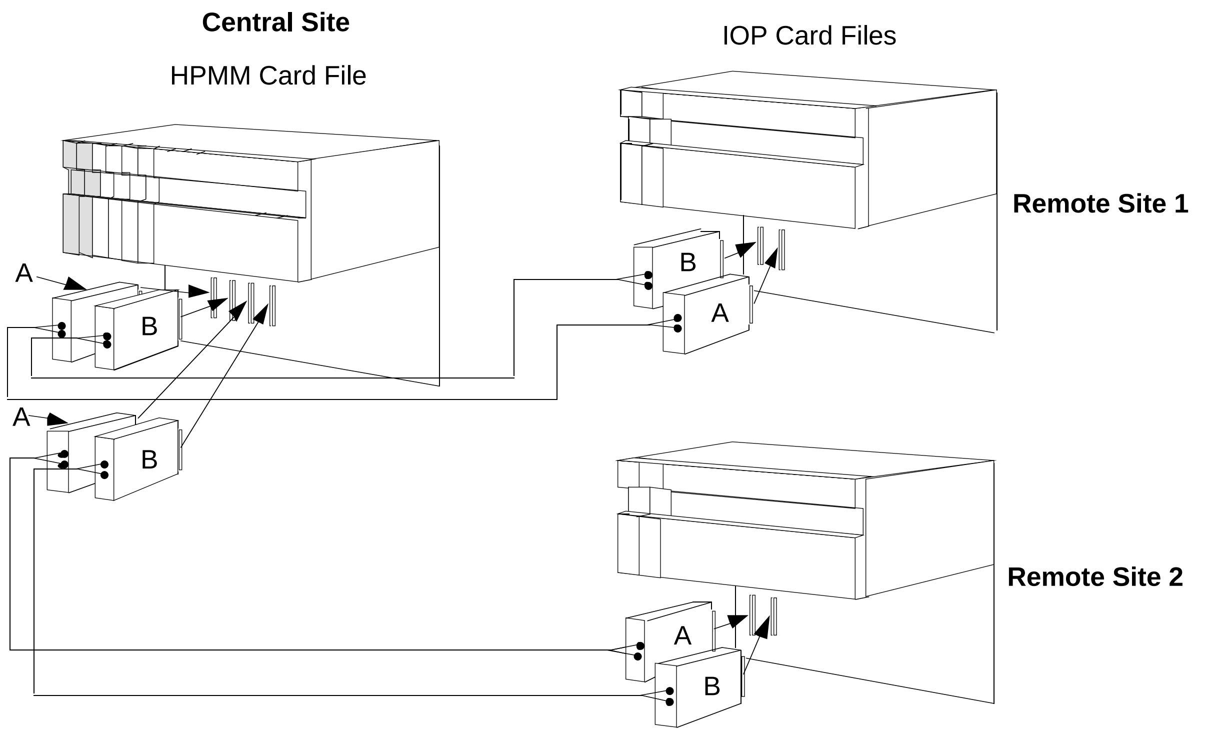
Each Long Distance I/O Link Extender card has an associated fiber optic coupler that drives a single pair of fiber optic cables. Each cable pair is terminated by a fiber optic coupler that terminates one fiber optic pair.

The Link A or Link B selection for the Long Distance I/O Link Extender is determined by a jumper on the card.

Long Distance I/O Link Extender connections nonredundant HPMM

Figure 2-12 illustrates the interconnections for a Long Distance I/O Link Extender in a High-Performance Process Manager that has a nonredundant HPMM.

Figure 2-12 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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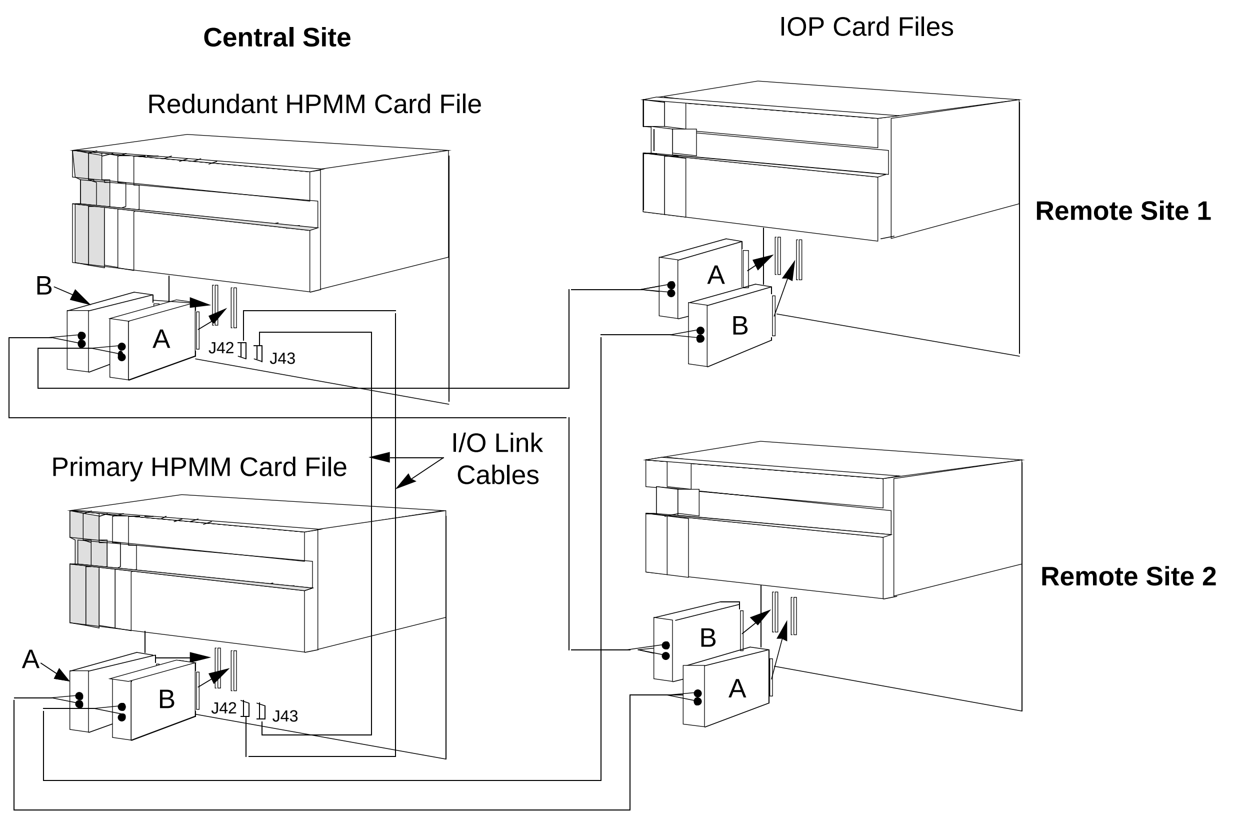
Long Distance I/O Link Extender connections redundant HPMMs

Figure 2-13 illustrates the interconnections for a Long Distance I/O Link Extender in a High-Performance Process Manager that has redundant HPMMs.

Figure 2-13 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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2.5 Field Termination Assemblies (FTAs)

Description

Terminal connectors on the Field Termination Assembly (FTA) provide the connection points for the process control wiring. Fuses, relays, and resistors protect the FTA circuitry, and sense, condition, or operate the connected device. The FTA communicates with an associated IOP, which in turn communicates with the HPMM(s) through the I/O Link Interface.

FTAs types

Standard types of FTAs, as described in Table 2-2, interface the field wiring and provide communication with an associated IOP. They are categorized as “standard” because Galvanically Isolated FTAs are also available as described in Table 2-3.

Continued on next page

Standard FTAs

Standard FTA types are listed in Table 2-2.

Table 2-2 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 ground. The FTA is also used to interface Smart Transmitter devices.
High Level Analog Input (HLAI)	Accepts high level analog inputs. The inputs are configurable as single-ended or differential in relation to logic ground.
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.
120 Vac Digital Input (DI)	Accepts ac digital inputs. All inputs are isolated from each other. Two versions of the FTA are available, with pluggable and without pluggable input modules.
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 pluggable 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 digital outputs that are isolated from each other and the HPM.
31-200 Vdc Solid-State Digital Output (DO)	Provides dc 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.
120 Vac/125 Vdc Relay Digital Output (DO)	Provides independent electromechanical relays for ac or dc digital outputs.

Continued on next page

Standard FTAs,
continued

Table 2-2 Standard Field Termination Assembly Types, Continued

FTA Type	Description
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.

Continued on next page

Galvanically Isolated FTAs

Galvanically Isolated FTA types are listed in Table 2-3.

Table 2-3 Galvanically Isolated Field Termination Assembly Types

FTA Type	Description
Remote Hardened Low Level Analog Input Multiplexer (RHMUX)	Accepts one set of low-level analog inputs. The inputs are sequentially multiplexed and can be either thermocouple (TC) or millivolt (Mv). One or two FTAs can be connected to its Power Adapter assembly and IOP.
Remote Hardened Multiplexer Non-Incendive Power Adapter (RHMUX NIPA)	The RHMUX NI Power Adapter provides the interface between an RHMUX IOP and one or two RHMUX FTAs, which can be mounted in a Division 2, Zone 1, or nonhazardous location.
Remote Hardened Multiplexer Intrinsically Safe Power Adapter (RHMUX ISPA)	The RHMUX IS Power Adapter provides the interface between an RHMUX IOP and one or two RHMUX FTAs, which can be mounted in a Division 1 or Zone 0 location.
High Level Analog Input (HLAI/STI)	The HLAI/STI FTA accepts high level analog inputs. All inputs are isolated from ground and each other. The FTA is also used to interface Smart Transmitter devices.
High Level Analog Input (HLAI)	The HLAI FTA accepts high level analog inputs. 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.
24 Vdc Digital Output (DO)	The 24 Vdc DO FTA provides isolated digital outputs to loads such as solenoid valves or lamps.

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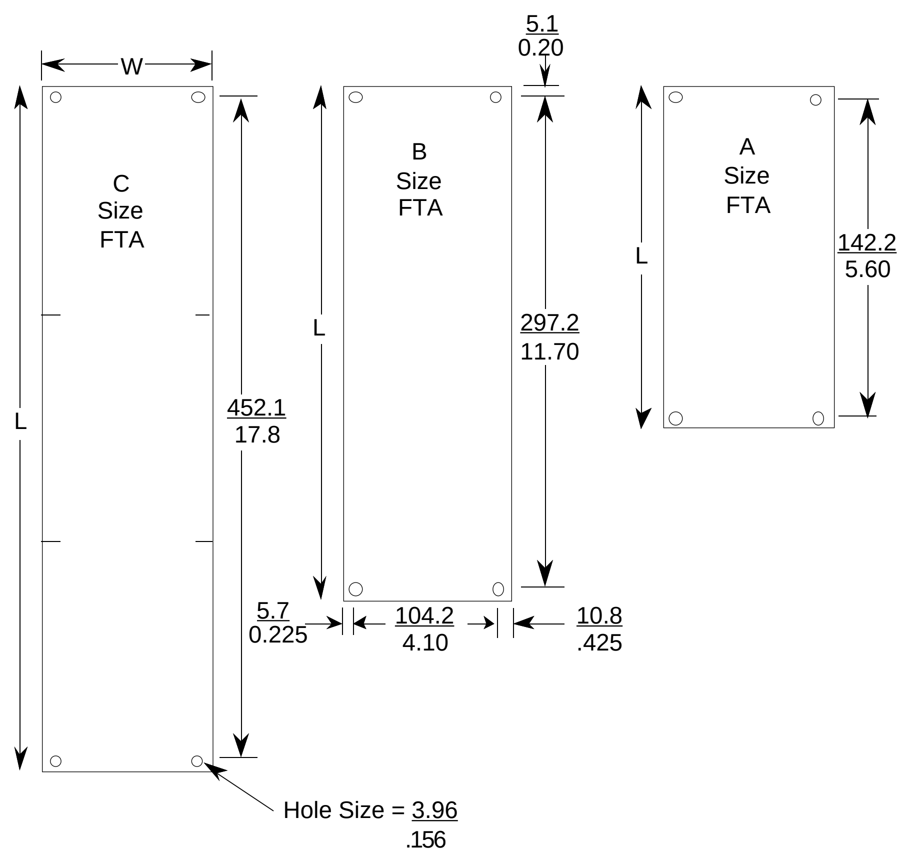
Three physical sizes

The standard FTAs have three physical sizes as illustrated in Figure 2-14. The Galvanically Isolated FTAs are one size only, B-size.

Figure 2-14 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: millimeters / 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.

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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 the field wiring must not be routed in the same channel.

Mounting orientation

Both standard (non-Galvanically Isolated) and Galvanically Isolated FTAs can be 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.

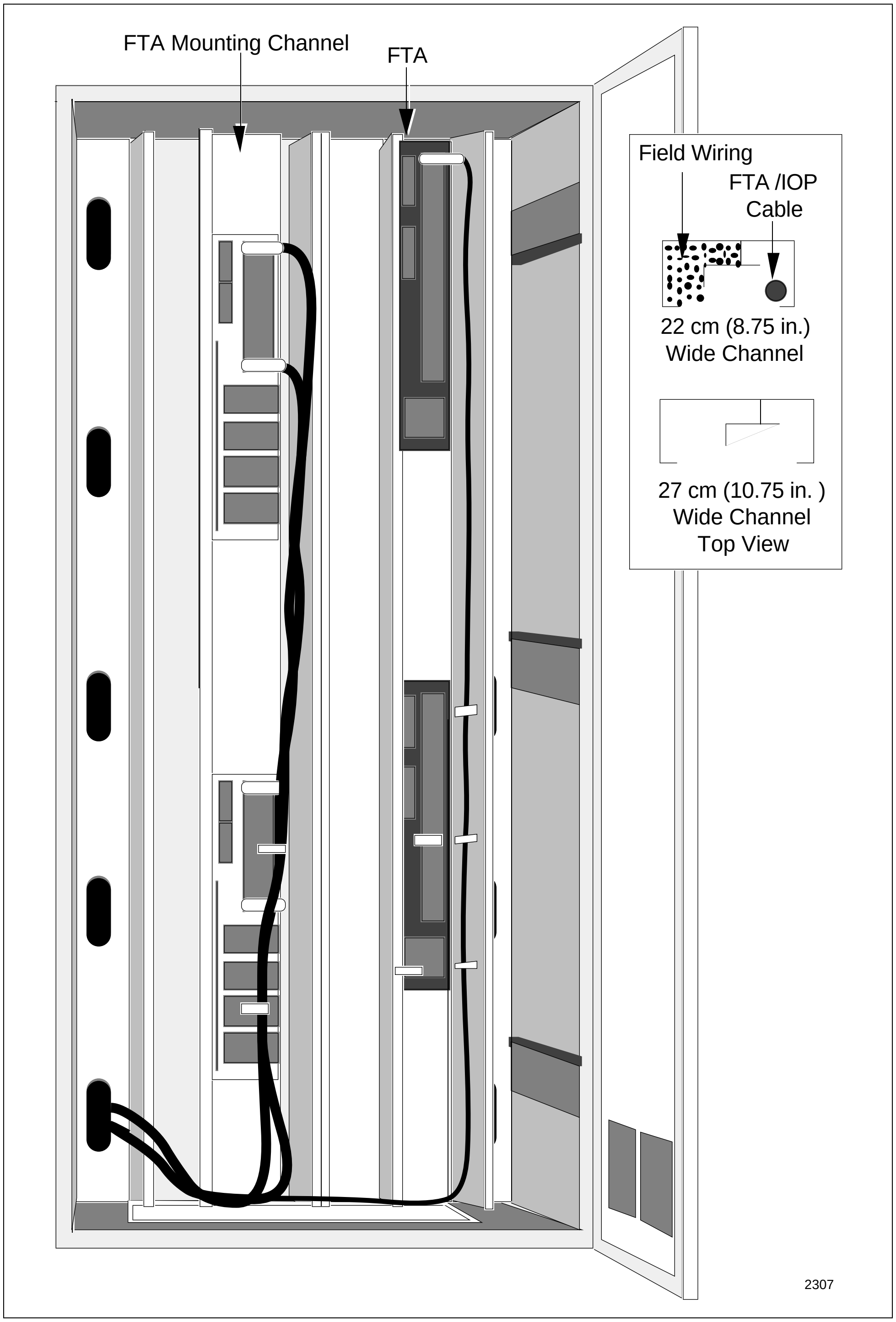
Optionally, Galvanically Isolated FTAs can also be mounted on horizontally oriented 2-foot long FTA Mounting Channels. Standard FTAs must not be mounted on horizontal FTA Mounting Channels.

Continued on next page

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 Figure 2-15.

Figure 2-15 Typical Vertical FTA Mounting Channel Layout



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Compression or screw terminals available

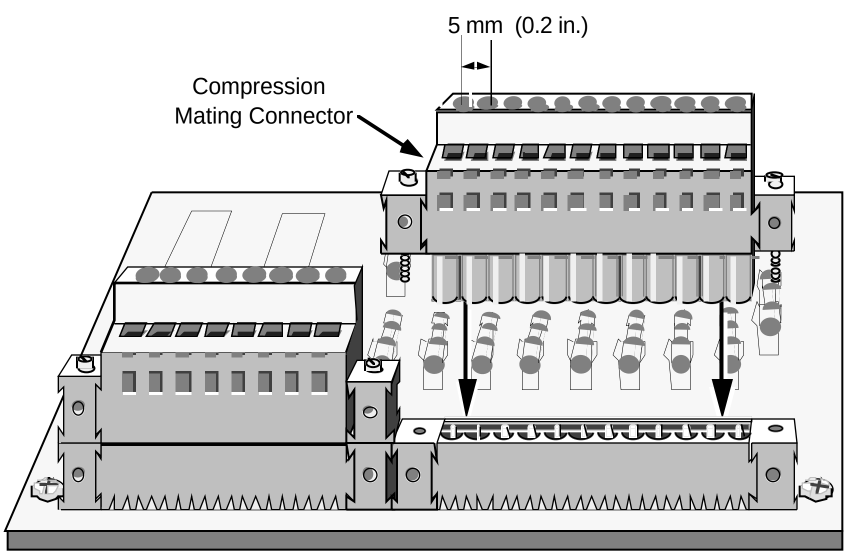
Most standard FTA types are available with either compression-type or screw-type terminal connectors. Some exceptions are the 6-inch Analog Output (AO), 6-inch High Level Analog Input (HLAI), 6-inch Low Level Analog Input Multiplexer (LLMux), and the 6-inch Digital Input Power Distribution Assembly, which are available with compression-type terminal connectors only. The Remote Hardened Low Level Analog Input Multiplexer (RHMUX) mounts in a separate enclosure and 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 that is used with Galvanically Isolated FTAs is available only with screw-type terminal connectors. See Section 15 for a description of the Marshalling Panel.

FTA compression-type terminal connector

Figure 2-16 is an illustration of a typical compression-type terminal connector connection to a standard FTA.

Figure 2-16 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

4401

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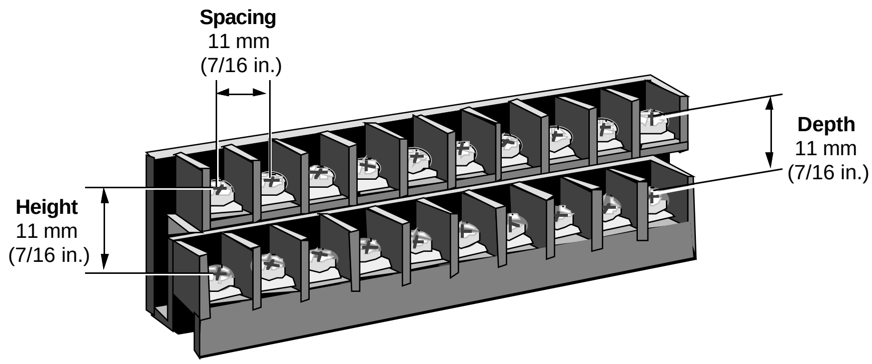
FTA fixed-screw terminal connector

Figure 2-17 illustrates a typical fixed-screw terminal connector as it would appear on a standard FTA.

Figure 2-17 Typical FTA Fixed-Screw Terminal Connector



Screw Terminal Strip Sizes

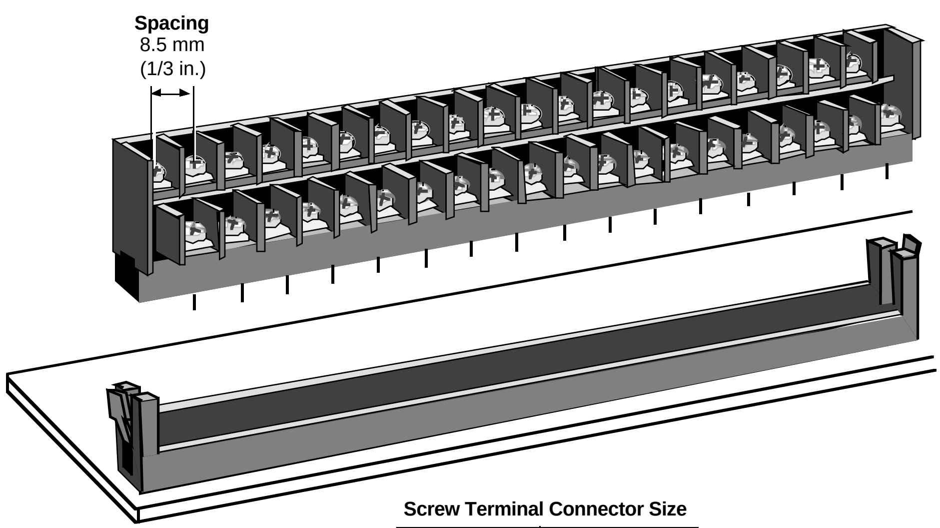
Number of Terminals	Connector Length
8	52 mm (2.0 in.)
12	74 mm (2.9 in.)
24	140 mm (5.5 in.)

4400

FTA removable-screw connector

Figure 2-18 illustrates a typical removable-screw terminal connector.

Figure 2-18 Typical FTA Removable-Screw Terminal Connector



Screw Terminal Connector Size

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

6170

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Galvanic Isolation Module connectors

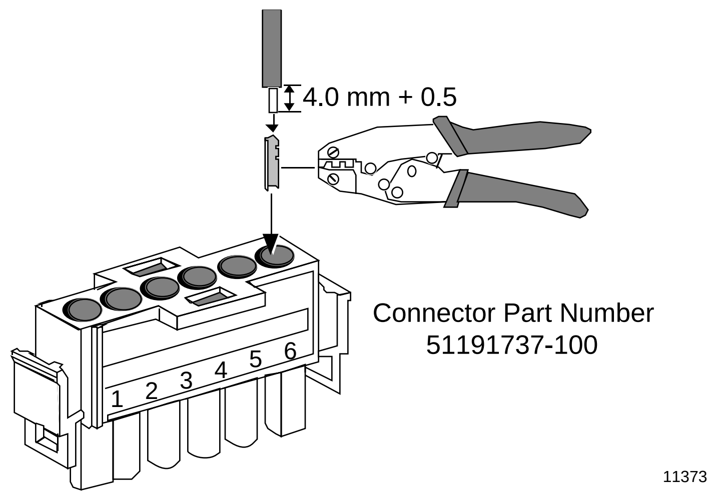
Figures 19 and 20 illustrate the crimp pin-type and compression-type terminal connectors for the Galvanically Isolated FTAs, respectively. The connectors on the Galvanic Isolation Modules have six terminals. Depending on the type of terminal connector, the terminals accept size 0.3 to 3.5 mm^2 (12 to 22 AWG) wiring.

Crimp pin-type terminal connector

Figure 2-19 illustrates the crimp-pin type Galvanic Isolation Module terminal connector.

Figure 2-19 Crimp-Pin Galvanic Isolation Module Terminal Connector

Wire Size	Crimp Pin Part Number	Crimp Tool Part Number
0.5-2.5 mm2 (14-20 AWG)	51191737-201	51191787-100



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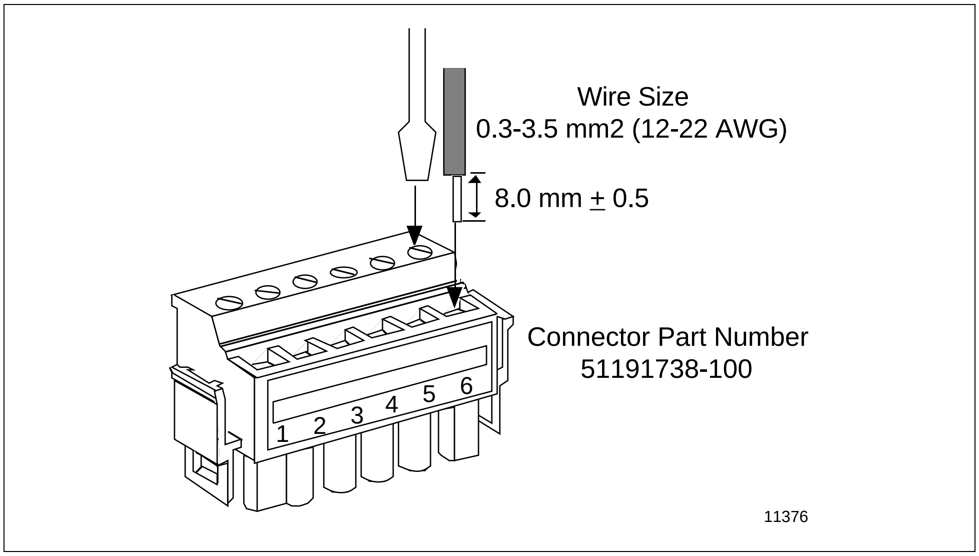
Compression-type terminal connector

Figure 2-20 illustrates the compression-type Galvanic Isolation Module terminal connector.

Figure 2-20 Compression-Type Galvanic Isolation Module Terminal Connector



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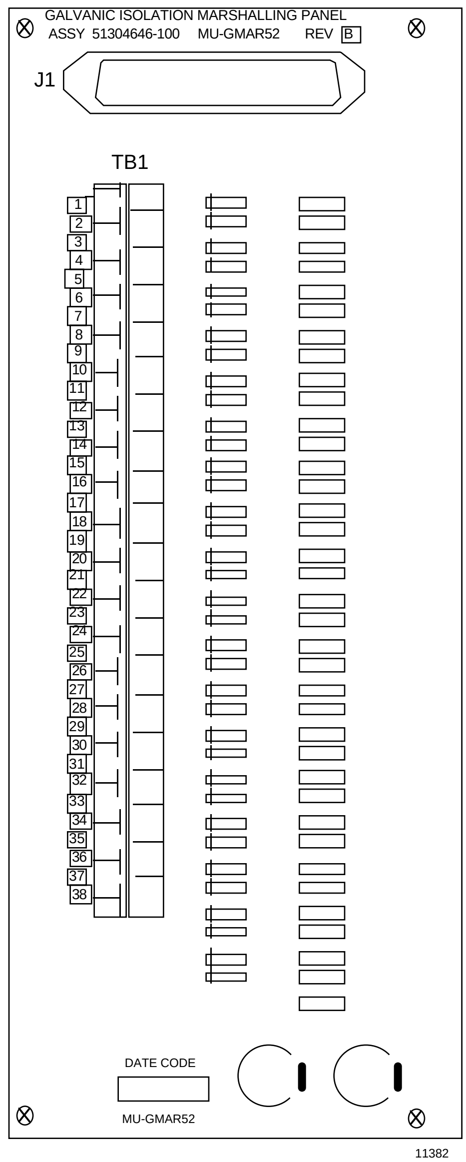
Marshalling Panel

The Marshalling Panel was developed to provide access to the signals from the auxiliary connectors on the Galvanically Isolated FTAs. It can also be used as a general purpose Marshalling Panel in the High-Performance Process Manager subsystem.

Figure 2-21 illustrates an assembly layout of the panel. The Marshalling Panel, model MU-GMAR52, is similar in shape and appearance to a "B" size FTA (see Figure 2-14). The assembly provides surge and ESD protection for the field wiring terminals. A 50-pin connector is provided on the assembly that accepts an IOP to FTA cable.

Figure 2-21 FTA Marshalling Panel Assembly Layout



2.6 Power Systems

Power System features

The High-Performance Process Manager Power System provides

- 24 Vdc power for operation of all HPMM cards, IOP cards, and FTAs
- A nominal 3.6 Vdc battery output for backup of the HPMM and IOP memory circuits.
- A nominal 0.25 ampere, 6 Vac output for operation of a LLAI line frequency clock circuit.

Two types of Power Systems

There are two types of Power Systems.

- Standard Power System
- AC Only Power System

Standard Power System

The Standard Power System has many features that include

- An optional redundant Power Supply Module (model MU-PSRX03/04).
- 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) for 12 hours (model MU-PSRX03) or 45 hours (model MU-PSRX04) backup with failure detection.
- An optional 48 Vdc Battery Backup Module (model MU-PSRB03/04) with a disconnect switch that backs up the 24 Vdc for 25 minutes.

Redundant Power Supply Modules

Redundant Power Supply Modules are recommended when the Power System provides power for redundant HPMMs. If the redundant HPMMs are resident in separate cabinets with their own Power System, a Power System with a single Power Supply Module is acceptable, though not fully recommended.

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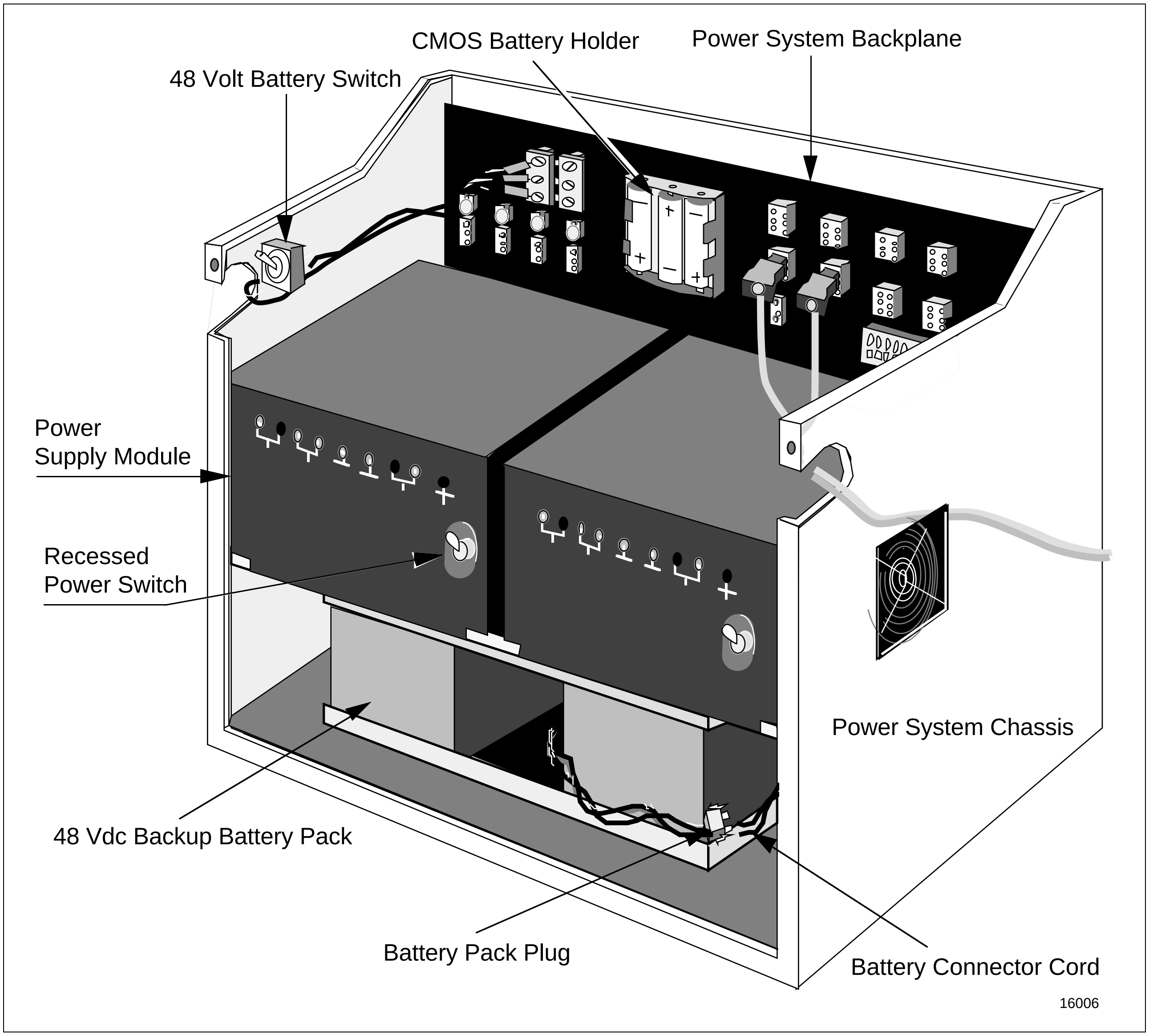
Model MU-PSRX03 Standard Power System

The layout of the model MU-PSRX03 Standard Power System is illustrated in Figure 2-22.

Figure 2-22 Standard Power System—Model MU-PSRX03



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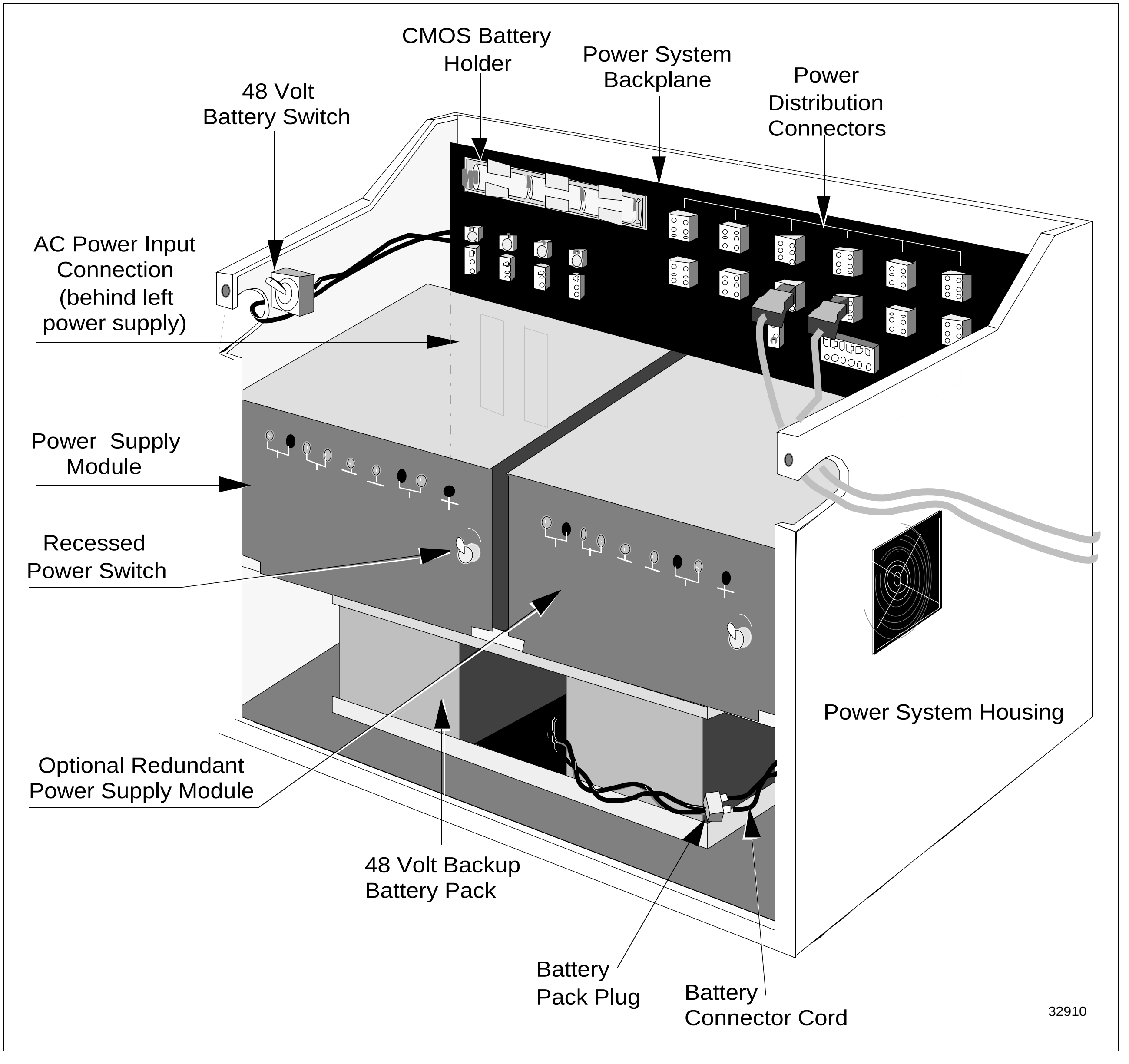
Model MU-PSRX04 Standard Power System

The layout of the model MU-PSRX04 Standard Power System is illustrated in Figure 2-23.

Figure 2-23 Standard Power System—Model MU-PSRX04



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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.

Alkaline batteries are used instead of rechargeable NiCad batteries for CMOS data retention in the AC Only Power System.

ATTENTION

ATTENTION—The AC Only Power System must not be used in CE Compliant applications.

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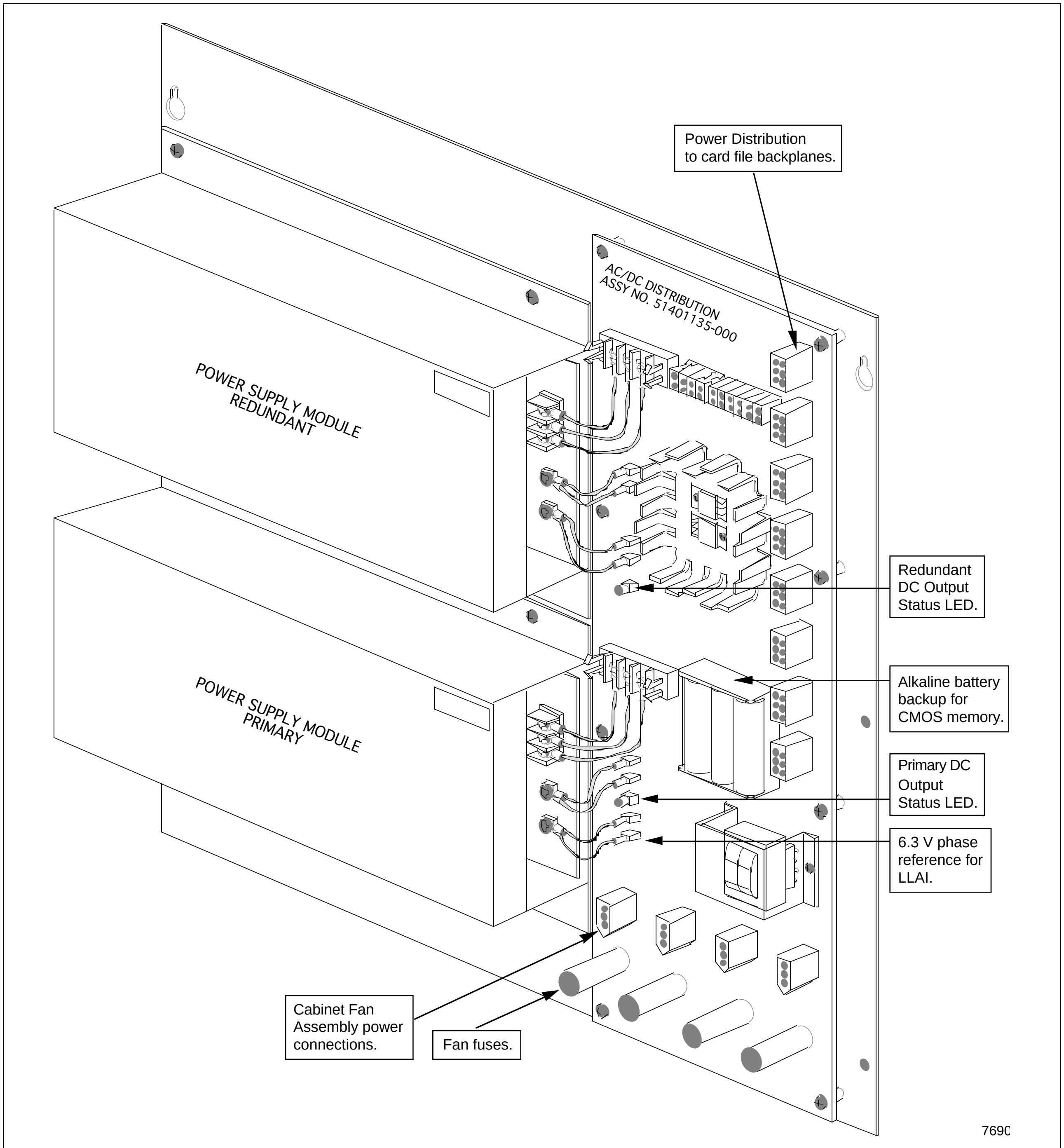
AC Only Power System illustration

The layout of the AC Only Power System is illustrated in Figure 2-24.

Figure 2-24 AC Only Power System—Not for CE Compliant Applications



2.7 Cabinet Configurations

Cabinet configurations

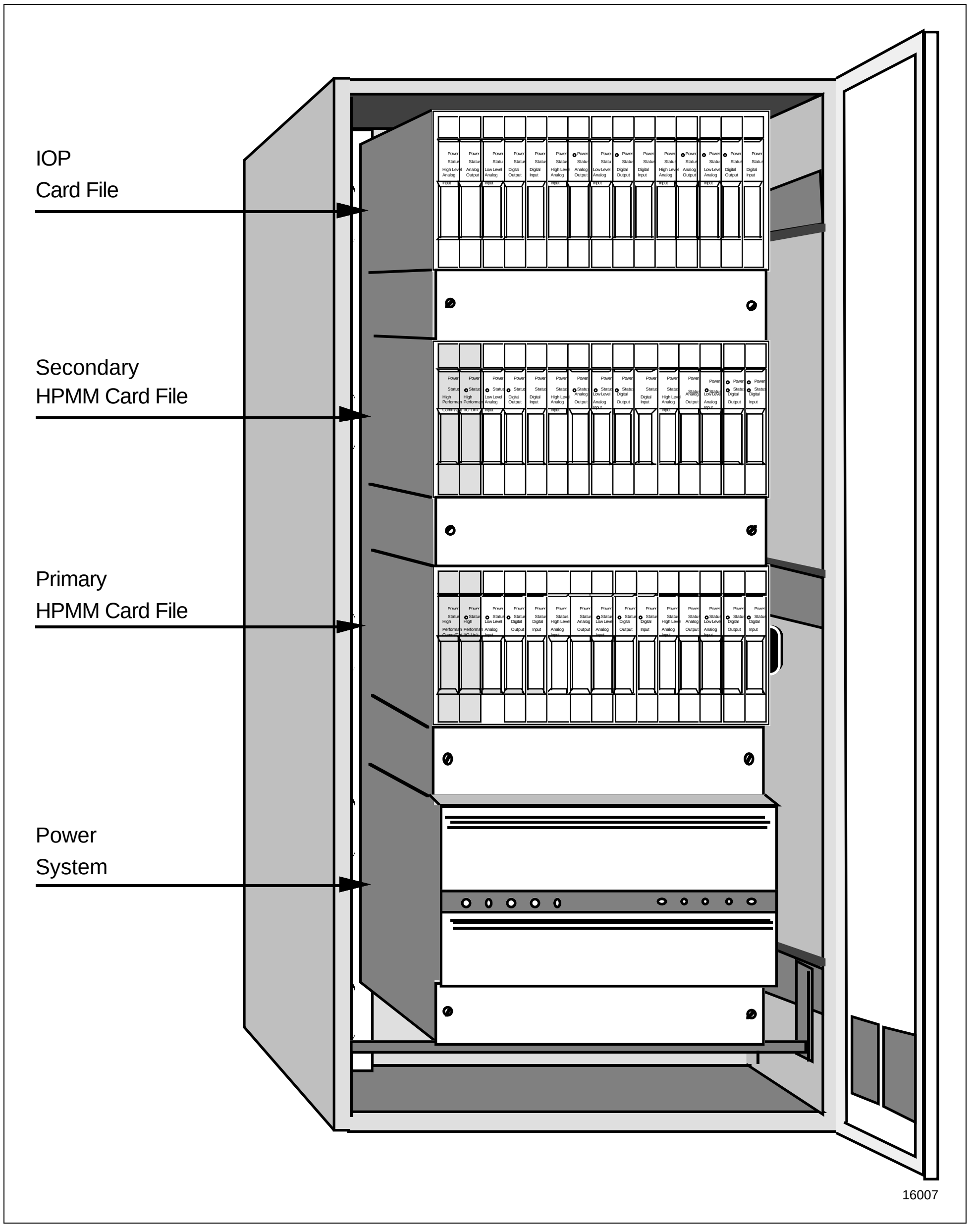
The High-Performance Process Manager subsystem can have various cabinet configurations. Cabinets can be complexed together or remotely separated. The HPMM and IOP card files can share the same Power System or have independent Power Systems. If the HPMMs share the same Power System, the Power System should contain redundant Power Supply Modules.

Continued on next page

Redundant HPMMs in a single cabinet

Figure 2-25 is an illustration of a single High-Performance Process Manager cabinet containing two HPMM card files in a redundant HPMM configuration and one IOP card file. The HPMM card files and the IOP card file share the same Power System.

Figure 2-25 Single Cabinet with Redundant HPMMs



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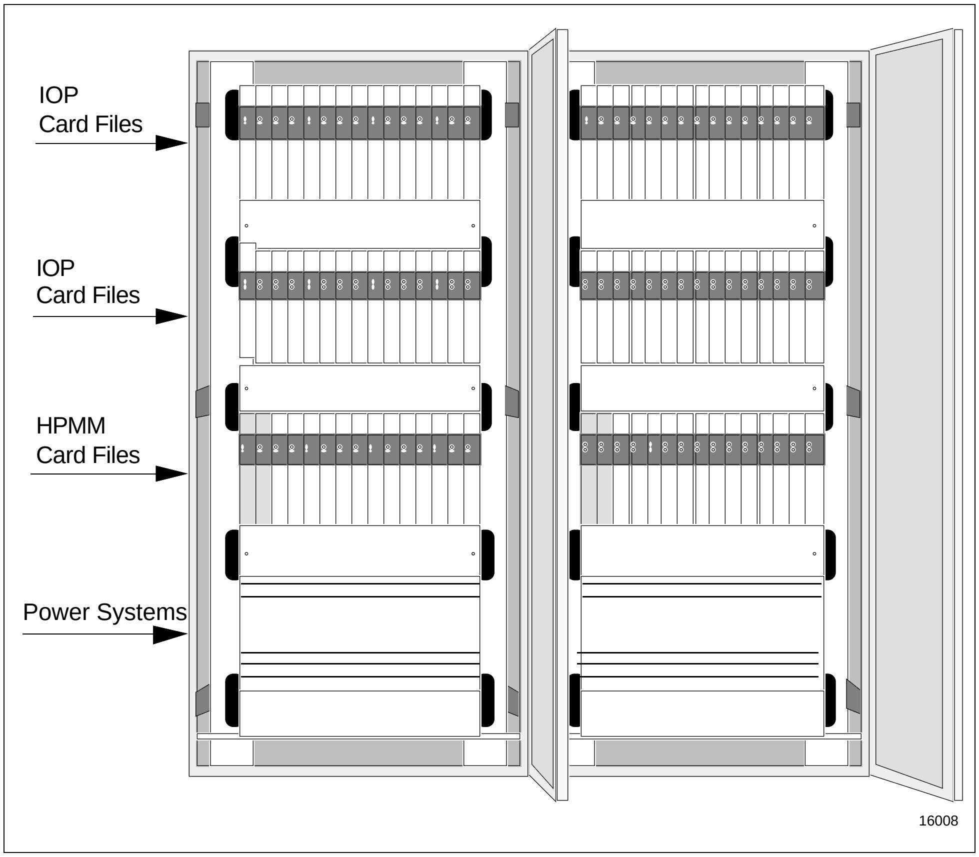
Redundant HPMMs in complexed cabinets

Two cabinets that are complexed together is illustrated in Figure 2-26. The redundant pair of HPMM card files are installed in separate cabinets. The purpose is to provide independent power for the HPMM card files and their associated IOP card files.

Figure 2-26 Complexed Cabinets with Redundant HPMMs



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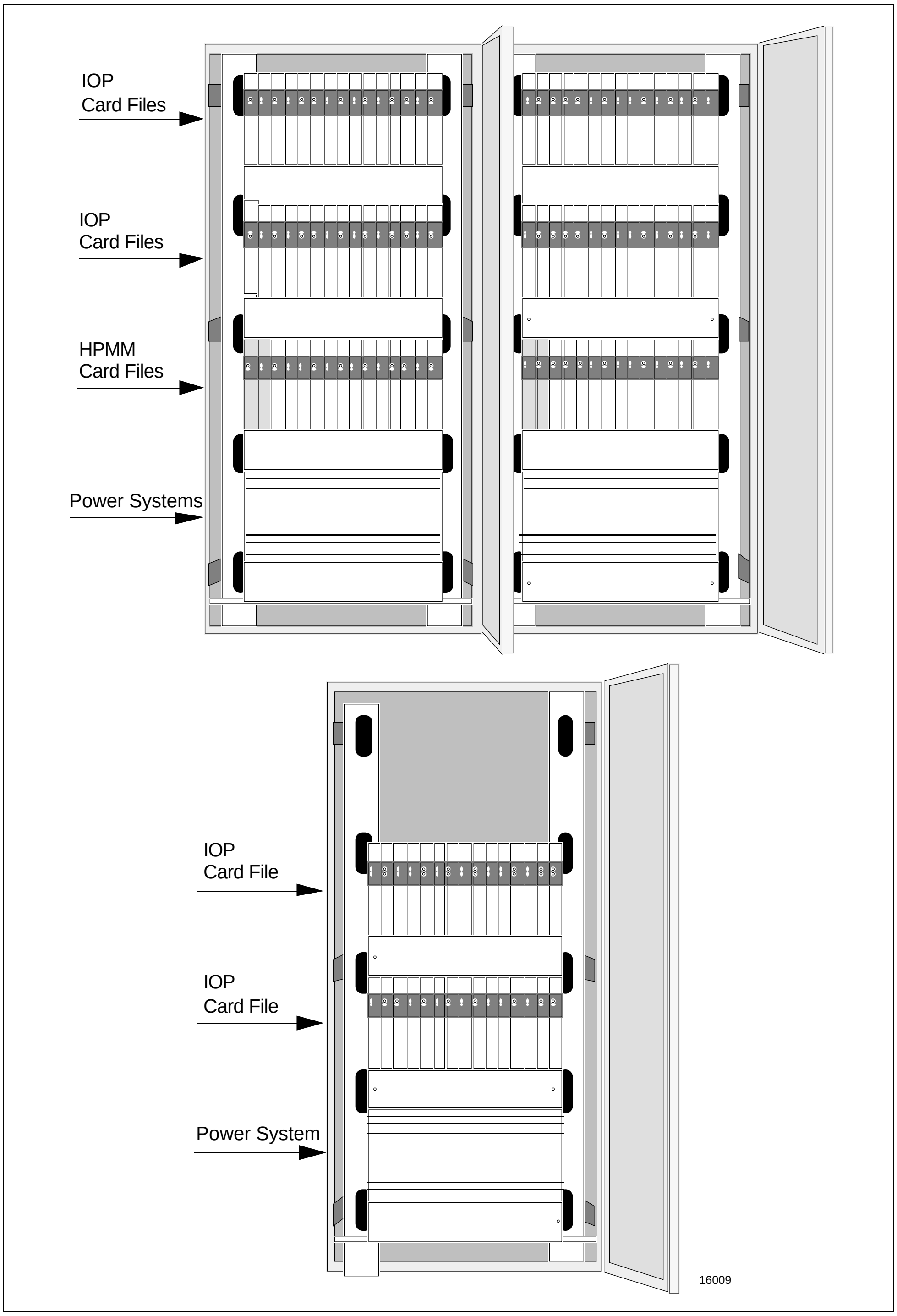
Local and remote HPM cabinets

Figure 2-27 illustrates a 2-cabinet complex with redundant HPMM card files and a remote cabinet that contains IOP card files. Communication with the remote cabinet is provided by fiber optic I/O Link Extenders.

Figure 2-27 Local Complexed Cabinets with Redundant HPMMs and a Remote I/O Cabinet



Section 3 – Power Requirements

3.1 Overview

Section contents

The topics covered in this section are:

Introduction

This section provides the user with information to plan adequate ac power service for his High-Performance Process Manager (HPM) subsystem. The section also aids the user in planning a power backup strategy when the primary source fails.

Power backup planning

A well planned power system for the High-Performance Process Manager minimizes subsystem downtime. In this section, we explore various paths for handling the loss of subsystem ac power. The selected path dictates whether a given HPM needs the optional dual Power Supply Modules and/or a battery backup for the 24 Vdc. This definition of the power equipment in an HPM allows the ac power system requirements to be defined in detail.

3.2 Backup Strategy

Planning strategy

There are several planning strategies for handling a loss of ac power to the HPM. This strategy takes advantage of any or all of the following:

- An optional battery backup for the 24 Vdc
- An optional secondary Power Supply Module
- An optional automatic ac transfer switch
- An Uninterruptible Power Supply (UPS)

Power continuity

Power continuity is established by the use of the optional battery backup for 24 Vdc. This battery backup option is available with the redundant Power Supply Module option. When an ac power loss occurs, the battery carries a full load of 20 amperes for minimum of 25 minutes. If 25 minutes is not sufficient, consider another backup source to provide ac power.

Two ac power sourcing methods

There are two methods in which two separate sources of ac power for an HPM subsystem can be implemented.

First method

The first method takes advantage of the HPM's redundant Power Supply Module option. The two Power Supply Modules can be wired to operate from two separate ac feeder sources as illustrated in Figure 3-1 or 3-2. The two ac feeder sources do not have to be of the same phase, frequency, voltage, or from the same service as long as each meets the power quality requirements discussed in subsection 3.3.

Second method

The second method, by which two ac feeder sources can be implemented, is through an automatic transfer switch. The HPM does not need redundant Power Supply Modules or dual ac feeders for this approach because the transfer switch provides only one ac output. The automatic transfer switch can detect an ac failure and execute a transfer of its load from one service to another in 5 milliseconds. The HPM will perform without compromise even if this cycle requires 10 milliseconds.

Better continuity of HPM power

The use of the battery backup option in an HPM with redundant Power Supply Modules further enhances the continuity of power.

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Uninterruptible Power Supply (UPS)

A second source of ac power can come from a public utility, another plant, or can be generated from an Uninterruptible Power Supply (UPS). In any case, an automatic or manual transfer switch is needed to complete the installation. Consider the case in which a nearby public utility ac feeder provides backup for the process facility steam plant. An automatic transfer switch should be installed to transfer from the steam plant's ac feeder to the public utility's ac feeder. A switch with maximum transfer time of 10 ms in both directions is recommended. The UPS offers even more possibilities.

UPS description

The UPS consists of a battery charger, a large battery, and a chopper to convert the battery's dc power into quality ac power. The UPS is always on and is always supplying power to its load through the battery that is on a float charge. Should the ac input fail, the UPS continues to serve the load without any changes and it will continue to operate until the battery is discharged, or the ac input to the UPS charger is restored. The capacity of the battery pack is specified by the UPS manufacturer and will provide many hours of backup.

UPS transfer switches

The UPS usually has two transfer switches. A switch on the output of the UPS automatically transfers the loads to plant power in case of failure in the UPS. A second transfer switch to the UPS input charger allows manual transfer to public utility power if there is extended failure of plant power. A UPS with two ac sources provides the means for several backup strategies. The HPM offers additional permutations with its optional redundant Power Supply Modules, dual-feeds, and battery backup. The need for all of this backup redundancy depends on how important it is to have a working control system when plant power is out for an extended period.

Power quality

After the overall power system strategy is selected, the quality and the quantity of power must next be determined.

3.3 Quality

Quality requirements

The HPM is typically connected to ac power as illustrated in Figure 3-1 or 3-2. It operates on any ac source that meets the following requirements:

- Voltage: 100-132/187-264 Vac, single phase
- Frequency: 47-63 Hz
- Total Harmonic Distortion (THD): 8% maximum
- Power dropout: 10 ms maximum

Verification

Techniques and equipment for verifying the above electrical power system parameters are described in the *High-Performance Process Manager Checkout* manual. Existing instrument power at most sites usually meets the above requirements.

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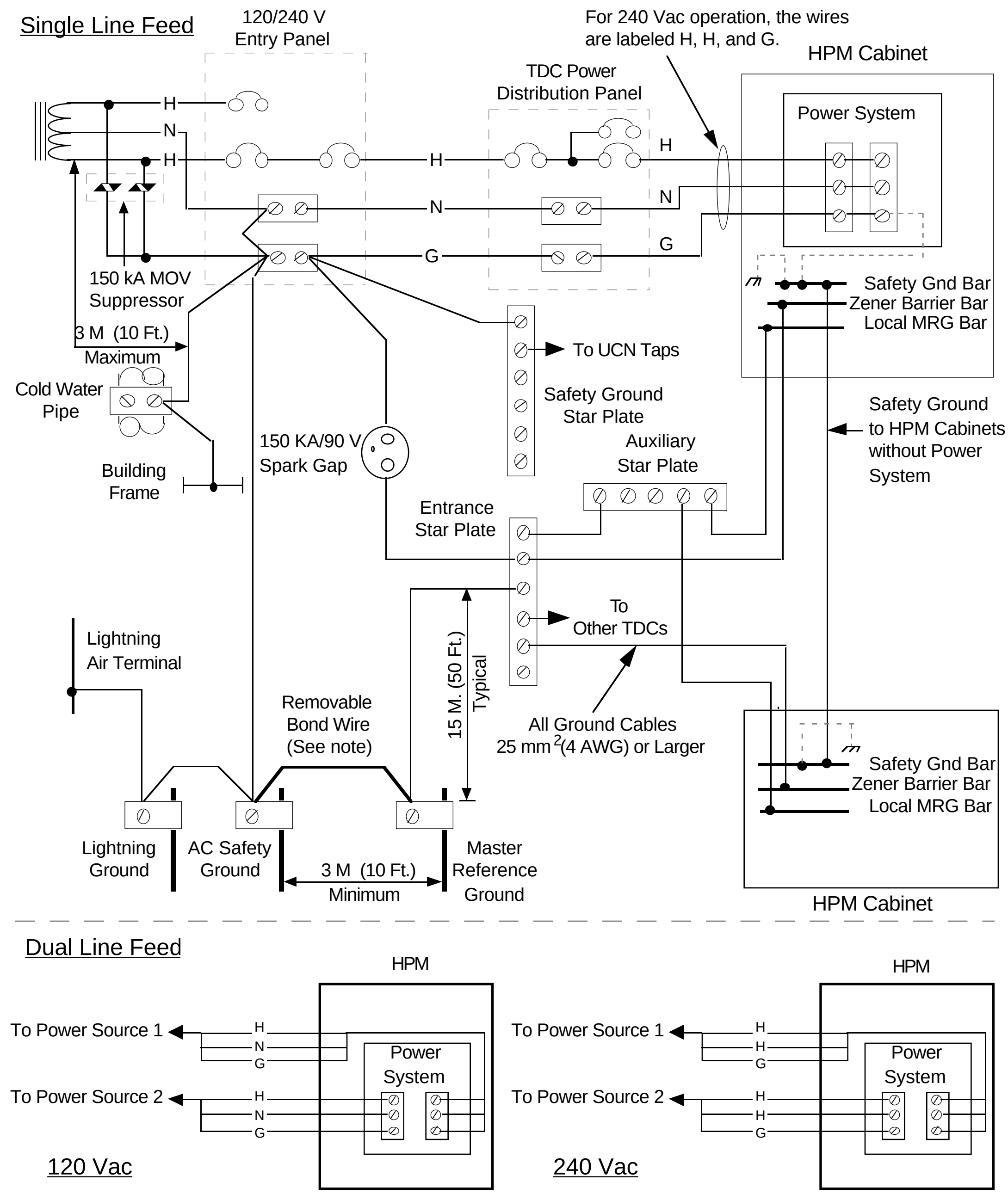
AC power and ground Figure 3-1 illustrates the ac power and ground connections for a typical multi-ground HPM installation that includes Master Reference Ground (MRG). The ground system is non-CE Compliant.

Figure 3-1 Subsystem AC Power and Ground Connections—Multi-Ground System



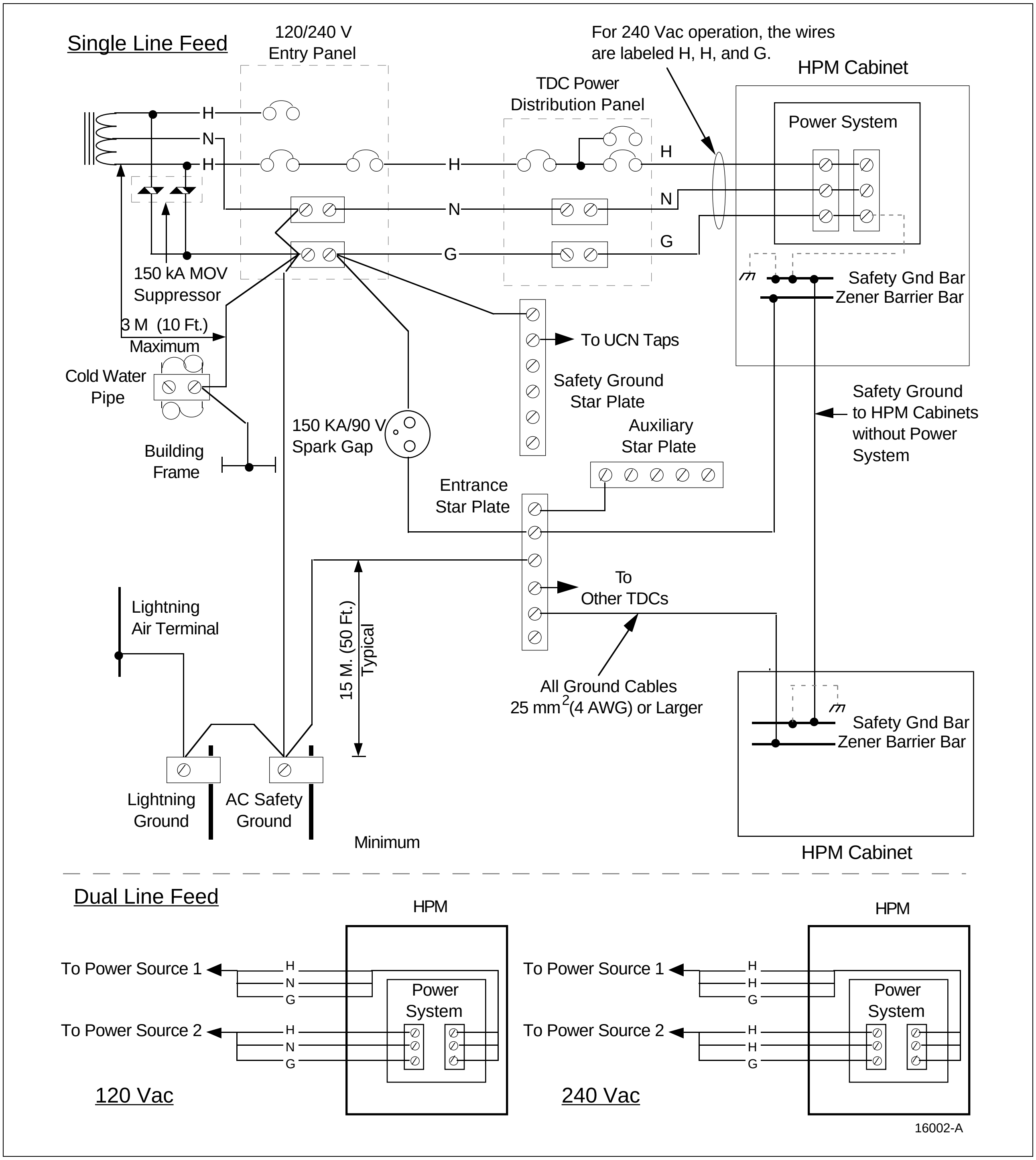
Note: Justification for the implementation of the bond wire between AC Safety Ground and Master Reference Ground is found in the *TPS System Site Planning* manual.

Continued on next page

AC power and ground

Figure 3-2 illustrates the ac power and ground connections for a typical single-ground HPM installation that is designated Safety Ground. The Safety Ground system is CE Compliant.

Figure 3-2 Subsystem AC Power and Ground Connections—Single-Ground System



3.4 Power Draw

Introduction

The power requirements for a High-Performance Process Manager (HPM) can necessitate the installation of one or more Power Systems in a cabinet complex. This requirement depends on the number and types of High-Performance Process Manager Modules (HPMMs), Input Output Processors (IOPs), and Field Termination Assemblies (FTAs) in the subsystem. In a large High-Performance Process Manager subsystem with redundant HPMMs and redundant IOPs, it may be desirable to install the HPMMs in separate cabinets with a Power System in each cabinet. With this configuration, a power failure in one Power System does not result in the failure of both the primary and secondary HPMMs and IOPs.

Power loading and initial inrush

Other considerations are the nonlinear loading and initial inrush that the Power System subassembly applies to the ac source when power is applied.

Fuse clearing

Clearing of the fuse (3 A) in the High-Performance I/O Link card in the HPMM may require additional current that a single Power Supply cannot adequately provide; therefore, a Power System with redundant Power Supply Modules is recommended.

Power System load requirements

Each Power System's load requirements must be examined as a function of the options that are installed in the High-Performance Process Manager. These demands are discussed in the *TPS System Site Planning* manual.

Power System considerations

Each Power System can provide up to 20 A of 24 Vdc power. By calculating the total current requirement, you can determine how many Power Systems are required. If more than one Power System is required, it may be desirable to connect each High-Performance Process Manager Module (HPMM) to a separate Power System. It may also be desirable to connect the "A" IOP and "B" IOP of a redundant pair to separate Power Systems.

Previously, Figure 2-25 illustrated a typical High-Performance Process Manager subsystem with redundant HPMMs in the same cabinet. Figure 2-26 illustrated a typical large subsystem in a cabinet complex with the redundant HPMMs in separate cabinets. Figure 2-25 illustrated a local cabinet complex with the redundant HPMMs in separate cabinets, and a remote cabinet with IOP card files.

Continued on next page

Provide adequate power

Generally, power for a subsystem with redundant HPMMs with up to 35 IOPs can be adequately provided by one Power System. A subsystem with redundant I/O may need additional Power Systems. The power calculation is made using the information provided in this subsection.

Subsystems with either remote I/O, or remote cabinets containing one or more IOP card files must be self-contained with at least one Power System.

3.4.1 Typical 24 Vdc Power Draw Calculations

Overview

Two examples of +24 Vdc power requirement calculations are illustrated in subsections 3.3 and 3.4. The Single Power System Example assumes a single cabinet with a dedicated Power System. The Dual Power System Example assumes a dual cabinet complex with each cabinet having a dedicated separate Power System.

Power calculation procedure

The calculations are based on the power requirements of the assemblies listed in Table 3-1. The current requirements are based on the typical maximum, assuming all channels are in use. Use the following steps to calculate the number of each type of IOP and associated FTA that an individual Power System must support.

1. Determine the number of channels needed for each type of IOP and associated FTA. Divide the total number by the number of channels that are available in the IOP. For example, using Table 3-1, if 256 High Level Analog Input (HLAI) IOP channels are needed, 16 IOPs and FTAs are required (256 channels ÷ 16 channels per IOP = 16 IOPs and 16 FTAs).
2. Multiply the number of IOPs by the current requirement for the type of IOP. For example, 16 model MU-PAIH02 HLAI IOPs require 2928 mA (16 HLAI IOPs x 183 mA = 2928 mA or 2.928 A). The current requirement is added to the **Total Module Current** for the Power System.
3. Multiply the number of FTAs by the current requirement for the type of FTA. For example, 16 model MU-TAIH12/52 HLAI FTAs require 5120 mA (16 HLAI FTAs x 320 mA = 5120 mA or 5.12 A). The current requirement is added to the **Total Module Current** for the Power System.
4. If redundant IOPs are required in the same Power System, double the IOP type count. For example, 16 redundant HLAI channels, A and B, require two IOPs (16 channels ÷ 16 channels per IOP x 2 = 2 IOPs). When the redundant IOPs reside in separate Power Systems, half the IOP power requirement is added to each Power System's Module Current power requirement (IOP A and IOP B).
5. To determine the **Total Module Current**, add together the total current for both the IOPs and their associated FTAs. For example, using Table 3-1, 256 HLAI channels require 2928 mA of IOP current and 5120 mA of FTA current (256 HLAI channels = 2928 mA+ 5120 mA = 8048 mA or 8.048 A).

Continued on next page

Assembly 24 Vdc power usage

Table 3-1 is a list of the power usage for High-Performance Process Manager assemblies.

Table 3-1 HPM Assembly 24 Vdc Power Usage

Description	Model Number	Channels	Assembly Current (Milliamps)
Left 7-Slot Card File—Slots 1-7, non-CE Compliant	MU-HPFH01	N/A	0
Left 7-Slot HPMM Card File—Slots 1-7, CE Compliant	MU-HPFH03	N/A	0
Right 7-Slot Card File—Slots 9-15, non-CE Compliant	MU-HPFH11	N/A	0
Right 7-Slot HPMM Card File—Slots 9-15, CE Compliant	MU-HPFH13	N/A	0
15-Slot Card File—Slots 1-15, non-CE Compliant	MU-HPFX02	N/A	0
15-Slot HPMM Card File—Slots 1-15, CE Compliant	MU-HPFX03	N/A	0
Left 7-Slot IOP Card File—Slots 1-7, CE Compliant	MU-HPFI03	N/A	0
Right 7-Slot IOP Card File—Slots 9-15, CE Compliant	MU-HPFI13	N/A	0
15-Slot IOP Card File—Slots 1-15, CE Compliant	MU-HPFI23	N/A	0
IOP Card File	MU-IOFX02	N/A	0
Nonredundant HPMM Card Set	MU-HPMS01	N/A	1375
Redundant HPMM Card Set	MU-HPMR01	N/A	2700
LLAI IOP Card	MU-PAIL02	8	58
LLMux IOP Card	MU-PLAM02	16	70
RHMUX IOP Card (requires an IS or NI Power Adapter)	MU-PRHM01	32	100
HLAI IOP Card	MU-PAIH02	16	183
HLAI IOP Card	MU-PAIH03	16	155
STI IOP Card	MU-PSTX02	16	100
STIM IOP Card	MU-PSTX03	16	100
AO IOP Card	MU-PAOX02	8	100
AO IOP Card	MU-PAOX03	8	100
AO IOP Card	MU-PAOY22	16	112
DI IOP Card	MU-PDIX02	32	90
DI IOP Card	MU-PDIY22	32	89
DISOE IOP Card	MU-PDIS11	32	210
DISOE IOP Card	MU-PDIS12	32	210
DO IOP Card	MU-PDOX02	16	64
DO IOP Card	MU-PDOY22	32	98

Continued on next page

Assembly 24 Vdc power usage, continued

Table 3-1 HPM Assembly 24 Vdc Power Usage, Continued

Description	Model Number	Channels	Assembly Current (Milliamps)
PI IOP Card	MU-PPIX02	8	208
SDI IOP Card	MU-PSDX02	2	70
SI IOP Card	MU-PSIM11	2	70
LLAI FTA	MU-TAIL02	8	350
LLAI FTA	MU-TAIL03	8	350
LLMux—RTD FTA	MU-TAMR02	16	185
LLMux—RTD FTA	MU-TAMR03	16	185
LLMux—TC/Local CJR FTA	MU-TAMT02	16	185
LLMux—TC/Local CJR FTA	MU-TAMT03	16	185
LLMux—TC/Remote CJR FTA	MU-TAMT12	16	185
LLMux—TC/Remote CJR FTA	MU-TAMT13	16	185
RHMUX—TC/Local CJR FTA (ISPA or NIPA provides power to FTA)	MC-GRMT01	16	0
RHMUX GI/IS Power Adapter (ISPA)	MU-GRPA01	32 *	300
RHMUX GI/NI Power Adapter (NIPA)	MU-TRPA01	32 *	575
HLAI/STI FTA	MU-TAIH02	16	320
HLAI FTA	MU-TAIH03	16	320
HLAI/STI FTA	MU-TAIH12/52	16	320
HLAI FTA	MU-TAIH13/53	16	320
HLAI/STI FTA	MU-TAIH22/62	16	320
HLAI FTA	MU-TAIH23	16	320
STI FTA	MU-TSTX03	16	320
STI FTA	MU-TSTX13/53	16	320

* An RHMUX Power Adapter provides the interface between one RHMUX IOP and one or two RHMUX FTAs. Each RHMUX FTA has 16 input channels providing a total of 32 inputs for the RHMUX subsystem.

Continued on next page

Assembly 24 Vdc power usage, continued

Table 3-1 HPM Assembly 24 Vdc Power Usage, Continued

Description	Model Number	Channels	Assembly Current (Milliamps)
AO FTA	MU-TAOX02	8	160
AO FTA	MU-TAOX12/52	8	171
AO FTA	MU-TAOY22/52	16	324
AO FTA	MU-TAOY23/53	16	324
24 Vdc DI FTA	MU-TDID12/52	32	408
24 Vdc DI FTA	MU-TDID72	32	410
24 Vdc Power Distribution Assembly	MU-TDPR02	12	200
24 Vdc DI FTA	MU-TDIY22/62	32	196
120 Vdc DI FTA	MU-TDIA12/52	32	192
120 Vdc DI FTA	MU-TDIA72	32	200
240 Vdc DI FTA	MU-TDIA22/62	32	192
24 Vdc Nonisolated DO FTA	MU-TDON12/52	16	0
24 Vdc Isolated DO FTA	MU-TDOY22/62	32	004
3-30 Vdc Solid-State DO FTA	MU-TDOD12/52	16	160
3-30 Vdc Solid-State DO FTA	MU-TDOD13/53	16	160
3-30 Vdc Solid-State DO FTA	MU-TDOD14/54	16	160
31-200 Vdc Solid-State DO FTA	MU-TDOD22/62	16	160
5-200 Vdc Solid-State DO FTA	MU-TDOD23/63	16	160
24-240 Vac Solid-State DO FTA	MU-TDOA12/52	16	160
120/240 Vac Solid-State DO FTA	MU-TDOA13/53	16	160
120 Vac/125 Vdc Relay DO FTA	MU-TDOR12/52	16	470
240 Vac/125 Vac Relay DO FTA	MU-TDOR22/62	16	470
240 Vac/125 Vac Relay DO FTA	MU-TDOY23/63	16	228
PI FTA	MU-TPIX12/52	8	136

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Assembly 24 Vdc power usage, continued

Table 3-1 HPM Assembly 24 Vdc Power Usage, Continued

Description	Model Number	Channels	Assembly Current (Milliamps)
SDI FTA—Toledo Scale Cell	MU-TSDT02	1	65
SDI FTA—Manual/Auto Station	MU-TSDM02	1	65
SDI FTA—UDC6000	MU-TSDU02	1	65
Manual/Auto Station	MU-MASX02	N/A	800
SI FTA—Allen-Bradley	MU-TSIA12	1	65
SI FTA—Modbus	MU-TSIM12	1	65
Power Adapter (LLMux, SDI, SI FTAs)	MU-TLPA02	2	360
Galvanically Isolated HLAI FTA	MU-GAIH12/82	16	1200
Galvanically Isolated HLAI/STI FTA	MU-GAIH13/83	16	1200
Galvanically Isolated HLAI/STI FTA	MU-GAIH14/84	16	1200
Galvanically Isolated HLAI FTA	MU-GAIH22/92	16	1200
Galvanically Isolated AO FTA	MU-GAOX02/72	8	440
Galvanically Isolated AO FTA	MU-GAOX12/82	8	440
Galvanically Isolated 24 Vdc DI FTA	MU-GDID12/82	32	800
Galvanically Isolated 24 Vdc DI FTA	MU-GDID13/83	32	800
Galvanically Isolated 24 Vdc DO FTA	MU-GDOD12/82	16	1800
Galvanically Isolated 24 Vdc DO FTA	MU-GDOL12/82	16	1800
Combiner Panel	MU-GLFD02	N/A	0
Marshalling Panel	MU-GMAR02	N/A	0
Galvanic Isolation Power Distribution Assembly	MU-GPRD02	N/A	160
Long Distance I/O Link Extender Cards/Couplers	MU-ILDX02	N/A	300
Long Distance I/O Link Extender Cards/Couplers	MU-ILDX03	N/A	300
Standard I/O Link Extender Cards/Couplers	MU-IOLM02	N/A	196
Standard I/O Link Extender Cards/Couplers	MU-IOLX02	N/A	190
Analog Output Standby Manual with case	MU-SMAC02	4	250
Analog Output Standby Manual - Digital	51401926-100	8	2200
Digital Output Standby Manual with case	MU-SMDC02	16	70
Digital Output Standby Manual without case	MU-SMDX02	16	100

3.4.2 Single Power System Calculation Example

Power calculation example

The following example in Table 3-2 meets the requirement that the total calculated current for an individual Power System be less than, or equal to 20 amperes.

Table 3-2 Single Power System Calculation Example

Assemblies	Total IOP/Module Current	Total FTA Current
Redundant HPMMs	2.700 A	N/A
High Level Analog Input (HLAI) IOPs, nonredundant (256 channels ÷ 16 channels/IOP = 16 IOPs x 183 mA = 2928 mA) (16 FTAs x 320 mA = 5120 mA)	2.928 A	5.120 A
High Level Analog Input (HLAI) IOPs, redundant A & B (16 channels x 2 = 32 channels ÷ 16 channels/IOP = 2 IOPs x 183 mA = 366 mA) (1 FTA x 320 mA = 320 mA)	0.366 A	0.320 A
Analog Output (AO) IOPs, nonredundant (120 channels ÷ 8 channels/IOP = 15 IOPs x 100 mA = 1500 mA) (8 FTAs x 171 mA = 1368 mA)	1.500 A	1.368 A
Analog Output (AO) IOPs, redundant A & B (16 channels x 2 = 32 channels ÷ 8 channels/IOP = 4 IOPs x 100 mA = 400 mA) (2 FTAs x 171 mA = 342 mA)	0.400 A	0.342 A
Subtotals	7.894 A	7.150 A

Total Power System Current = 7.894 + 7.150 = 15.044 A

3.4.3 Dual Power System Calculation Example

Calculation examples

The following examples in Table 3-3 and 3-4 meet the requirement that the total calculated current for an individual Power System be less than, or equal to 20 amperes.

Power System 1 calculation

Table 3-3 Dual Power System Calculation Example (Power System 1)

Power System 1		
Assemblies	**Total IOP/Module Current**	**Total FTA Current**
Single HPMM	1.375 A	N/A
High Level Analog Input (HLAI) IOPs, nonredundant (80 channels ÷ 16 channels/IOP = 5 IOPs x 183 mA = 915 mA) (16 FTAs x 320 mA = 5120 mA)	0.915 A	1.600 A
High Level Analog Input (HLAI) IOPs, redundant A (240 channels = 16 channels/IOP = 15 IOPs x 183 mA = 2740 mA) (15 FTA x 320 mA = 4800 mA)	2.740 A	4.800 A
Analog Output (AO) IOPs, nonredundant (40 channels ÷ 8 channels/IOP = 5 IOPs x 100 mA = 500 mA) (5 FTAs x 171 mA = 855 mA)	0.500 A	0.855 A
Analog Output (AO) IOPs, redundant A (120 channels ÷ 8 channels/IOP = 15 IOPs x 100 mA = 1500 mA) (15 FTAs x 171 mA = 2565 mA)	1.500 A	2.565 A
Subtotals	7.030 A	9.820 A

Total Power System 1 Current = 7.03 + 9.82 = 16.85 A

Continued on next page

3.4.3 Dual Power System Calculation Example, Continued

Power System 2 calculation

Table 3-4 Dual Power System Calculation Example (Power System 2)

Power System 2		
Assemblies	**Total IOP/Module Current**	**Total FTA Current**
Single HPMM	1.375 A	N/A
High Level Analog Input (HLAI IOPs, redundant B (240 channels = 16 channels/IOP = 15 IOPs x 183 mA = 2740 mA) (15 FTA x 320 mA = 4800 mA)	2.740 A	4.800 A
Analog Output (AO) IOPs, redundant B (120 channels ÷ 8 channels/IOP = 15 IOPs x 100 mA = 1500 mA) (15 FTAs x 171 mA = 2565 mA)	1.500 A	2.565 A
Subtotals	6.615 A	7.365 A

Total Power System 2 Current = 6.615 + 7.365 = 13.98 A

3.4.4 HPM AC Power Draw

Introduction

After you have determined the number of Power Systems that will be required, the subsystem's ac power, substation sizing requirement, and heat generation can be determined.

Maximum power requirements

Provide enough power for fully loaded HPM Power Systems rather than designing only for the existing dc power loads. A Power System with redundant Power Supply Modules that is providing 20 amperes of 24 Vdc power and is charging its 48 vdc backup battery has an ac line draw of 7.6 amperes rms at 120 Vac.

A Power System with a single Power Supply Module that has a 20 ampere 24 Vdc load has an ac line draw of 7.1 amperes rms at 120 Vac.

When operating at 240 Vac, halve the ac current requirement.

3.4.5 Crest Factor

Introduction

Power Systems that were manufactured before November 1994 used a Power Supply Module that is black-colored and was manufactured by the Cherokee Company. The Power Supply Module has a higher crest factor than the Power Supply Module that is currently used in the Power System. The current Power Supply Module is silver-colored and manufactured by Bikor Corporation.

Early production Power Supply Module

The crest factor for the black-colored Cherokee Power Supply Module is 2.2. This means that the current draw from the ac power line is not sinusoidal but has a peak value of 2.2 times the rms current value.

A linear load has a peak current value of 1.414 times the rms value; therefore, the peak value of the current draw from the ac line for this type of Power Supply Module is 1.6 times higher than it would be if the Power Supply Module is a perfectly linear load.

Later production Power Supply Module

The crest factor for the silver-colored Bikor Power Supply Module is 1.7 (worst case). The peak current drawn from the ac power line is 1.7 times the rms current value. The peak value of the current draw from the ac line for the Power Supply Module is 1.2 times higher than it would be if the Power Supply Module is a perfectly linear load.

AC power source sizing

Size the ac substation transformer and/or the UPS to accommodate peak current rather than rms current. This will prevent a distortion problem in the line voltage that is caused by current spikes in the load. Circuit breakers and conductors are still sized by using rms values.

The substation transformer and/or UPS may be providing power to different loads at the facility that have different crest factors. To properly size the substation transformer and/or UPS, you must calculate a crest factor for the aggregate load. To do this, calculate the total peak current and the total rms current for all the loads. The aggregate load crest factor is the ratio of these two values.

3.4.6 Inrush Current

Introduction

This discussion assumes that the Power Supply Module is operating from a 120 Vac line source.

Power systems that were manufactured before November 1994 used a Power Supply Module that was black-colored and was manufactured by the Cherokee Company. The Power Supply Module has a higher inrush current than the Power Supply Module that is currently used in the Power System. The current Power Supply Module is silver-colored and manufactured by Bikor Corporation.

Early production Power Supply Module

When power is initially applied, the black-colored Cherokee Power Supply Module has a worst case instantaneous peak inrush of 85 amperes that declines to 27 amperes peak within two milliseconds. Within five seconds, it then declines to the normal operating repetitive peak current.

For 240 volt operation, the inrush current is doubled.

Two Power Supply Modules on the same circuit breaker will draw twice as much current.

Later production Power Supply Module

The silver-colored Bikor Power Supply Module has an inrush current of 35 amperes for the first half-cycle. After initially applying power to the Power Supply Module, the current diminishes during each half-cycle until the steady-state current is reached within five ac line cycles.

Two Power Supply Modules on the same circuit breaker will draw twice as much current.

Continued on next page

3.4.6 Inrush Current, Continued

Solving the Inrush problem

A substation or UPS can handle the Inrush current by using one of several methods:

- When powering up a large system with many devices, the surge is large and the ac source may take 10 cycles or more to reach specifications; however, because the system is not operational, a slow power-up is not important.
- A substation transformer or a UPS may already include an inherent surge allowance, such as a 50% overload capability while meeting all other specification requirements.
- A larger substation may be purposely selected to include the Inrush as steady state current. For example, applying power to a redundant HPM Power System creates an Inrush of 54 amperes peak. Because the redundant Power Supply Modules already requires a steady state operating current of 8.6 amperes ac rms with a Crest Factor of 2.09, the substation already provides (8.6 x 2.09 =) 18 amperes peak. Therefore, the example substation needs to be increased in size by (54 - 18 =) 36 amperes peak to handle the surge to service the particular HPM Power System.
- When the UPS is too small to provide a workable Inrush capability, it can be split into even smaller units so that each HPM has its own unit. As such, servicing an HPM may cause a momentary fold-back of its UPS, but the other units are unaffected.

The following discussion on substation sizing considers all the previous current requirements and allows an extra 36 amperes peak for Inrush to service one redundant HPM Power Supply Module at a time. The discussion also assumes that the current production silver-colored Bikor Power Supply Module is in use.

3.5 Substation Sizing

Conversion example

The published current rating for a substation transformer or UPS is created with the assumption that it will be used for a linear load. A linear load has a Crest Factor of $\sqrt{2}$. Because the load Crest Factor for electronic equipment is not $\sqrt{2}$, conversion is required. This is accomplished by converting all the TPS system rms amperages to peak values as illustrated in the following example.

Load Description	RMS Draw (Amperes)	Crest Factor	Peak Draw (Amperes)
HPMMs (5)	38.0	1.7	38 x 1.7 = 64.6
Operator Console CRTs	35.0	2.27	35 x 2.27 = 79.5
Subtotals	73.0		144.1
Future Expansion	x 1.33		x 1.33
HPM Inrush Allowance			36.0
Total	97.0		228.0

No Inrush allowance for the LCN Operator Console is required. The soft-start power supplies have a maximum Inrush of 10 amperes, so they are easily accommodated by the 36 ampere allowance for the HPMs.

The 228 ampere peak is derated by $\sqrt{2}$ for the purpose of selecting a transformer; thus, a 161 ampere (228 amperes peak $\div \sqrt{2}$) linear-load handling capacity transformer is required. In other words, it is now known that a 161 linear-ampere ac rms transformer can deliver the required 228 ampere peaks.

You will need a 20 kVA (120 V x 161 A) transformer, either for 120 V, 240 V, or 208 V line-to-line grounded Y. Conductors and breakers are sized using the 97 amperes rms calculation.

Substation and UPS requirements

As previously calculated, an off-the-shelf substation or UPS must have a Volt-Amperes (VA) capacity that is significantly greater than the rms total for the load. A custom designed substation or UPS can be designed so that the peak and RMS requirements for electronic loads coincide. Significant economies are possible. See subsection 3.7.

3.6 Circuit Breaker Sizing

AC feeder

For an HPM with one 24 Vdc Power Supply Module, one ac feeder is used. With two Power Supply Modules, one or two feeders may be used. See Figure 3-1 or 3-2.

Circuit breakers

The ac feeder conductors require current limiting for protection. Circuit breakers used for this purpose are to be sized for the ac rms current and are not to be adjusted for the Crest Factor.

One Power Supply Module

An HPM with one 24 Vdc Power Supply Module requires one ac feeder and has a worst case ac line draw of 7.1 amperes ac rms. Local electrical codes usually require that the feeder circuit breaker be sized at 125% of its noncontinuous-plus-continuous load. The ac feeder requires a 10-ampere circuit breaker. This is the nearest common size that gives a 125% over sizing allowance.

Two Power Supply Modules

For an HPM with two 24 Vdc Power Supply Modules on one ac feeder, the total worst case draw is 7.6 amperes ac rms. Again, a 10-ampere circuit breaker is required.

Two Power Supply Modules on two ac feeders

For an HPM with two Power Supply Modules on two ac feeders, either Power Supply Module can draw 7.6 amperes ac rms, or there can be some random proportioning. As such, each feeder needs a 10-ampere circuit breaker. When using two Power Systems for one HPM, two ac feeders are required. Both Power Systems should be connected to both ac feeders.

ATTENTION

ATTENTION—Do not use a circuit breaker larger than 15 amperes. The Power System wiring is not rated to handle a larger feeder.

3.7 Custom UPS and Power Factor

Introduction

Frequently, the UPS and substation components are designed specifically for each installation. Significant economies are possible by specifying the load as thoroughly as possible. The designers will then optimize the design for the exact combination of ac rms current, repetitive peak current, Inrush, and distortion.

Power Supply Module power factor

Power systems that were manufactured before November 1994 used a Power Supply Module that was black-colored and was manufactured by the Cherokee Company. The current Power Supply Module is silver-colored and manufactured by Bikor Corporation. The black-colored Cherokee Power Supply Module has a power factor of 0.8 over a broad range of loads. The current silver-colored Bikor Power Supply Module has a power factor-correction feature incorporated into the design. Its power factor is greater than 0.95.

3.8 Automatic Bypass Switch

Introduction

An automatic bypass switch is often included in the power source to allow instantaneous transfer between two ac sources. Both the primary and backup power sources should be of instrument grade. Transfer to a substandard power source in an emergency does not always happen.

Transfer time requirement

The switch transfer time should be less than 10 milliseconds in both directions. This allows maintenance personnel to freely operate the switch without disturbing the operation. Additional discussion about transfer switches can be found in subsection 3.2.

3.9 Surge Protection

Introduction

Any instrument power distribution panel should have some transient protection. See Figure 3-1 or 3-2.

Protector usefulness

A protector is useful under the following conditions:

- Should an ac feeder develop a short circuit, its circuit breaker may not open until peak currents have reached 10,000 amperes or more. The sudden interruption of such a large current when a circuit breaker opens injects a severe transient into the rest of the electrical system.
- HPM servicing may require that the Power Supply Modules be turned off and on. Even at normal load currents, significant transients may be generated in the distribution panel.
- Lightning may strike the facility power feeder and send significant transients into the instrument system.

Power Supply Module performance

The HPM Power Supply Module is rated to perform to all its specifications while handling a variety of transients, such as a 3 kV impulse for 8 x 20 microseconds. This provides a safety factor to allow for feed through when the surge protector operates.

MOV protector

A Metallic Oxide Varistor (MOV) is the preferred power line protector. Compared to a protector based on a spark gap, the MOV protector does not short circuit the power along with the transient. Use a 150 kA unit. Overcapacity here does not carry a penalty.

A suitable protector can be purchased from Lightning Protection Corporation in Santa Barbara, CA at telephone number 805-967-5089. For a 120/240 Vac system, use Model 20208.

3.10 Grounded Conductor

Power source's grounded conductor

The power source to the HPM may or may not have a grounded conductor. This does not make any difference to the HPM as long as local electrical codes are satisfied.

3.11 Redundant Safety Grounds

Introduction

The electronics in the HPM are insulated from its enclosures. The use of metal conduits to the enclosures does not affect operation of the equipment. The placement of cabinets on metal floors, the bonding of the cabinets to metal floor supports, cabinets touching metal structure, or the purposeful installation of redundant safety grounds also does not effect the operation of the equipment.

Reference

Grounding is discussed in the *TPS System Site Planning* manual. Grounding also relates to lightning protection that is also discussed in the *TPS System Site Planning* manual.

3.12 Emergency Shutdown

Introduction

Electrical codes may require the ability to shut down system power from principal exit doors. This emergency shutdown requirement is satisfied most economically by placing the instrument power distribution panel within arm's length of the room exit. See the room layout in Figure 2-1.

3.13 Trays and Conduits

Raised floor

Power and signal wiring in the electronics room is easily accommodated by using a raised floor. The space underneath the floor becomes one large wiring tray. Power and signal cables for the HPM m ay be routed together as long as the cabling is approved for the circuits being handled. Contact or relay signals must be in shielded cables to prevent contact arcing from inducing Electromagnetic Interference (EMI) into other signal cables.

Continued on next page

3.13 Trays and Conduits, Continued

FTA cables

The 50-conductor FTA cables may exit the HPM cabinets and go to facility terminal panels that incorporate FTAs. This is discussed in detail in the *High-Performance Process Manager Installation* manual. The cables have 24 volts from a Class 1 Power Limited source as defined in the National Electrical Code (NEC) in the USA. This usually requires that the FTA cables are installed in their own trays (the connectors are too big to pull through conduit) if they leave the cabinet. The dedicated trays are considered as an extension of the HPM cabinet.

Field circuit

Field circuits are different. Most are limited in the FTAs to Class 2 Power Limited source requirements. This allows a great deal of freedom in their installation as discussed in the Section 5 of this manual.

Cable segregation

Refer to Figure 2-1 for the following discussion. Local codes may require that all wiring be placed in enclosed metal trays or conduit. It is then recommended that the circuits to an HPM be segregated into separate trays or compartment as follows:

- Power cables should be placed in one tray/conduit. The need for a cover depends on local codes. All safety ground conductors also use this tray. The ac circuit cables in this tray usually originate at the instrument ac distribution panel.
- Process signals at 30 volts ac/dc peak or less go into their own tray/conduit. This includes 1-5 V/4-20 mA, alarm contacts, UCN coaxial cables, and Master Reference Ground (MRG) cables. All signals in the tray usually originate at the 0-30 volt signal terminal panel.
- Signals above 30 volts, although normally considered as power circuits, should route through their own tray/conduit. All signals in this tray usually originate at the facility 31-250 volt signal terminal panel.
- FTA cables leaving cabinets usually need their own tray as discussed previously.

Intrinsic Safety

Intrinsic Safety systems with zener barriers or current limiting resistors usually require another conduit or tray compartment. This is covered in Section 5 of this manual.

3.14 Existing TPS System AC Power

Power compatibility

The power required for the HPM is compatible with power provided for all other TPS systems. Connect the HPM to existing TPS system's power when it is convenient.

Section 4 – Process Wiring

4.1 Overview

Section contents

The topics covered in this section are:

Introduction

The process control signal wires connect to the High-Performance Process Manager (HPM) at the Field Termination Assemblies (FTAs). The type of FTA selected is dependent upon the process equipment. There are 16 types of FTAs to choose from. Some of the FTA types support IOP redundancy. Some FTA types provide Galvanic Isolation and are for Intrinsically Safe applications.

ATTENTION

ATTENTION—In the past, it was a requirement that Galvanically Isolated, Intrisically Safe (GI/IS) FTAs had to be mounted on horizontally oriented FTA Mounting Channels in an HPM cabinet. The requirement is no longer needed because of component and design improvements.

Galvanically Isolated FTAs can now be mounted on vertically oriented FTA Mounting Channels; however, there is still a requirement that Galvanically Isolated FTAs and standard (non-Galvantically Isolated) FTAs, and the wiring to them, be properly separated in the cabinet.

Any FTA Mounting Channels on which Galvanically Isolated FTAs will be mounted must be installed in an inverted (upside down from the normal) position.

FTA mounting

FTAs are installed on FTA Mounting Channels that are located in the front of a single-access HPM cabinet, and in the rear and/or front of a dual-access cabinet. The number of FTA Mounting Channels that can be accommodated in a cabinet is dependent upon whether the cabinet is single access or dual access, and whether standard or wide FTA Mounting Channels are installed. See Section 8 or 9 for a detailed description of the cabinets and their FTA Mounting Channels.

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ATTENTION

The field wiring to Galvanically Isolated FTAs must be routed such that a strict 2-inch minimum separation is maintained between any other wiring, cable, or electrical part, or be separated by a divider that is grounded metal or nonconductive material.

FTA Mounting Channels

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 FTA to IOP cabling, and the process control wiring.

The standard (non-Galvanically Isolated) FTA to IOP or Power Distribution Assembly cabling is routed in the right channel, and the process control wiring is routed in the left channel. The reverse is true for Galvanically Isolated FTAs because the FTA Mounting Channel is installed in an inverted position.

Power Distribution and Marshalling Panels

The model MU/MC-GPRD02 Power Distribution Panel can be mounted on any FTA Mounting Channel that is installed in the normal or inverted position; however, proper wiring separation must be observed.

The model MU/MC-GMAR52 Marshalling Panel must not be mounted on an FTA Mounting Channel that has a Galvanically Isolated FTA mounted on it.

4.2 FTA Selection

Overview

The FTA has circuits that convert the process control signals to voltage and current levels that can be accommodated by the High-Performance Process Manager electronics. There are a number of FTA types with each type designed for a specific type of signal.

Rules

Rules for selecting the appropriate FTAs, installing, configuring, and the connections to the associated IOP and the process control signals, are discussed in detail in the *Process Manager I/O Installation* manual.

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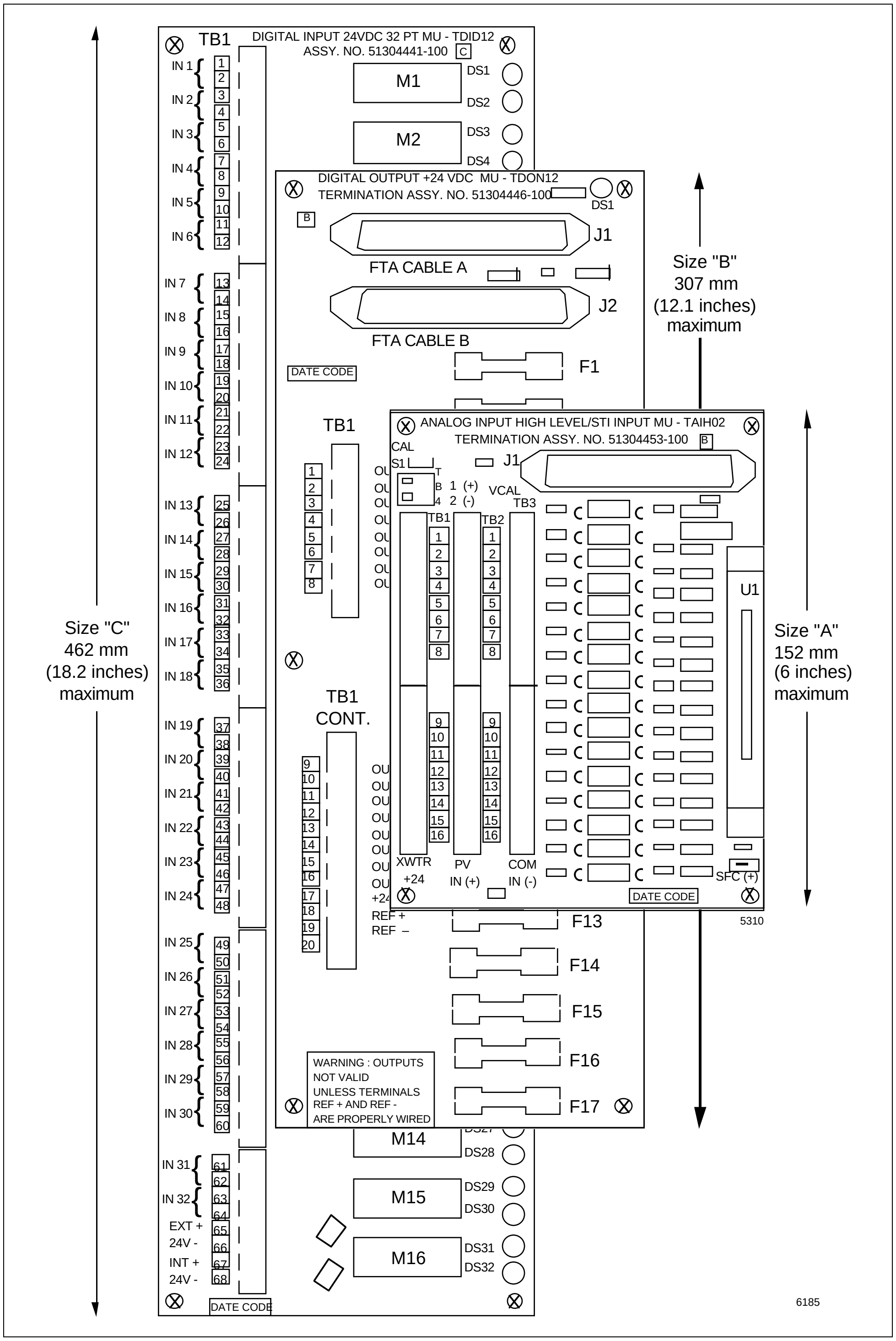
FTA sizes

The assembly layouts of three physical sizes of FTAs are illustrated in Figure 4-1.

Figure 4-1 Field Termination Assembly (FTA) Sizes



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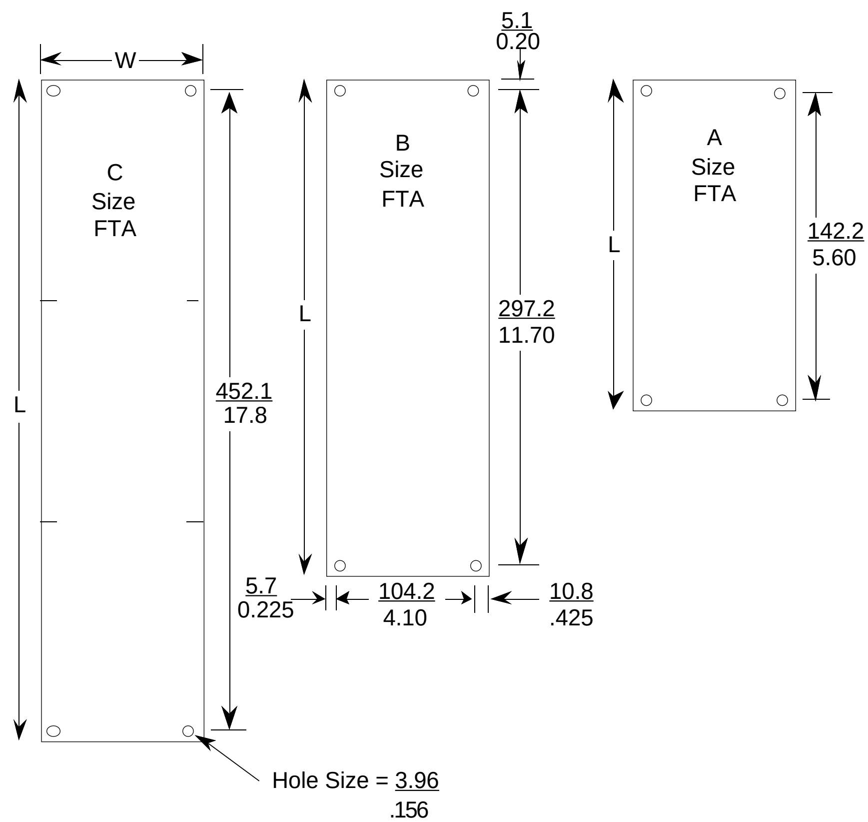
FTA sizes, continued

As a function of the type and number of process control signals the FTA interfaces, FTAs are produced in three different sizes, size A, B, and C. The size dimensions are shown in Figure 4-2.

Figure 4-2 Field Termination Assembly (FTA) Mounting Dimensions



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: millimeters / 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.

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FTA types

Because of FTA size differences, the number of FTAs that can be installed in a cabinet will vary. Tables 4-1 and 4-2 are lists of FTAs and support assemblies by model number. When appropriate, the FTA's or supporting assembly's field terminal connector type, number of input or output signal channels, and mounting size are listed.

Standard FTAs

For standard types of FTAs, the terminal connector types are compression (C), nonremovable screw (S), and removable screw (RS).

Table 4-1 Standard FTAs and Associated Assemblies

Model Number	Description	Terminal Type	Channels	Mounting Size
MU-TAIH02	High Level Analog Input/STI (Single IOP)	C	16	A
MU-TAIH03	High Level Analog Input (Single IOP)	C	16	A
MU-TAIH12	High Level Analog Input/STI	C	16	B
MU-TAIH13	High Level Analog Input	C	16	B
MU-TAIH22	Enhanced Power High Level Analog Input/STI	C	16	B
MU-TAIH23	Enhanced Power High Level Analog Input	C	16	B
MU-TAIH52	High Level Analog Input/STI	S	16	B
MU-TAIH53	High Level Analog Input	S	16	B
MU-TAIH62	Enhanced Power High Level Analog Input/STI	S	16	B
MU-TSTX03	Smart Transmitter Interface (Single IOP)	C	16	A
MU-TSTX13	Smart Transmitter Interface	C	16	B
MU-TSTX53	Smart Transmitter Interface	S	16	B
MU-TAIL02	Low Level Analog Input (Single IOP)	C	8	B
MU-TAIL03	Low Level Analog Input (Single IOP)	C	8	B
MU-TAMR02	Low Level Analog Input Multiplexer—RTD (Single IOP)	C	16	B
MU-TAMR03	Low Level Analog Input Multiplexer—RTD (Single IOP)	C	16	B
MU-TAMT02	Low Level Analog Input Multiplexer—TC—Local CJR (Single IOP)	C	16	B
MU-TAMT03	Low Level Analog Input Multiplexer—TC—Local CJR (Single IOP)	C	16	B
MU-TAMT12	Low Level Analog Input Multiplexer—TC—Remote CJR (Single IOP)	C	16	B
MU-TAMT13	Low Level Analog Input Multiplexer—TC—Remote CJR (Single IOP)	C	16	B

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Standard FTAs, continued

Table 4-1 Standard FTAs and Associated Assemblies, Continued

Model Number	Description	Terminal Type	Channels	Mounting Size
MC-GRMT01	Remote Hardened Low Level Analog Input Multiplexer TC Local CJR	S	16	Non Standard
MU-GRPA01	RHMUX GI/IS Power Adapter	C	2	A
MU-TRPA01	RHMUX GI/NI Power Adapter	C	2	B
MU-TAOX02	Analog Output (Single IOP)	C	8	A
MU-TAOX12	Analog Output	C	8	B
MU-TAOX52	Analog Output	S	8	B
MU-TAOY22	Analog Output with Standby Manual Connector	C	16	B
MU-TAOY23	Analog Output without Standby Manual Connector	C	16	B
MU-TAOY52	Analog Output with Standby Manual Connector	S	16	B
MU-TAOY53	Analog Output without Standby Manual Connector	S	16	B
MU-TDID12	24 Vdc Digital Input	C	32	C
MU-TDID52	24 Vdc Digital Input	S	32	C
MU-TDID72	24 Vdc Digital Input (Single IOP)	RS	32	C
MU-TDIY22	24 Vdc Digital Input	C	32	B
MU-TDIY62	24 Vdc Digital Input	S	32	B
MU-TDIA12	120 Vdc Digital Input	C	32	C
MU-TDIA52	120 Vdc Digital Input	S	32	C
MU-TDIA72	120 Vdc Digital Input (Single IOP)	RS	32	C
MU-TDIA22	240 Vdc Digital Input	C	32	C
MU-TDIA62	240 Vdc Digital Input	S	32	C
MU-TDON12	24 Vdc Nonisolated Digital Output	C	16	B
MU-TDON52	24 Vdc Nonisolated Digital Output	S	16	B
MU-TDOY22	24 Vdc Isolated Digital Output	C	32	B
MU-TDOY62	24 Vdc Isolated Digital Output	S	32	B

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Standard FTAs, continued

Table 4-1 Standard FTAs and Associated Assemblies, Continued

Model Number	Description	Terminal Type	Channels	Mounting Size
MU-TDOD12	3-30 Vdc Solid-State Digital Output	C	16	B
MU-TDOD13	3-30 Vdc Solid-State Digital Output	C	16	B
MU-TDOD14	3-30 Vdc Solid-State Digital Output	C	16	B
MU-TDOD52	3-30 Vdc Solid-State Digital Output	S	16	B
MU-TDOD53	3-30 Vdc Solid-State Digital Output	S	16	B
MU-TDOD54	3-30 Vdc Solid-State Digital Output	S	16	B
MU-TDOD22	31-200 Vdc Solid-State Digital Output	C	16	B
MU-TDOD23	31-200 Vdc Solid-State Digital Output	C	16	B
MU-TDOD62	31-200 Vdc Solid-State Digital Output	S	16	B
MU-TDOD63	31-200 Vdc Solid-State Digital Output	S	16	B
MU-TDOA12	120/240 Vac Solid-State Digital Output	C	16	B
MU-TDOA13	120/240 Vac Solid-State Digital Output	C	16	B
MU-TDOA52	120/240 Vac Solid-State Digital Output	S	16	B
MU-TDOA53	120/240 Vac Solid-State Digital Output	S	16	B
MU-TDOR12	120 Vac/125 Vdc Relay Digital Output	C	16	B
MU-TDOR52	120 Vac/125 Vdc Relay Digital Output	S	16	B
MU-TDOY23	120 Vac/125 Vdc Relay Digital Output	C	16	B
MU-TDOY63	120 Vac/125 Vdc Relay Digital Output	S	16	B
MU-TDOR22	240 Vac/125 Vdc Relay Digital Output	C	16	B
MU-TDOR62	240 Vac/125 Vdc Relay Digital Output	S	16	B
MU-TPIX12	Pulse Input	C	8	B
MU-TPIX52	Pulse Input	S	8	B
MU-TSDT02	Serial Device Interface—Toledo Weigh Cell	DB-25	1	A
MU-TSDM02	Serial Device Interface—Manual/Auto Station	C	1	A
MU-TSDU02	Serial Device Interface—UDC 6000 Modbus	C	1	A
MU-TSIA12	Serial Interface—Allen-Bradley	DB-25	1	A

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Standard FTAs, continued

Table 4-1 Standard FTAs and Associated Assemblies, Continued

Model Number	Description	Terminal Type	Channels	Mounting Size
MU-TSIM12	Serial Interface—Modbus RTU	C/DB-25	1	A
MU-TDPR01	Digital Input Power Distribution Assembly—16 outputs	S	N/A	A
MU-TDPR02	Digital Input Power Distribution Assembly—12 outputs	S	N/A	A
MU-TLPA02	Power Adapter (supports LLMux, SDI, and SI)	C	2	A

Galvanically Isolated FTAs

For Galvanically Isolated FTAs, the terminal connector types are compression (C) and crimp pin (CP). The Marshalling Panel has nonremovable screw (S) terminals.

Table 4-2 Galvanically Isolated FTAs and Associated Assemblies

Model Number	Description	Terminal Type	Channels	Mounting Size
MC-GRMT01	Remote Hardened Low Level Analog Input Multiplexer TC with Local CJR	S	16	Non Standard
MU-TRPA01 *	Remote Hardened Non-Incendive Power Adapter	C	2	B
MU-GRPA01 *	Remote Intrinsically Safe Power Adapter	C	2	A
MU-GAIH12	High Level Analog Input	C	16	B
MU-GAIH82	High Level Analog Input	CP	16	B
MU-GAIH13	High Level Analog Input/Smart Transmitter Interface	C	16	B
MU-GAIH83	High Level Analog Input/Smart Transmitter Interface	CP	16	B
MU-GAIH14	High Level Analog Input/Smart Transmitter Interface (High drive)	C	16	B
MU-GAIH84	High Level Analog Input/Smart Transmitter Interface (High drive)	CP	16	B
MU-GAIH22	High Level Analog Input (Auxiliary receiver output)	C	16	B
MU-GAIH92	High Level Analog Input (Auxiliary receiver output)	CP	16	B

* The RHMUX Power Adapter receives +24 V power through the cable that interfaces with the RHMUX IOP, not the GI Power Distribution Assembly (MU-GPDR02). The Power Adapter provides the interface between one RHMUX IOP and two RHMUX FTAs.

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Galvanically Isolated FTAs, continued

Table 4-2 Galvanically Isolated FTAs and Associated Assemblies, Continued

Model Number	Description	Terminal Type	Channels	Mounting Size
MU-GAOX02	Analog Output (Single IOP)	C	8	B
MU-GAOX72	Analog Output (Single IOP)	CP	8	B
MU-GAOX12	Analog Output	C	8	B
MU-GAOX82	Analog Output	CP	8	B
MU-GDID12	24 Vdc Digital Input (Contact output to IOP)	C	32	B
MU-GDID82	24 Vdc Digital Input (Contact output to IOP)	CP	32	B
MU-GDID13	24 Vdc Digital Input (Solid-state output to IOP)	C	32	B
MU-GDID83	24 Vdc Digital Input (Solid-state output to IOP)	C	32	B
MU-GDOD12	24 Vdc Digital Output (Contact output to IOP)	C	16	B
MU-GDOD82	24 Vdc Digital Output (Contact output to IOP)	CP	16	B
MU-GDOL12	24 Vdc Digital Input (Line Fault Detection)	C	16	B
MU-GDOL82	24 Vdc Digital Input (Line Fault Detection)	CP	16	B
MU-GLFD02	Combiner Panel	N/A	N/A	A
MU-GPRD02	Power Distribution Assembly	N/A	N/A	A
MU-GMAR52	Marshalling Panel	S	N/A	B

4.3 Cabinet Entry

Cabinet Access

The process control signal cables enter the High-Performance Process Manager cabinet through either the top or bottom.

Bottom entry

For bottom entry, the cabinet floor has sliding plates that are retained by cage nuts or Allen screws. The plates can be adjusted to vary the size of the entry slots.

Top entry

When top entry is desired, the top panel is removed by extracting the cabinet lifting eye-bolts, and then punching entry holes in the panel as needed.

CAUTION

CAUTION—Do not attempt to punch holes in the panel while it is still mounted on the cabinet. This may cause metal debris from the panel to drop down onto the cabinet equipment and result in electrical damage when power is applied to the equipment.

Cable clamping

For either top or bottom entry, the cables should be clamped firmly to the inside of the cabinet. The clamping should be able to withstand approximately a 45 kg (100 pound) pull. The cabinet is special because it includes a cable clamp rail at the bottom. The rail can be remounted at the top if required.

Reference

See Section 8 or 9 for a illustration that shows the floor FTA cable entry points for the type of cabinet installed.

4.4 Signal Tray Wiring Compatibility

Wiring rules

The process wiring to the High-Performance Process Manager should be segregated by signal level in different trays or conduits to minimize cross talk. The segregation rules are as follows:

- Millivolt signals from electrical components, such as thermocouples, low voltage dc signals, 1-5 V/4-20 mA, and digital/contact circuits with voltages less than 30 Vac peak/DC, should be in individual cables that provide a protective shield. They can all be routed in the same cable tray. The tray can also include UCN coaxial cables, Master Reference Ground cables (Safety Ground cables in a CE Compliant installation) cables, and 50-conductor FTA to IOP cables.
- Circuits running at higher voltages, or nonshielded circuits at any voltage, belong in their own metal tray compartment or conduit. Thermocouple signals with a common mode of over 30 Vdc are also in this latter category.
- Wiring to Galvanically Isolated FTA must be separated from all other wiring.

More information can be found in the *High-Performance Process Manager Installation*, *Process Manager I/O Installation*, or the *TPS System Site Planning* manuals.