Honeywell

Experion

Control Hardware Planning

Guide

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Notices and Trademarks

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About This Document

Provides an overview of things you should consider when planning for the installation of your Experion control hardware.

Release Information

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References

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

Document Title

Contacts

World Wide Web

The following Honeywell web sites may be of interest to Process Solutions customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Honeywell Process Solutions	*http://hpsweb.honeywell.com*

Telephone

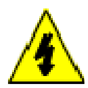
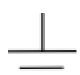
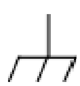
Contact us by telephone at the numbers listed below.

Location	Organization	Phone
United States and Canada	Honeywell IAC Solution Support Center	1-800-822-7673
Europe	Honeywell TAC-EMEA	+32-2-728-2704
Pacific	Honeywell Global TAC - Pacific	1300-300-4822 (toll free within Australia) +61-8-9362-9559 (outside Australia)
India	Honeywell Global TAC - India	+91-20-2682-2458
Korea	Honeywell Global TAC - Korea	+82-2-799-6317
People's Republic of China	Honeywell Global TAC - China	+86-10-8458-3280 ext. 361
Singapore	Honeywell Global TAC - South East Asia	+65-6580-3500
Taiwan	Honeywell Global TAC - Taiwan	+886-7-323-5900
Japan	Honeywell Global TAC - Japan	+81-3-5440-1303
Elsewhere	Call your nearest Honeywell office.	

Symbol Definitions

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

Symbol	Definition
	ATTENTION: Identifies information that requires special consideration.
	TIP: Identifies advice or hints for the user, often in terms of performing a task.
	REFERENCE -EXTERNAL: Identifies an additional source of information outside of the bookset.
	REFERENCE - INTERNAL: Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.

Symbol	Definition
	**WARNING, Risk of electrical shock**: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Functional earth terminal**: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	**Earth Ground**: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Chassis Ground**: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

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Introduction

Overview

About this guide

This guide is intended to provide information to assist you in planning and designing the installation of your Experion control hardware. Control hardware is an umbrella term used to refer to the Honeywell control and input/output components that can be supplied with an Experion system.

This guide complements the *Sever and Client Planning Guide* that provides planning and design topics for Experion servers and clients.

Online documentation reference

Knowledge Builder is the online documentation library for the Experion system. It is provided on a compact disc and can be installed on a suitable personal computer. If you are using a printed copy of the *Control Hardware Planning Guide*, we recommend that you install Knowledge Builder to take advantage of its online search and reference capabilities.

Initial Planning and Design Activities

Getting Started

Review Experion capabilities

Read the *Overview* section in Knowledge Builder so that you understand the basic concepts and terminology, and appreciate the capabilities of Experion.

Complement the information in this document with the data in the *Server and Client Planning Guide* to cover all aspects of an Experion installation.

REFERENCE - INTERNAL

Please refer to the *Server and Client Planning Guide* for planning and design topics for Experion servers and clients as well as information about adding third-party controllers.

General Prerequisites

Before designing a system, collect as much information as possible about the plant and its processes. This helps to define the specific control requirements for your plant. The following mix of skills and plant data are general prerequisites for the planning process.

Skill or Data	Purpose
Understanding of Basic Monitoring and Control Concepts	• Need a basic knowledge of the concepts of process monitoring and control to adequately plan your control system installation. • Need a **Process Narrative** to provide a literal description of the plant processes
Piping and Instrumentation Diagrams (P&IDs)	• Shows the equipment used in the plant and how it is connected, in schematic format. • Can be used to break down large processes into constituent subprocesses.
Flow Diagrams	• Describes the sequence of events in plant processes. • Defines how the control system should be used to interact with the processes.

Skill or Data	Purpose
Engineering and System Specifications	• Describe operational requirements; that is, what the system needs to do. • Describe when and how your Experion system will be implemented. • Describe details of the Experion system's hardware and software.
Other Resources	• Wiring diagrams, • Computer-aided drafting (CAD) schematics of the plant, • Other plant layout diagrams, often showing electrical wiring configurations, the location of power cables, and other helpful information. • Subject-matter-experts (typically engineers) in the process, control, instrumentation, etc., who can provide details that might be missing from schematics and diagrams. • Process operators who can often tell you how the plant is run, and provide valuable insight into the design of custom displays.

Schedules and Responsibilities

Pre-installation schedule

After you have selected a suitable location for your system equipment, establish a schedule incorporating all phases of site preparation and system installation work. Use the following checklist to schedule and monitor the events that must occur prior to the actual delivery and installation of your system.

Event	Date	
	Plan	***Actual***
Determine whether building modification or construction is required.		
Verify building-access dimensions.		
Determine the requirements, if any, of additional electrical power, power conditioning, or grounding; arrange for its installation.		
Determine the locations, pathways, and types of communications data-lines; arrange for their installation.		
Implement ElectroStatic Discharge (ESD) and ElectroMagnetic Inteference (EMI) reduction measures.		
Complete corrosion analyses for site location.		
Determine whether air conditioning is required, then arrange for its installation.		
Order cables.		
Verify equipment delivery and installation schedule.		
Order power panels.		
Order the required quantity and type of data-line communications equipment necessary for your system application.		
Order furniture, storage equipment, and other similar equipment to support your needs.		
Thirty days before delivery, complete the following tasks:		
Install and test primary power equipment.		

Event	Date	
	Plan	***Actual***
Install lighting fixtures.		
Complete the support facilities (such as media storage).		
Verify that all required construction, electrical and communications wiring, air conditioning, fire, and smoke-detection equipment installation have been completed.		

Notify your Honeywell Account Manager of your facility's state of readiness, or of any possible contingencies that might delay installation.

Customer responsibilities

In general, you are responsible for preparing your facility as outlined in this guide, so that the Experion System can be properly installed. Your responsibilities as a customer are as follows:

- Install this equipment in accordance with the requirements of the National Electrical Code (NEC), ANSI/NFPA 70, or the Canadian Electrical Code (CEC), C22.1.
- To furnish and install (at your expense, and sole responsibility) all internal building wiring (including power and signal cables) in accordance with the NEC or the CEC.
- To install any power and signal cables according to the NEC, CEC, and other local regulations and requirements.
- Before shipment, to prepare the premises for installation; to provide installation to include space, a stable power supply, connectors, cables, and fittings.
- For equipment that Honeywell installs, to provide necessary labor for unpacking and placement of equipment and packing for return.
- To provide equipment that is not manufactured or supplied by Honeywell.

Shipping and Receiving

Shipping

Honeywell ships and insures the Experion System components.

Environmental considerations

Through-out the transit process, the environment must be monitored; correction must be made if the following controller equipment ratings are exceeded:

- Temperature Range: -55° to 85° C (-67° to 158° F)
- Humidity Range: 5 to 95% RH non-condensing

CAUTION

The humidity range in a corrosive atmosphere will vary.

Cost

The following issues should be taken into account in determining shipping costs:

- The shipping distance and the weight of the equipment (responsibility of the purchaser).
- Listed equipment weights are adjusted up to 25 percent higher to allow for the weight of: cables, operating supplies, shipping materials, spare parts, and test equipment.
- Mileage figures used in determining cost can be obtained from the *Household Goods Carriers Bureau Mileage Guide*, or from an automobile road atlas.

Receiving

Depending on the tariffs in effect, the carrier may be responsible for placing and delivery of the system equipment at your facility according to the tariffs in effect.

Moving

Guidelines for moving equipment into your facility (particularly for large systems) are described below:

- Check the maximum equipment dimensions against possible obstacles; these may include such things as narrow hallways, restricted doorways, and small elevators.
- Check for availability and readiness of any necessary devices for moving equipment to or within your facility. In most cases, the system and its equipment will be accommodated by the usual equipment-moving devices.
- Delays can be avoided by giving the delivery carrier advance notice of any special requirements. If notified in advance, Honeywell can alert the carrier on your behalf.

Unpacking

When unpacking the equipment, check the shipment against the invoice; immediately notify your Honeywell Account Manager of any discrepancies.

If a Product Registration Label (containing the Model Number and Serial Number of the component) is affixed to the shipping carton when received, remove and return it to Honeywell at the noted address to ensure follow-up service and support.

Warehousing

In some instances, it may be necessary to temporarily store the system components before installation. In this event, keep the factory wrapping intact to minimize humidity. If it is necessary to unseal the equipment for customs or receiving, add more desiccant; then reseal the package.

Ensure that the selected storage area does not subject the equipment to environmental extremes beyond those listed in the previous section.

Control Network Considerations

Communications Network

New or existing network

The first thing to consider when designing a control system network is whether the system will be incorporated into an existing network, or a new network will be implemented.

- If planning a new network, you need to consider issues such as the network architecture to use.
- If planning to use an existing network, you will have to determine how to integrate the networks as seamlessly as possible. If the existing network has a system administrator, they should help with the integration.
- If a complex network is being planned, it might be advisable to consult professional network designers. Honeywell can design and implement your network, if desired.

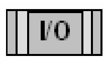
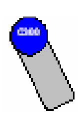
Identifying topology diagram symbols

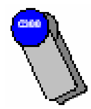
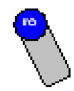
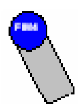
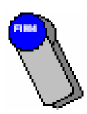
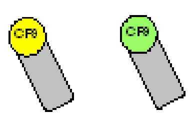
About the symbols

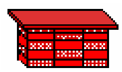
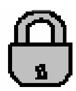
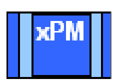
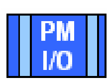
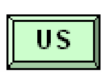
The symbols listed in the following table are used to simplify the node and component references to reduce the size and enhance the readability of the topology diagrams included in this document.

If Symbol is . . .	Then, it represents
Native Experion Computer-Based Components	
	Experion Server
	Redundant Experion Server
	Application Control Environment
	Experion Flex Station
	Experion Console Station
	Experion Console Extension
Experion with TPS Computer-Based Components	
	Experion Server (TPS) used with TPS Systems and connected to the TPN (LCN) Network
	Redundant Experion Server (TPS) used with TPS Systems and connected to the TPN (LCN) Network

If Symbol is . . .	Then, it represents
ACT	Application Control Environment (TPS) used with TPS Systems and connected to the TPN (LCN) Network
EST	Experion Console Station (TPS) used with TPS Systems and connected to the TPN (LCN) Network
Experion Level 3/Level 4 Application Components	
EAS	Experion Application Server
PHDS	PHD Server
eSRV	Experion eServer
WKS	Experion Desktop Workstation
Miscellaneous Computer-Based Components	
W2K3 DS	Windows 2003 Domain Server
W2K DS	Windows 2000 Domain Server
OPC$_S$	Third-Party OPC Server
OPC$_C$	Third-Party OPC Client

If Symbol is . . .	Then, it represents
	Windows Terminal Server
	Windows Terminal Server (Client)
Experion Series A Embedded Control Components	
	C200 Controller
	Redundant C200 Controller
	Series A Chassis I/O
	Series A Rail I/O
	Series H Rail I/O
	Series A FIM (Chassis)
	Redundant Series A FIM (Chassis)
Experion Series C Embedded Control Components	
	C300 Controller

If Symbol is . . .	Then, it represents
	Redundant C300 Controller
	Series C I/O
	Redundant Series C I/O
	Series C FIM (FIM4)
	Redundant Series C FIM (FIM4)
	Control Firewall (9-Port)
Miscellaneous Embedded Control Components	
	Fail Safe Controller (FSC)
	Safety Manager

If Symbol is . . .	Then, it represents
Miscellaneous Network Components	
	Cisco Switch
	Cisco Fault Tolerant Ethernet (FTE) Switches
	Cisco Router
	Network Firewall
	Network Security Lock/Key
Legacy TPS Components	
	xProcess Manager
	Process Manager I/O
	Network Interface Module
	Universal Station
	Global Universal Station

Experion cluster types

Overview

The following Table provides a summary of the various general Experion Server/Cluster Network configurations possible with Experion R300 and later. The sections that follow provide more information and diagrams to explain each configuration type.

Not all network combinations are shown, but the examples, along with the associated Configuration Rules, provide you with the necessary guidelines to understand how Experion systems may be configured.

In the Table, the term **Process** means an Experion system with C200, C300, and /or ACE Controllers, and so on. Any **Process** system may also include SCADA devices and so on. SCADA only systems do not include C200, C300, or ACE Controllers.

Cluster Type	Application (Process/ SCADA)	Level 1/Level 2 Network Choices	Level 3 Network Choices	See Note
1: L3 Ethernet	Process	ControlNet	Non-Redundant Ethernet	1
		CIP Ethernet		
	SCADA	Misc	Non-Redundant Ethernet	2
2: L3 Dual Ethernet	Process	ControlNet	Dual Ethernet	1
		CIP Ethernet		
	SCADA	Misc	Dual Ethernet	2
3: L3 FTE	Process	ControlNet	FTE	3
	SCADA	Misc	FTE	2
4: L2 FTE	Process	FTE	Ethernet	2, 4
			FTE	
5: TPS	TPS, Process and SCADA	LCN/UCN and/or FTE	Ethernet	2, 5
			FTE	

Notes:

1. Level 2 **CIP Ethernet** means non-redundant Ethernet using Ethernet Module TC-CEN021.

2. The **Misc** equals SCADA Network(s) that may consist of Serial Devices (RS232 or RS485), ControlNet Connections, and/or Ethernet Interfaces (for example, MODBUS TCP) or combinations of these. In addition, SCADA points and connections may coexist with C200s and TPS within specified capacity constraints.
3. Level 1/Level 2 CIP Ethernet from Servers to C200s is **not** supported when using Level 3 FTE based Clusters.
4. Level 3 is Router connected when using FTE for L2 Supervisory Network. L3 may then be separate FTE community or normal non-redundant Ethernet.
5. When FTE-based Controllers are used with a TPS Cluster, then FTE must also be used as an additional L2/L1 Network, and L3 then becomes router connected. Otherwise, the Ethernet/FTE connected to the TPS connected computer nodes is considered the L3 Network.

Experion Cluster Type 1

The following topology is a small Experion cluster network configuration. This configuration can be specified to ship from the factory when a non-redundant cluster is specified. This cluster is a small computer workgroup that uses local accounts and is not commonly connected to any other Ethernet network. The Server may or may not be connected to a ControlNet Supervisory Network depending on whether it is a C200 and/or SCADA application. Typically, redundant servers use a redundant network solution; so redundant servers are not typical for this configuration type.

Characteristics

- Single Ethernet
- Redundant or Non-Redundant Server (shown)
- Windows Server 2003 Operating System
- Local Windows or Traditional Accounts
- Workgroup

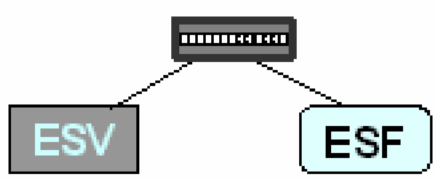


Figure 1 Experion Cluster Type 1

Configuration Rules (CT1)

Reference	Description
CR_CT1.0	Experion users may use Windows group-based accounts, Windows accounts, or Traditional operator accounts. If using Windows accounts, using a Windows Domain controller and Domain based Windows accounts is strongly recommended for account maintenance, especially as the number of nodes increases.
CR_CT1.1	Experion services use local Windows accounts.
CR_CT1.2	All Experion nodes are configured to be part of the same Workgroup or Domain, if used.
CR_CT1.3	Only Windows 2003 Server is supported as the operating system for the Experion server.
CR_CT1.4	Only Windows XP is supported as the operating system for the Experion Flex Station.
CR_CT1.5	Server may use a Dual CPU configuration.

Experion Cluster Type 2

The following topology is a small to medium Experion cluster network configuration. This is the configuration shipped from the factory when a redundant cluster is specified without FTE. This cluster is a small computer workgroup that uses traditional accounts and is commonly not connected to any other network. If Windows accounts are to be used for operators, in a redundant server topology, a Windows domain controller is strongly recommended for account maintenance. The Server may or may not be connected to a ControlNet Supervisory Network depending on whether it is a C200 and/or SCADA application. Typically, redundant network solutions support redundant servers, so a non-redundant server is not typical for this configuration type.

Characteristics

- Dual Ethernet
- Redundant (shown) or Non-Redundant Server
- Windows Server 2003 Operating System
- Traditional or Windows Accounts
- Workgroup or Domain

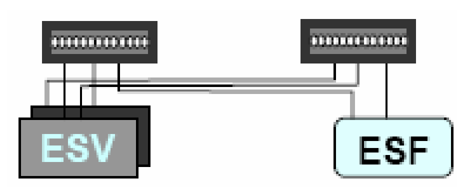


Figure 2 Experion Cluster Type 2

Configuration Rules (CT2)

Reference	Description
CR_CT2.0	Experion users may use Windows group-based accounts, Windows accounts, or Traditional operator accounts. If using Windows accounts, using a Windows Domain controller and Domain based Windows accounts is strongly recommended for account maintenance, especially as the number of nodes increases.
CR_CT2.1	Experion services use local Windows accounts.
CR_CT2.2	All Experion nodes are configured to be part of the same Workgroup or Domain, if used.
CR_CT2.3	Only Windows 2003 Server is supported as the operating system for the Experion server.
CR_CT2.4	Only Windows XP is supported as the operating system for the Experion Flex Station.
CR_CT2.5	Server may use a Dual CPU configuration.

Experion Cluster Type 3

The following topology is an example of a medium to large Experion cluster configuration. You can connect from 1 to 40 Flex Stations to the Experion server. The server may or may not be connected to a ControlNet Supervisory network (shown) depending on whether it is a C200 and/or SCADA application. Typically, FTE solutions are used with redundant servers, so a non-redundant server is not typical for this configuration type.

Characteristics

- FTE Level 3 Network
- Redundant (shown) or Non-Redundant Server
- Windows Server 2003 Operating System (for Experion server)
- Traditional or Domain Windows Accounts
- External Network

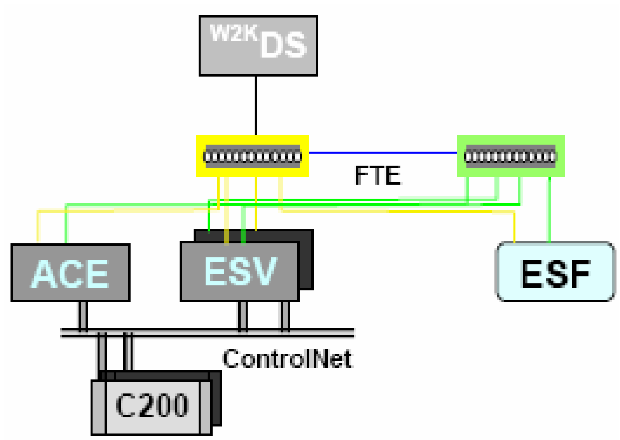


Figure 3 Experion Cluster Type 3

Configuration Rules (CT3)

Reference	Description
CR_CT3.0	Experion users may use Windows group-based accounts, Domain Windows accounts or Traditional operator accounts.
CR_CT3.1	Experion services use local Windows accounts.
CR_CT3.2	Experion operator based security has been qualified with Windows 2000 native mode and Windows 2003 domains – all modes.
CR_CT3.3	Experion nodes may be part of a Windows Domain
CR_CT3.4	In a Domain configuration, all nodes in the Experion cluster should be time synchronized with the Domain controller or dedicated NTP Server.
CR_CT3.5	In a workgroup configuration, the time must be synchronized between redundant servers and all console stations in the Experion cluster. They should also be synchronized with any other clusters connected through the Distributed Server Architecture (DSA).
CR_CT3.6	A Windows 2000 (W2K) Domain controller (shown) cannot be directly connected through FTE. It must be configured as a **single-connected** node on either of the FTE segments or through a router in the Level 3 network. If using a backup Domain controller, we recommend that you **single-connect** it to the opposite FTE segment.
CR_CT3.7	A Windows 2003 (W2K3) Domain controller (not shown) is supported on FTE. The FTE Driver must be installed in the Domain server node.
CR_CT3.8	The Experion servers use Windows 2003 server operating system (OS). However, Experion **MUST NOT** be installed on a Domain controller. For example, neither the Experion server nor the ACE node can reside on the same server node as the Domain controller.
CR_CT3.9	FTE requires the use of qualified switches. Please refer to the FTE Technical Data and Specification document for the latest FTE configuration rules.
CR_CT3.10	The ACE node runs on Windows 2003 server operating system and must be a member of the Domain, if a Domain is configured.
CR_CT3.11	Only one System Event Server (SES) must be installed per FTE Community. If Experion servers are redundant, the SES is installed on both servers. The System Management runtime software should be installed on all nodes in the Experion cluster that are to be monitored by the System Event Server. The time should be synchronized between the redundant servers and all Experion cluster nodes being monitored by the System Event Server

Reference	Description
CR_CT3.12	The System Management runtime software should be installed on all nodes that are to be monitored by the System Event Server. The time should be synchronized between the redundant servers and all Experion cluster nodes being monitored by the System Event Server
CR_CT3_13	The High Security Policy Workstation Package should be installed on the redundant servers.

Experion Cluster Type 4

The following topology is an example of a medium to large Experion cluster configuration with Console Stations and FTE-based Controllers (not shown). You can connect from 1 to 40 Stations to the Experion server, of which up to 10 of these Stations can be configured as Console Stations within the Console Station configuration limits. Typically, FTE solutions with FTE Bridge module and Console Stations are used with redundant servers; so a non-redundant server is not typical for this type of configuration.

Characteristics

- FTE Level 2 Network
- Redundant Server
- Windows 2003 Server Operating System (for Experion server)
- Domain Windows Accounts
- External Network Router
- Console Stations

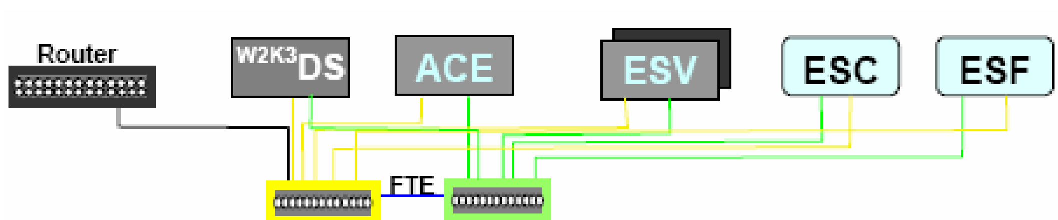


Figure 4 Experion Cluster Type 4

Configuration Rules (CT4)

Reference	Description
CR_CT4.0	Experion users may use Windows group-based accounts, Domain Windows accounts or Traditional operator accounts.
CR_CT4.1	Experion services use local Windows accounts.
CR_CT4.2	Experion operator based security has been qualified with Windows 2000 native mode and Windows 2003 domains – all modes.
CR_CT4.3	Experion nodes may be part of a Windows Domain
CR_CT4.4	In a Domain configuration, all nodes in the Experion cluster should be time synchronized with the Domain controller or a dedicated NTP Server.
CR_CT4.5	In a workgroup configuration, the time must be synchronized between redundant servers and all Console Stations in the Experion cluster. They should also be synchronized with any other clusters connected through the Distributed Server Architecture (DSA).
CR_CT4.6	If Domains are configured, configuration rules CR_CT3.6 to CR_CT3.8 apply to this topology
CR_CT4.7	FTE requires the use of qualified switches. Please refer to the FTE Technical Data and Specifications document for the latest FTE configuration rules.
CR_CT4.8	The ACE node runs on Windows 2003 server operating system and must be a member of the Domain, if a Domain is configured.
CR_CT4.9	The CR_CT3.11 to CR_CT3_13 rules apply to this topology.

Experion Cluster Type 5

The following topology is an example of an Experion server for TPS (ESVT) that forms a type of Experion cluster introduced in Experion R201. An ESVT cluster is defined as the operator stations and controllers associated with a particular Experion server (or servers in the case of redundant servers) connected to the same Local Control Network (LCN). This server is primarily used to connect to TPN, SCADA points, and points from other Experion clusters. Although FTE is shown in this diagram, it is not mandatory for ESVT and ESTs unless C200/ACE nodes are also on the network.

Characteristics

- LCN Level 2 Network
- Redundant (shown) or Non-Redundant Server
- Windows Server 2003 Operating System (for Experion server)
- Domain Windows Accounts
- FTE (shown) or Ethernet Level 3 Network

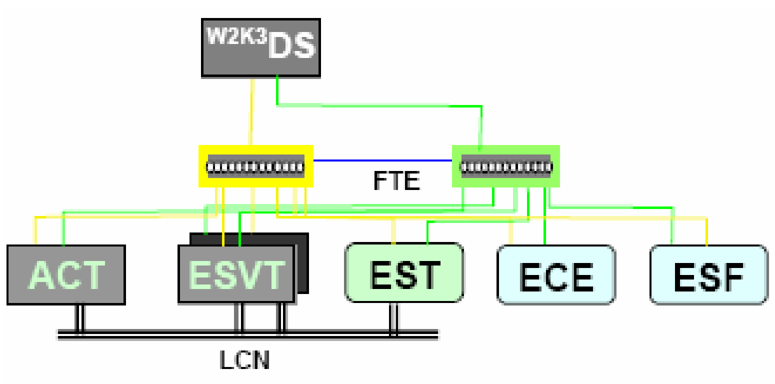


Figure 5 Experion Cluster Type 5

Configuration Rules (CT5)

Reference	Description
CR_CT5.0	One (1) ESVT Per TPN (2 for Redundancy).

Reference	Description
CR_CT5.1	ESVT supports up to 20 EST nodes per TPN, as long as no C200/C300/FIM4 nodes are directly connected to the ESVT. If any of these nodes are connected, then the ESVT supports only 10 EST nodes.
CR_CT5.2	ESVT supports a total of 40 Stations – ESTs + ESFs combined. Up to 3 ECEs are supported for each EST.
CR_CT5.3	ESVT supports FTE-connected C200s, C300s, FIM4 and/or ACE. If any C200s, C300s or FIM4 nodes are connected, then the ESVT supports only 10 EST nodes.
CR_CT5.4	Performance of the ESVT, EST, ECE, and ACT is expected to be similar to that of the ESV, ESC, ECE, and ACE, respectively.
CR_CT5.5	EST and ESVT supports both non-redundant Ethernet and FTE implementations for L3 network.
CR_CT5.6	An LCNP4-connected platform is required for both the EST and the ESVT and ACT. These platforms must be purchased from Honeywell.
CR_CT5.7	A domain controller is required to implement the ESVT/EST solution. Configuration rules CR_CT3.6 to CR_CT3.8 apply to this topology.
CR_CT5.8	Flex Stations cannot be members of an LCN console.
CR_CT5.9	Flex Stations on ESVT support native Window. A limited, remote native Window capability is qualified on Flex Stations (as well as on ESC, ECE, EST, and **remote** ESTs). This functionality is **not integrated** with the Experion environment on these stations, as is the **local** native Window on the EST. Specifically, cross environment display invocations are **not** supported, in addition to other cross environment functions.
CR_CT5.10	DSA is fully supported between ESVT and Experion servers following all existing DSA rules and capacity constraints with the following exceptions: • Native Window functions (on the remote LCN), including detail displays and group displays are not supported across DSA connections. • TPS faceplates are not supported remotely (depend on a LCN direct connect). • HMIWeb faceplates for TPN points are supported. • Confirmation of operator messages is not supported remotely (Acknowledgements (ACKs) work Okay).
CR_CT5.11	The CR_CT3.11 to CR_CT3_13 rules apply to this topology.

Experion DSA and TPS interoperability

Level 3 router connected

The following topology is an example of how a native Experion cluster connects to TPS system cluster. The ESVT cluster may be connected to an Experion cluster through the Level 3 Router.

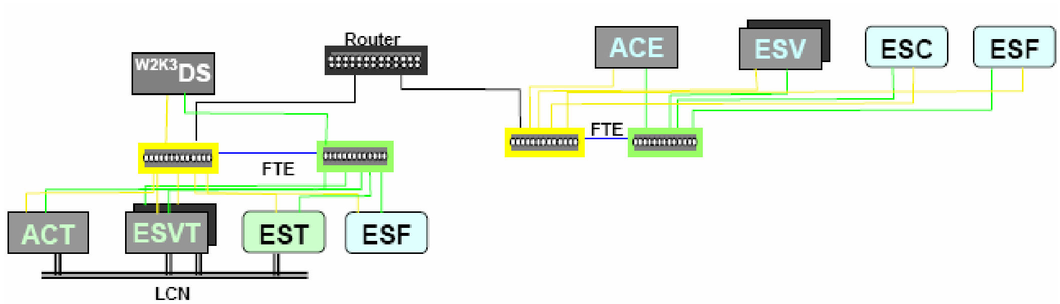


Figure 6 Router Connected Topology

Common FTE community

The following topology is an example of how a native Experion cluster connects to TPS system cluster. The ESVT Cluster may also be connected to other Experion Clusters in the same Level 2 FTE Community, assuming that maximum community size limits allow it.

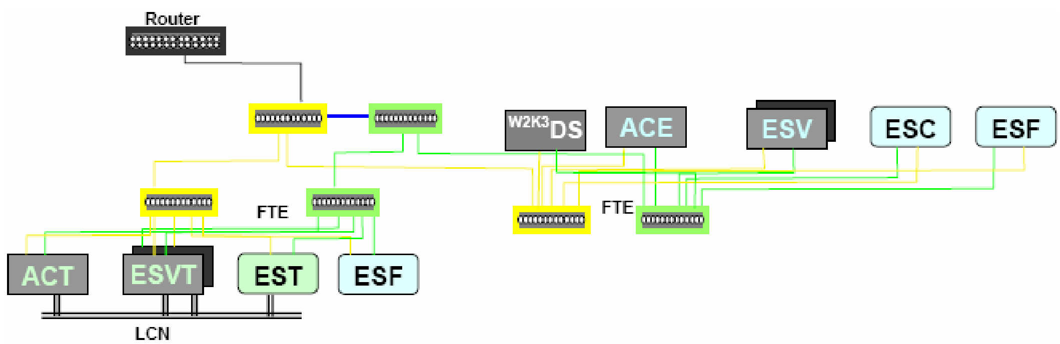


Figure 7 Common FTE Community Connected Topology

Experion and OPC

Level 2 OPC client or server connection

The following topology is an example of how a third-party OPC client or server (non-FTE node) connects to an Experion system over FTE, directly on the Level 2 network. Note that the Console Stations do not maintain direct connectivity with the third-party OPC client/server nodes. All OPC data collected by the Console Station comes from the Experion server.

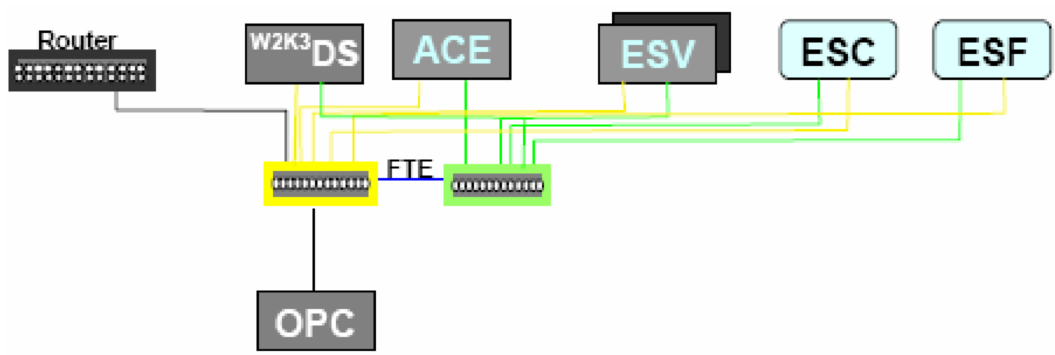


Figure 8 Level 2 OPC Server Topology

Configuration Rules (OPC)

Reference	Description
CR_OPC.0	The Experion Servers are supported with either normal Non-Redundant 10/100Mb Ethernet or through a 100Mb FTE Network, following all FTE configuration rules.
CR_OPC.1	The CR_CT3.6 to CR_CT3.8 rules apply to this topology.
CR_OPC.2	If a domain is used the Honeywell or 3rd party OPC client computer must also be added to the domain.
CR_OPC.3	Support for connection of a Honeywell or third-party OPC client to redundant Experion servers is achieved by using the Redirection Manager software on the Honeywell or third-party OPC client computer.
CR_OPC.4	If the Redirection Manager option is used, the System Management software must be installed on the Experion servers and the Honeywell or third-party OPC client computer.

Level 3 OPC Client or Server Connection

The following topology is an example of how Honeywell or third-party OPC client or server connects with an Experion system through a Level 3 Router. Note that the Console Stations do not maintain direct connectivity with the third-party OPC client/server nodes. All OPC data collected by the Console Station comes from the Experion server. All OPC data collected by third-party or Honeywell OPC clients comes from the Experion server.

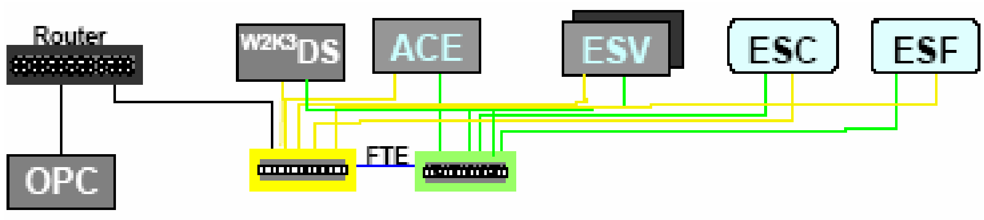


Figure 9 Level 3 OPC Server Topology

Configuration Rules

The configuration rules CR_OPC.0 to CR-OPC.4 listed above also apply for this topology.

ACE OPC Gateway

OPC Gateway Client

The following diagrams (network not shown) show two configurations, the data paths, and what protocols are used for the ACE with OPC Gateway interface.

The OPC Gateway client process is capable of communicating with any controller communicating through the Control Data Access (CDA) protocol. However, the ACE controller is the only supported peer at this time. This creates a gateway interface between Experion control systems and any OPC Data Access compliant servers through the OPC Gateway function block.

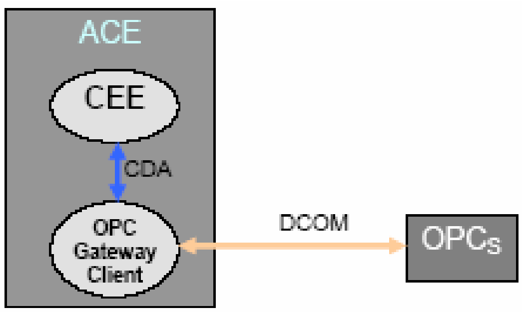


Figure 10 Resident OPC Gateway Client

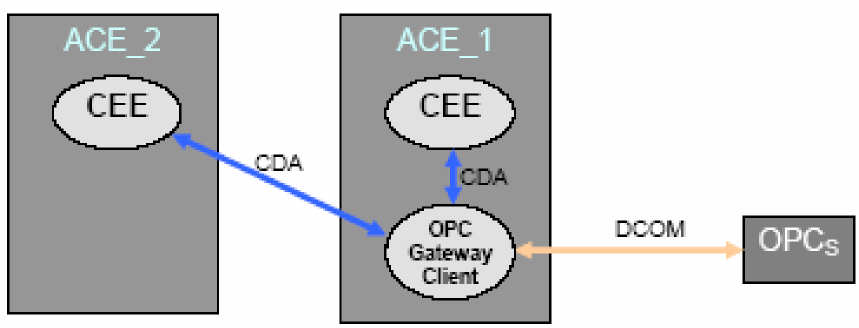


Figure 11 Non-resident OPC Gateway Client

Configuration Rules (OPCG)

The configuration rules CR_ICG.0 to CR-ICG.11 listed below also apply for these configurations.

Experion Inter-Cluster Gateway

The following diagrams are examples of how the Inter-Cluster Gateway (ICG) block introduced in Experion R300 can be used. This block is both an OPC client and a **private** OPC server that resides on a designated ACE node. The ICG Block is used to provide ACE to ACE, Peer-to-Peer between ACE nodes that reside in different Experion clusters.

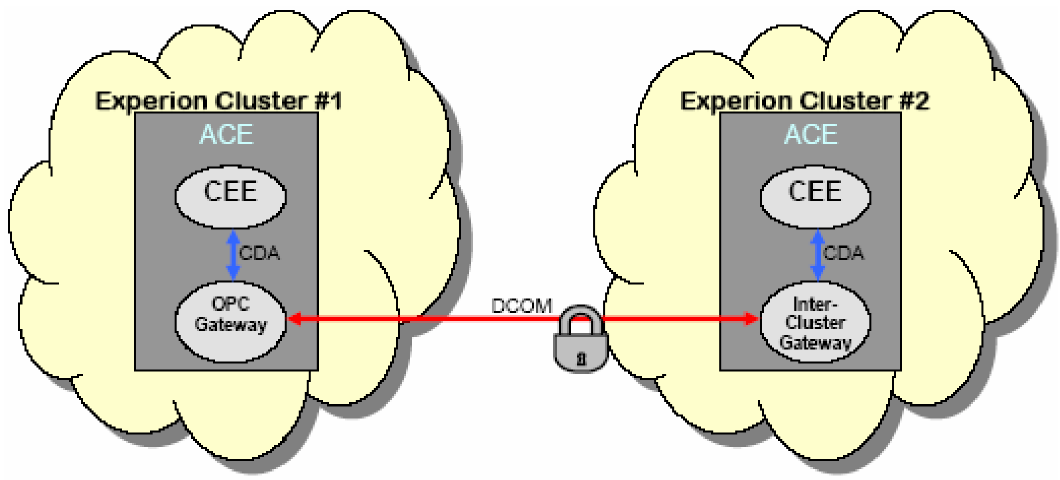


Figure 12 Simple Experion Inter-Cluster Gateway

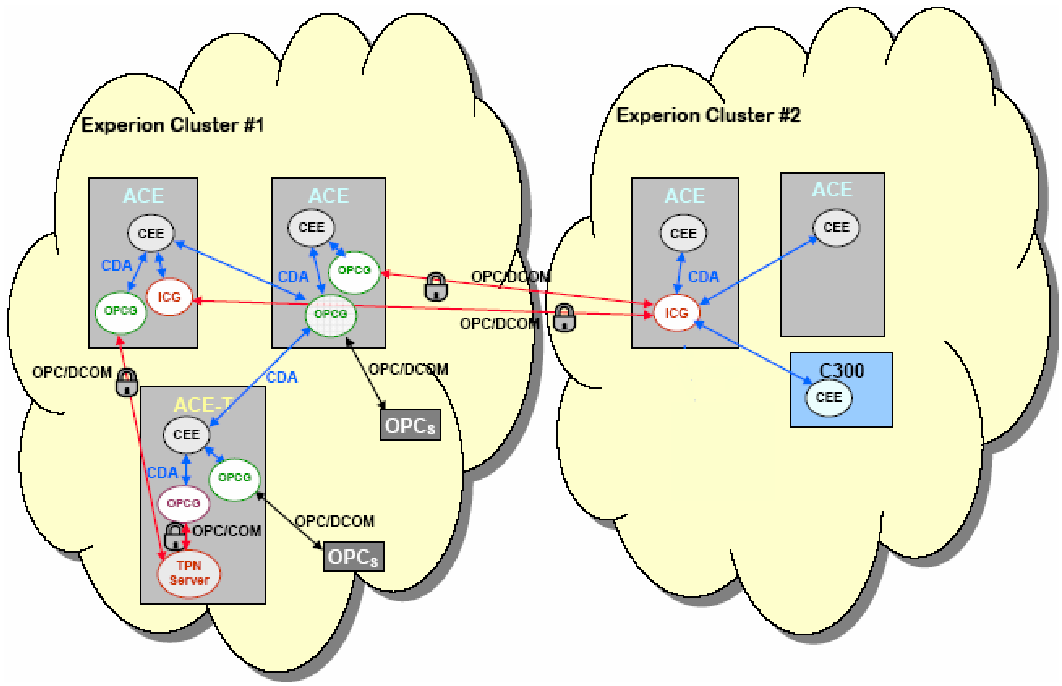


Figure 13 Complex Experion Inter-Cluster Gateway and OPC Gateway

Configuration Rules (ICG)

Reference	Description
CR_ICG.0	Each OPC Gateway (OPCG) can connect to just one OPC Server.
CR_ICG.1	The OPCG and the ICG can be installed and used only on the ACE node.
CR_ICG.2	Each CDA connection to an OPCG or an ICG consumes one Peer Connection Unit (PCU).
CR_ICG.3	Only one ICG can be configured per ACE node.
CR_ICG.4	Multiple OPCGs can be configured per ACE Node. The maximum number of OPCGs per ACE is 15.
CR_ICG.5	An ICG can be configured to be just an OPC server or both an OPC server and an OPC client.

Reference	Description
CR_ICG.6	The ICG client can only be connected to another ICG server. For example, it cannot connect to any other Honeywell Communication Interface (HCI) or third-party OPC server.
CR_ICG.7	The DCOM connection to an ICG OPC server is **private** (password protected) and can only be used by an OPCG or another ICG client.
CR_ICG.8	The DCOM connection to the TPN Server on an LCN connected ACE is **private** (password protected) and can only be used by an OPCG (locally or remotely).
CR_ICG.9	The number of OPC clients supported by a single ICG server is only limited by CPU and Memory on the ACE node.
CR_ICG.10	The number of CDA connections supported by a single ICG is 30.
CR_ICG.11	The number of CDA connections supported by a single OPCG is 30.

Experion Application Topologies

Experion Application Server (EAS)

The Experion Application Server (EAS) is an Experion server that hosts various applications, uses DSA to access L2 control data for an Experion control platform server. The EAS supports the Enterprise Model and SQL Server Database.

An EAS may reside at L2, L3, L3.5 (DMZ), or L4 in the network architecture, depending upon the application's requirements. In addition to EAS Nodes, applications also utilizes various Workstation Client Nodes that are associated with the EAS Servers.

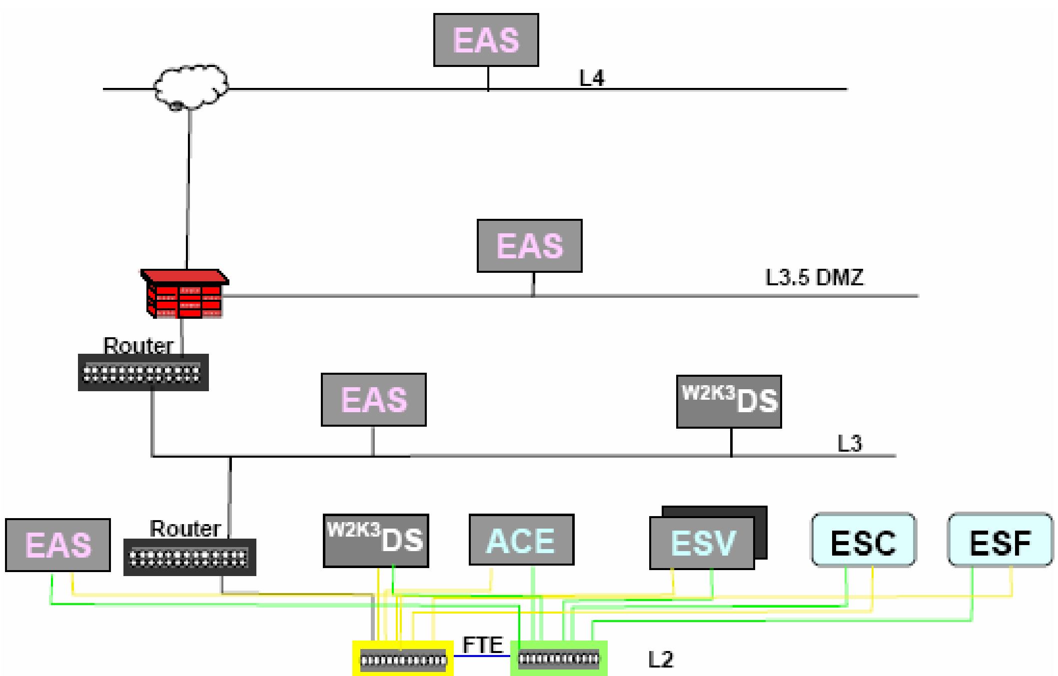


Figure 14 EAS topology

PHD Integration Topologies

The following topology diagrams illustrate how the PHD Server may fit into the Experion System. Not all possible combinations are shown, but these examples will illustrate the general network schema.

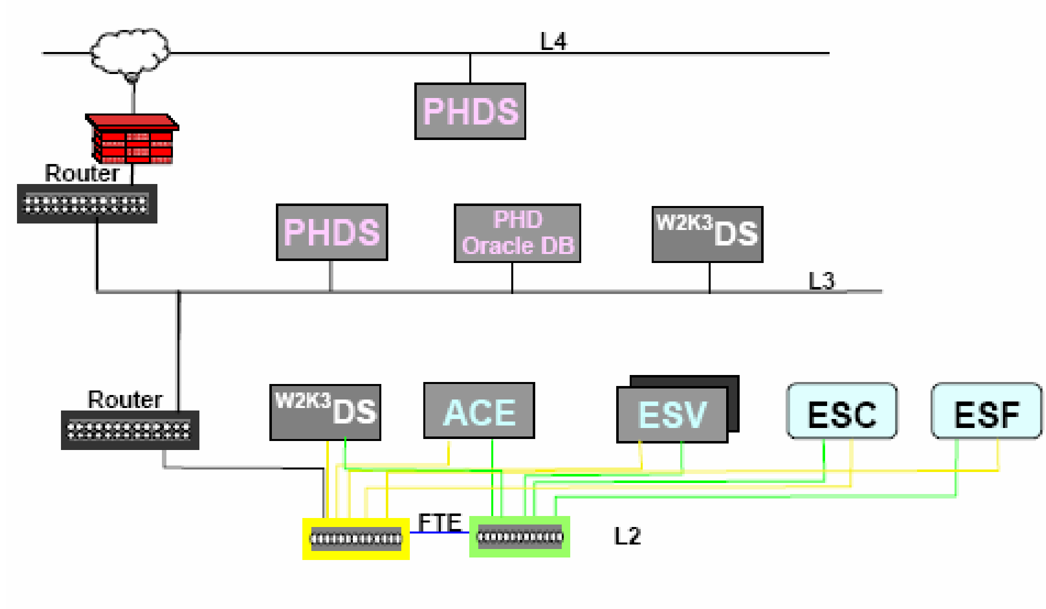


Figure 15 Basic PHD Integration Topology

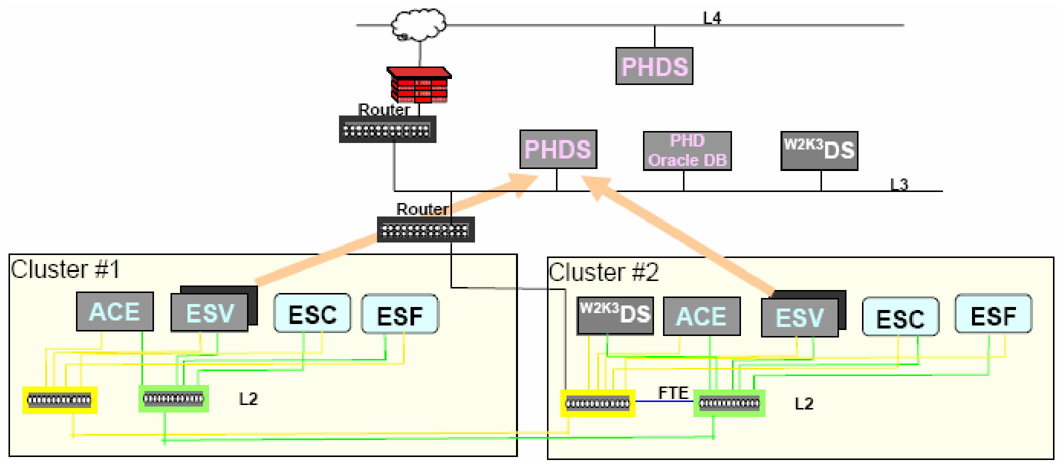


Figure 16 Multi-Cluster PHD Integration Topology

Configuration Rules (PHD)

Reference	Description
CR_PHD.0	The Level 3 (L3) FTE and redundant routers are optional but required for redundant path support between PHD server and the Experion server(s).
CR_PHD.1	If a domain controller is used, Experion operators and PHD users will be domain accounts. If no domain controller is used, then accounts will be local accounts.
CR_PHD.2	The Oracle based PHD tag database may optionally be on a separate node (as shown).
CR_PHD.3	An optional PHD topology includes a PHD backup (also known as Shadow) server at level four.
CR_PHD.4	Maximum of 3 Experion server/redundant pairs per PHD server.
CR_PHD.5	Each Experion server can only connect to one PHD server.

Terminal Services

The following diagram is an example of how a Flex Station is used as the terminal services server, and is hosting the four terminal service sessions (the maximum allowed). Two of the sessions are used to run Control Builder. Two other sessions are running both Control Builder and Enterprise Model Builder. In the example, the terminal services client nodes do not have any Experion configuration tool content installed. The Experion server accounts for each instance of the configuration tool running, whether it is run through a terminal services session or directly on an Experion client. The limits of configuration tool instances are policed by the server.

Terminal services capability

Terminal services connections to an Experion client host can be used to remotely configure or monitor an Experion system. Typically, this method is used to bridge a security firewall from the Business Network into the Plant Network. However, the use of terminal services places additional load on the node that hosts the sessions. The use of terminal services is considered an advanced technique that should only be employed if the **resource loading issues are understood** as described below in the Configuration Rules section.

In the example below, a Flex Station is used as the terminal services server, and is hosting the 4 terminal service sessions (the maximum allowed). Two of the sessions are used to run Control Builder. Two other sessions are running both Control Builder and Enterprise Model Builder. In the example, the terminal services client nodes do not have any Experion configuration tool content installed. Typically, this Flex Station would reside in the DMZ.

The Experion server accounts for each instance of the configuration tool running, whether it is run through a terminal services session or directly on an Experion client. The limits of configuration tool instances are policed by the server.

Depending on the number and types of applications that are run through the terminal services session, considerable resources can be consumed on the host node. To run the Configuration Studio and a typical contingent of tools, up to 200MB of RAM can be consumed **per terminal services session**. In the example below, an additional 800MB of RAM is recommended for the hosting flex client node.

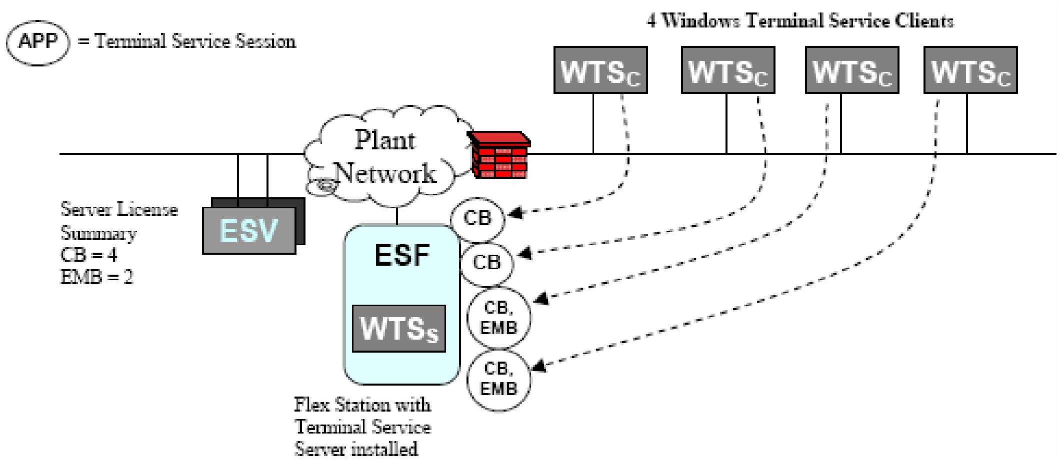


Figure 17 Terminal Server Topology

Configuration Rules (WTS)

Reference	Description
CR_WTS.0	Terminal Services should only be hosted by nodes that are normally used to host configuration tools applications (Flex Station, Console Station).
CR_WTS.1	Host node memory should provide 200MB RAM for each terminal services session that is expected to run on that node.
CR_WTS.2	A limit of 4 Terminal Services sessions can be hosted by any one client node.
CR_WTS.3	A limit of 4 Control Builder sessions can run through terminal services on any single node.
CR_WTS.4	A limit of 2 Enterprise Model Builder sessions can run on any single node.
CR_WTS.5	Configuration tools running directly on the hosting client will reduce the number of tools that can be run through the terminal services connection. For example, if a CB session is running on the host client, then only 3 additional CB instances could be initiated through terminal services sessions.

Terminal Services Restrictions

When multiple sessions are running on the same terminal server node, the applications used in each session may share a common resource on the node hosting the sessions. The following table identifies some configuration operations and the potential for resource conflicts.

Application / Operation	Potential Conflict
Qualification and Version Control System	A conflict will occur if dual check-in operations are attempted. This function is **not recommended** for use with Terminal Services.
Control Builder Import/Export	There is a potential conflict if the same target location is used by two simultaneous users exporting files. **Import/Export should only be performed by one terminal services user at a time**.
Control Builder Load/Upload	Server point building can fail if simultaneous loads are performed. **Loading/Uploading should only be performed by one terminal services user at a time.**

Supervisory Networks

About Supervisory networks

The supervisory network is used for communication between Experion servers and Controllers. The Controllers are the chassis-mounted Control Processor Module (CPM) that is also known as the C200 Controller or Process Controller, the Series C form factor C300 Process Controller and the Application Control Environment (ACE) supervisory controller that is running on a separate computer node. This network is dedicated for Server to Controller communications including CPM peer-to-peer with other CPMs as well as Application Control Environment supervisory controller peer-to-peer with CPMs through a Fault Tolerant Ethernet (FTE) connection or a direct ControlNet connection

Fault Tolerant Ethernet (FTE) Support

The Experion R200 system or later supports using Honeywell's Fault Tolerant Ethernet network as its preferred supervisory network. A Fault Tolerant Ethernet Bridge module in a C200 Controller or FIM chassis provides the interface to the FTE network for chassis-based components. The existing ControlNet and Ethernet type supervisory networks are still supported, but they cannot be used simultaneously on an Experion server with a FTE network to connect to C200 Controller or FIM chassis. Please refer to the *Fault Tolerant Ethernet Implementation Guide* for more information.

The Series C form-factor components are designed to connect directly to an FTE network through a Control Firewall.

FTE Supervisory Network Topologies

Basic C200 Controller Fault Tolerant Ethernet Bridge (FTEB) topology

The following topology is an example of using the FTE Bridge module in a C200 Controller or FIM chassis in a single Experion server cluster in a single FTE community.

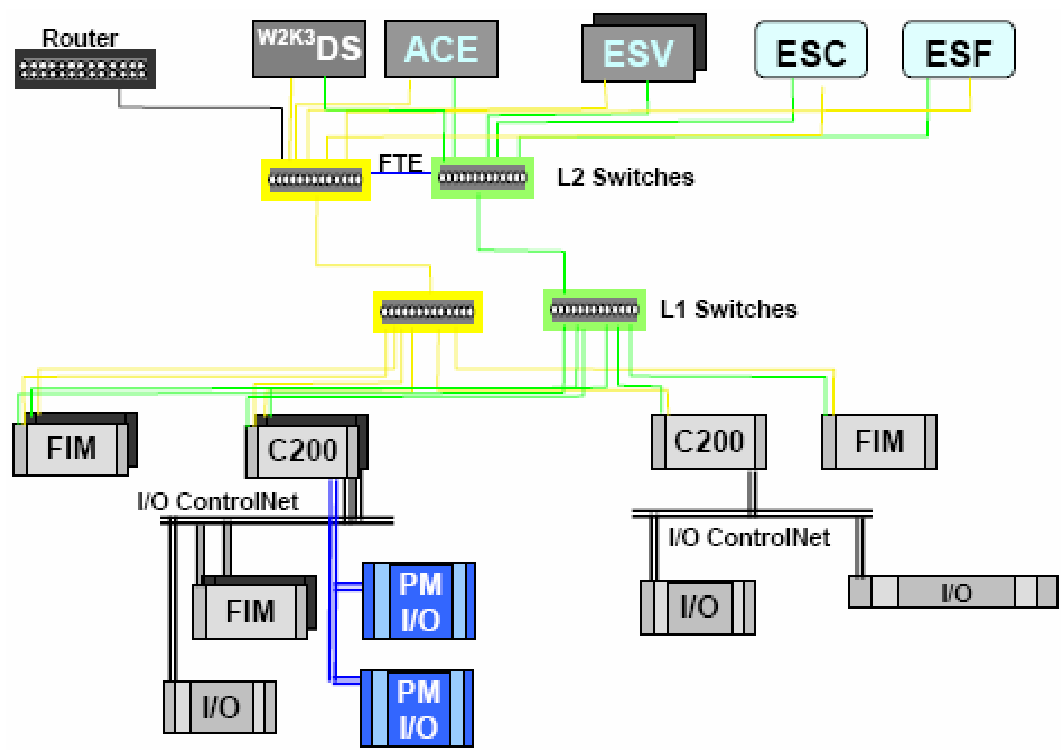


Figure 18 Basic C200 FTE Topology

Configuration Rules (C2F)

Reference	Description
CR_C2F.0	Only one type of Supervisory Control Network (FTE or ControlNet or Non-redundant Ethernet) is supported per Experion Server. In other words, FTEB-based C200s and ControlNet connected C200s cannot be assigned to the same Server. A SCADA ControlNet segment to PLCs and so on may be

Reference	Description
	supported on the same server as FTEB based C200 Controllers.
CR_C2F.1	The FTEB module is a single slot module that may reside in one of the following type chassis configurations located on the Supervisory L1 FTE Network. • Non-Redundant C200 Controller chassis • Redundant C200 Controller Chassis Pair (RCP) • Non-redundant FIM-only chassis • Redundant FIM-only Chassis Pair (RFCP)
CR_C2F.2	The FTEB module may reside in any slot position within the chassis.
CR_C2F.3	Only one FTEB module is allowed in a single chassis. FTEB has not been qualified to provide bridging to another FTE segment through the chassis backplane
CR_C2F.4	FTEB supports Device Indexes in the range 1-99. The FTEB must be assigned a unique Device Index by dialing in a number from 1-99 on a pair of rotary switches on the module. Device Index number 99 will be designated an illegal value for a redundant chassis since the next sequential value "100" is not available for the redundant partner, but 99 can be used for a non-redundant chassis.
CR_C2F.5	Assign Device Indexes from 1 and up.
	TIP Better network utilization will result from using lower values for Device Indexes, as this results in smaller FTE diagnostic messages.
CR_C2F.6	Assign sequential Device Indexes to redundant module pairs – one odd number and the next higher even number. For example, assign 1 and 2, then 3 and 4, and so on. **Note 1**: This is different than ControlNet CNI addressing. **Note 2**: The user assigned Device Index (through hardware switches), will stay with the module regardless of current module's redundancy role. MAC address, PD_TAG and DEV_ID are all factory-assigned and also stay with the FTEB regardless of its role. Only the IP Address will swap on redundancy role change (failover).
CR_C2F.7	IP addresses are automatically assigned by Control Builder for FTEBs and use a simple formula in the BOOTP server:

Reference	Description
	• IP address = Base IP Address + Device Index • Redundant modules use odd-even IP address scheme. Current primary has odd IP address; current secondary has even IP address equal to primary's IP address plus one. For example, consider node 1/node 2 pair: – Node 1 (pri) receives 10.1.0.1 from BOOTP, assumes 10.1.0.1 (already odd). – Node 2 (sec) receives 10.1.0.2 from BOOTP, assumes 10.1.0.2 (already even). • In case of role reversal: – Node 1 (secondary) receives 10.1.0.1 from BOOTP, assumes 10.1.0.1 + 1 = 10.1.0.2 (make it even by adding one). – Node 2 (primary) receives 10.1.0.2 from BOOTP, assumes 10.1.0.2 - 1 = 10.1.0.1 (make it odd by subtracting one).
CR_C2F.8	Non-redundant FTEB modules may use any Device Index value – odd-even pairing used by redundant FTEB pairs do not apply to non-redundant FTEBs, but once a single Device Index for an odd-even pair of numbers is used by a non-redundant FTEB, the other number in that pair can only be used by another non-redundant FTEB.
CR_C2F.9	Device Index/IP address rules restrict number of redundant FTEB modules in the FTE community to 49.
CR_C2F.10	Each node has a unique 48-bit MAC address assigned by the factory. This address can be found on the FTEB module hardware label. The user does not need to use or remember this address when installing or configuring a FTE Network.
CR_C2F.11	The FTE Base IP Address used for Level 1 Experion FTE nodes may be assigned from a **Private** IP Address space or from the user's Corporate IP address space. **Split Subnets** are also supported whereby the Level 1 nodes can be **private** and the Level 2 nodes can reside in the Corporate space. See the FTE Overview and Implementation Guide for FTE IP address usage and IP assignment guidelines and rules.
CR_C2F.12	For critical peer-peer communications that cannot tolerate a communication delay of longer that 250 ms, following an FTE cable fault, the C200s and/or FTE connected Series A FIMs should reside on the same switch pair.

Multiple Experion cluster FTE bridge topology

The following topology is an example of how the FTE Bridge module can be used to connect redundant C200 Controllers in two Experion server clusters.

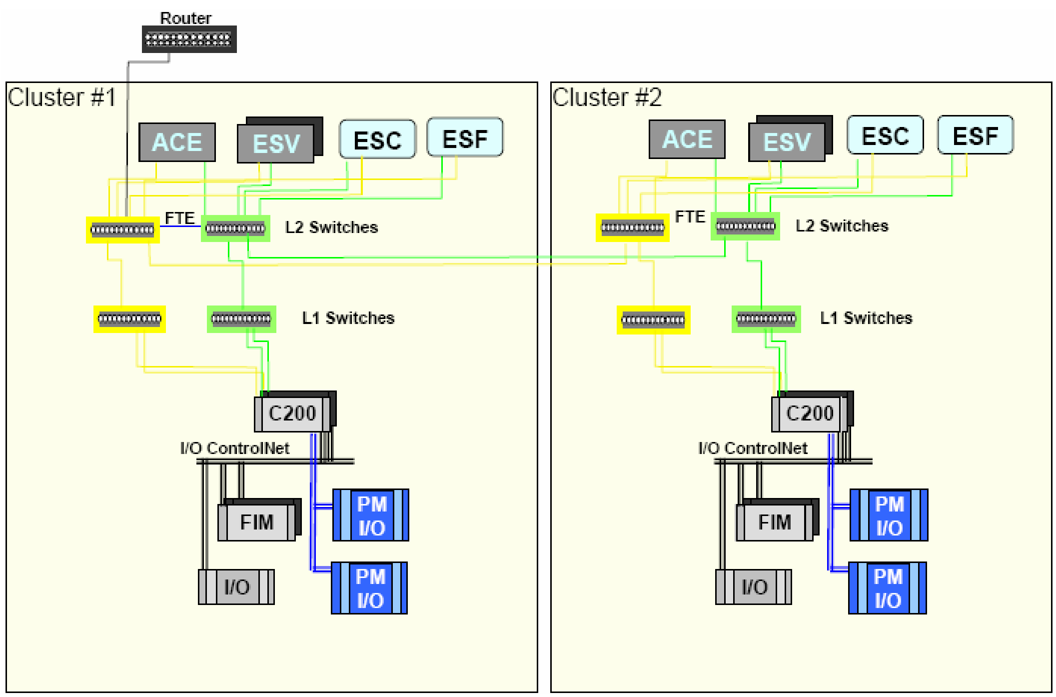


Figure 19 Multiple Experion Cluster C200 FTE Topology

Configuration Rules (MCF)

Reference	Description
CR_MCF.0	More than one Experion cluster may be configured in the same FTE community within the allowed FTE community size.
CR_MCF.1	When multiple Experion servers are configured in the same FTE community, the same **Base IP Address must** be configured in **System-wide Preferences** in Control Builder on each Experion Cluster.
CR_MCF.2	Best Practice - The BOOTP Server Service should only be enabled on one of the Experion cluster server pairs to avoid conflicting BOOTP responses, if the

Reference	Description
	previous rule is not adhered to for some reason.
CR_MCF.3	All FTEB Modules across all Experion server clusters in the same FTE community must have unique Device Indexes assigned.
CR_MCF.4	All servers in the same FTE community should be assigned to the same IP sub-group range to allow access to these from the level-3 network in an easy manner. Refer to the FTE Overview and Implementation Guide for details.
CR_MCF.5	FTEB modules in the same FTE community will support Exchange Block communications between C200 Controllers assigned to different servers.

Basic C300 Controller with Control Firewall FTE topology

The following topology is an example of using C300 Controllers with Control Firewalls (CF9) in a Level 1 FTE community.

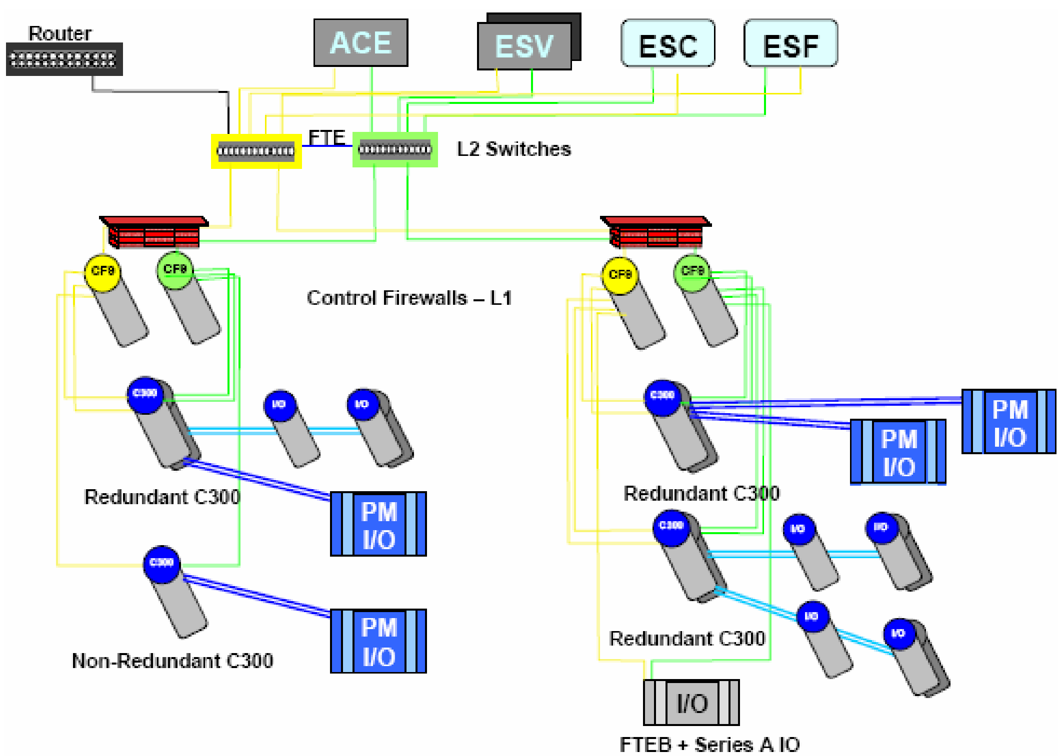


Figure 20 Basic C300 FTE Topology

Configuration Rules (C3F)

Reference	Description
CR_C3F.0	Every C300 must be connected to a Control Firewall.
CR_C3F.1	Every Control Firewall must be connected through its uplink port to an L1 or L2 CISCO Switch. This may be through Standard Twisted Pair (STP) or Fiber-link (not shown). The CISCO Port connected to the CF9 must be configured for *portfast* operation.
CR_C3F.2	Control Firewalls cannot be **stacked**.
CR_C3F.3	Control Firewalls do not count as a **network layer**. For example, CF9s do no count against the maximum of 3 layers of FTE switches.
CR_C3F.4	Experion R300 supports up to 16 C300s per Server (redundant C300 only counts as a single C300 for this limit).
CR_C3F.5	C300s must be assigned a unique Device Index between 1-509, using the 3 switches on the I/O Termination Assembly (IOTA).
CR_C3F.6	C300 Controller that is to be configured as non-redundant must be given an odd device index.
CR_C3F.7	The following Devices Index and IP Address Configuration Rules for FTEB: CR_C2F.5 to CR_C2F.7 and CR_C2F.10 to CR_C2F.11 also apply to the C300.
CR_C3F.8	The C300 Controller will not be capable of establishing OPC connections to OPC servers through the OPC Gateway in the Experion R300 release.

Multiple Experion cluster mixed C200 and C300 topology

The following topology is an example of how C200 Controllers and C300 Controllers can be mixed in two Experion server clusters.

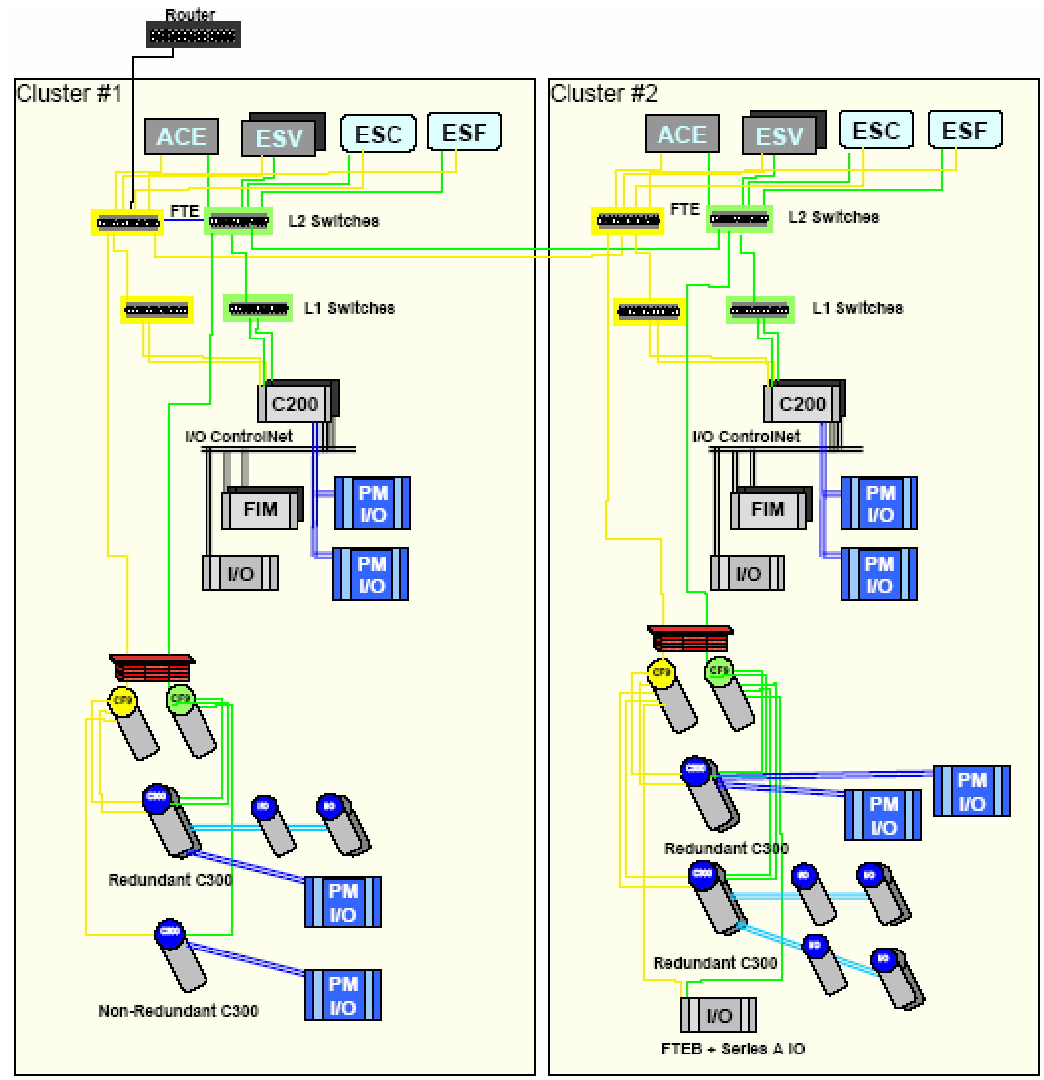


Figure 21 Multiple Experion Cluster with Mixed C300 and C200 FTE Topology

Configuration Rules (MCM)

Reference	Description
CR_MCM.0	The previous configuration rules CR_C2F.x, CR_MCF.x, and CR_C3F.x also apply to this topology as appropriate.
CR_MCM.1	FTEB based C200 Controllers are not qualified to be connected to the CF9 module.
CR_MCM.2	C200 to C300 peer-to-peer is supported when configured on the same server/ERDB.
CR_MCM.3	Both C200s and C300s combined count against the total number of controllers per server limits.
CR_MCM.4	C300 can use Exchange blocks for peer-to-peer communications to other C300s or C200s residing on another server, if they are resident in the same FTE community.

C300 interoperability with PLC topologies

You can use the FTE Bridge module as a gateway to have the C300 interoperate peer-to-peer with ControlNet, DH+, or CIP Ethernet resident PLCs and AB devices (Panel View, and so on) using the Exchange Block library in a manner similar to the C200. The following example topology diagram shows how this can be done, along with configuration rules on any topology restrictions.

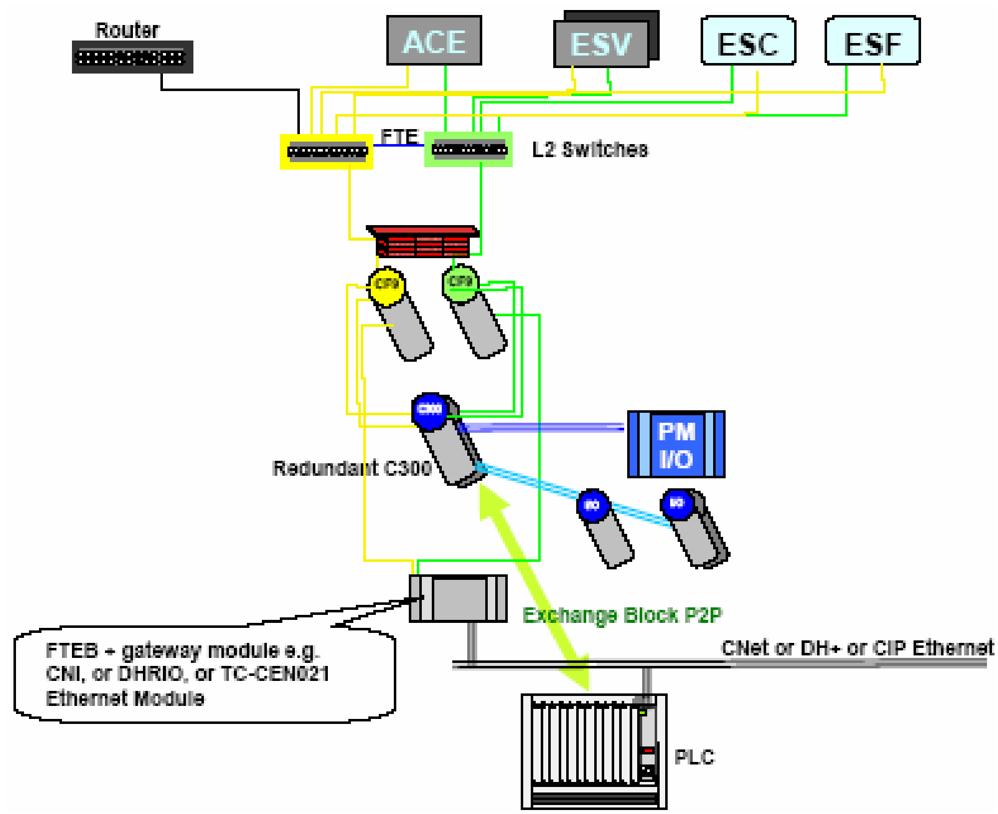


Figure 22 Typical C300 and PLC Interoperable Topology.

Configuration Rules (3LC)

Reference	Description
CR_3LC.0	Access by Rockwell Tools and RSLinx for configuration of PLCs will not work through the FTE Bridge module path to the underlying network; for example, ControlNet, DH+, or CIP Ethernet. The Allen-Bradley Programming Tools access to the PLCs must use an alternate path or a separate computer locally attached to the PLC.
CR_3LC.1	The SCADA channel access to PLCs will not work through the FTE Bridge module path to the underlying network; for example, ControlNet, DH+, or CIP Ethernet. The Experion server must access these PLCs through an alternate path; for example, PCIC ControlNet card, DH+ Gateway (KTX or KE module), or separately connected non-redundant Ethernet path for CIP Ethernet access.
CR_3LC.2	Exchange Block limits apply to the C300 in the same as they did to the C200
CR_3LC.3	If the FTE Bridge module chassis being used for Exchange peer-to-peer does **NOT** also contain Series A I/O Modules but only Exchange Block Gateway module(s), then it may reside on a separate control firewall (CF9) or CISCO Switch in the FTE Community.
CR_3LC.4	The FTE Bridge module chassis resident Gateway modules (CNI, DHRIO, and TC-CEN021) may be shared by more than one C300, as long as other Exchange Block rules and limits are enforced.

C200 with FTE interoperable topologies

There are some topology options available for integrating PLCs and SCADA devices into the Experion system with an FTE supervisory network. The following sections describe two options using high-level topology diagrams for quick reference.

Using FTE and ControlNet on Experion server

The following diagram shows a valid topology that is qualified for Experion R200 or later to allow you to use PCIC modules and RSLinx communication to communicate with third-party devices over ControlNet. You must include downlink CNI modules in your C200 Controllers with FTE Bridge modules to provide peer-to-peer communications using Exchange blocks with the third-party ControlNet devices.

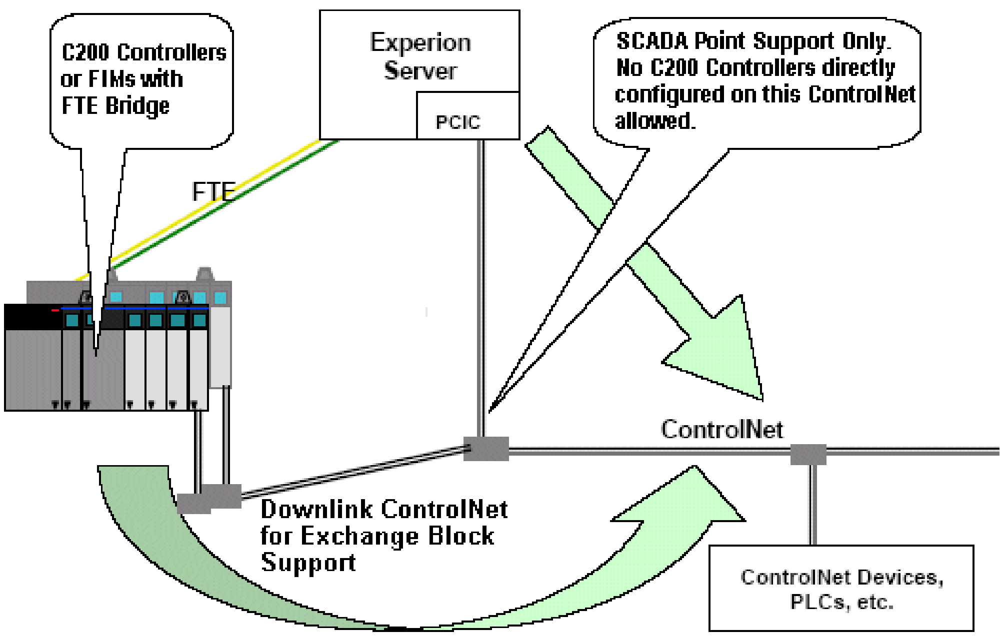


Figure 23 Possible C200 with FTE and ControlNet for Third-Party ControlNet Devices Topology

Using FTE with ControlNet over Ethernet

The FTE Bridge module does **not** support communications directly with ControlNet Interface Protocol (CIP) based Ethernet PLCs or devices.

The following diagram shows a topology that lets you use non-redundant ControlNet (CIP) over Ethernet and RSLinx communication to Rockwell Ethernet based third-party devices. You must use RSLinx to support data access for SCADA points associated with the Ethernet-based PLCs. The C200 Controllers with FTE Bridge modules require a separate TC-CEN011(obsolete) or TC-CEN021 Ethernet module to provide peer-to-peer communications using Exchange blocks with the third- party Ethernet devices. One of the pair of FTE switches may be used for the non-redundant Ethernet connections, if the physical ports are available.

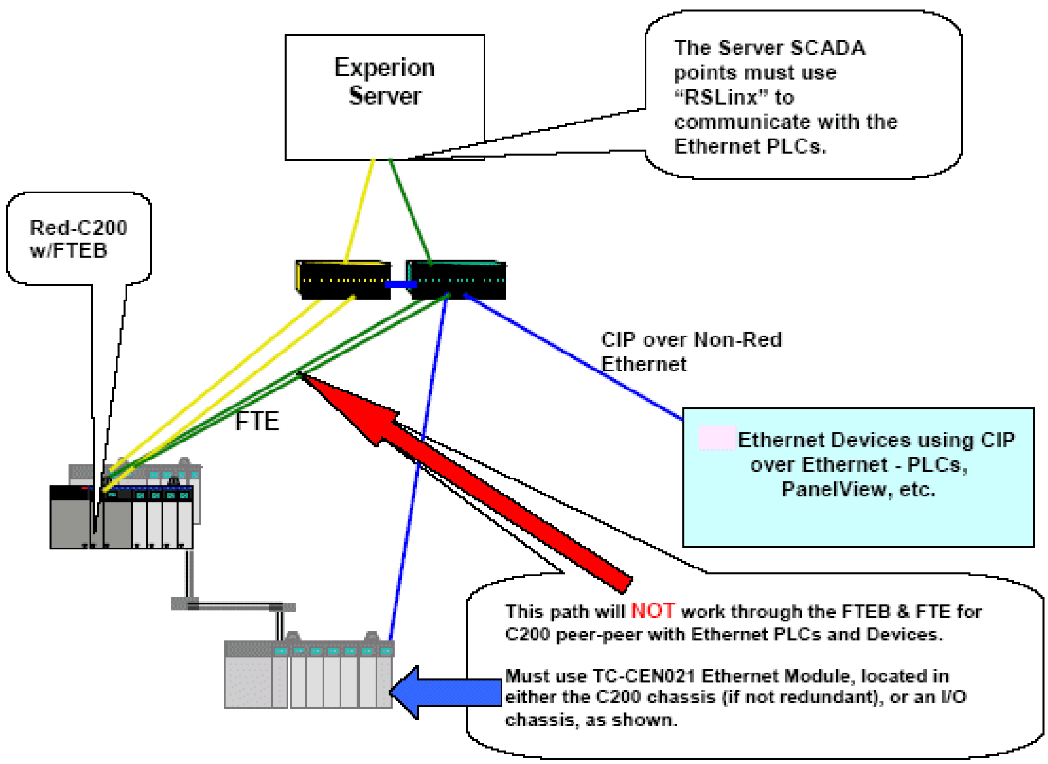


Figure 24 Possible C200 using FTE with ControlNet for Rockwell Ethernet Third-Party Devices Topology

ControlNet Supervisory Network Topologies

Small ControlNet topology

The following topology is an example of the smallest ControlNet supervisory network with single Experion server, Flex Station, and Control Builder on a single computer.

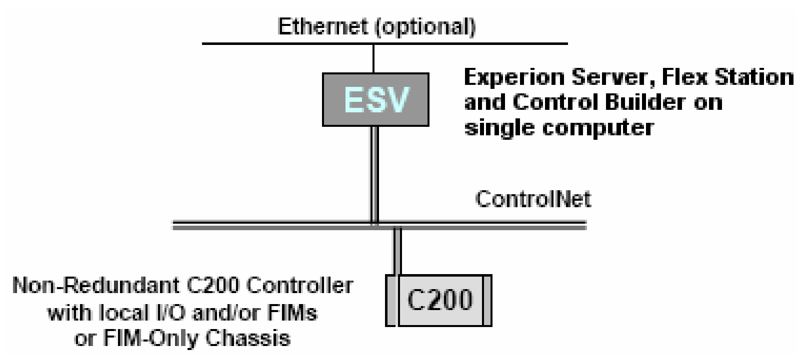


Figure 25 Small ControlNet Topology

Configuration Rules (SCT)

Reference	Description
CR_SCT.0	The use of the Microsoft Loopback Adapter Driver is required if system does not include a configured Ethernet card. See *Software Installation Guide* for installation instructions for this Driver.
CR_SCT.1	The Application Control Environment (ACE) is **NOT** qualified to run on the Experion server node

Conjoined redundant C200 Controller topology

The following topology is a **special** case small configuration that allows I/O to be connected to the supervisory ControlNet segment. More specifically, a chassis of Series A I/O and/or FIMs, or Series A or H Rail I/O can be attached to the Supervisory ControlNet segment. This topology is allowed to satisfy the requirement to have at least two ControlNet node addresses on each network segment that are **NOT** resident in the Redundant Controller chassis. In this case, the two nodes are the PCIC module in the computer and the Remote Series A chassis I/O and/or FIM CNI module, or the Remote Series A or H Rail Gateway module.

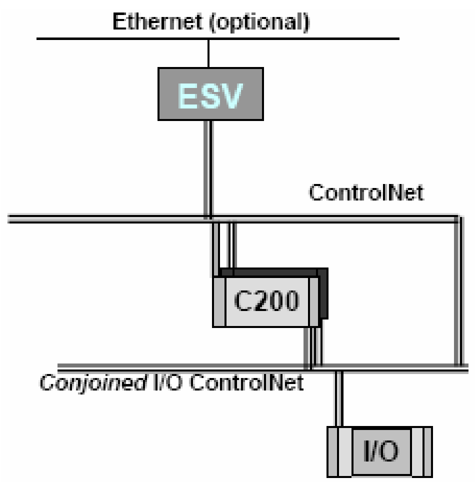


Figure 26 Conjoined Redundant C200 ControlNet Topology

Configuration Rules (CR2)

The following rules pertain to a condition on ControlNet called **becoming lonely** that can occur when a PCIC or a CNI module has no other node to ***talk to*** for some short period. When a node becomes lonely, it will loose its configuration file and cause errors when it regains access to other nodes

Reference	Description
CR_CR2.0	The Conjoined topology is only allowed for a single redundant C200 Controller configuration without Redundant servers, where the PCIC interface module would become temporarily alone on the Controller switchover.

Reference	Description
CR_CR2.1	When CR_C2F.0 is not allowed due to multiple Controllers being configured on ControlNet or when FTE/FTEB is being used, use the following method to allow a single Series A I/O chassis or single Series A or H Rail Gateway configuration with a redundant C200 Controller to operate properly: • Add another CNI module, or another Series A or H Rail Gateway module to the same I/O ControlNet segment. This additional ControlNet device is commonly known as a **Buddy Node** and is installed merely to keep the other I/O ControlNet node from becoming **lonely** when the C200 RCP might switchover.

Basic ControlNet topology

The following topology is an example of the ControlNet supervisory network with basic Experion ControlNet components and shows where it is connected in the cluster.

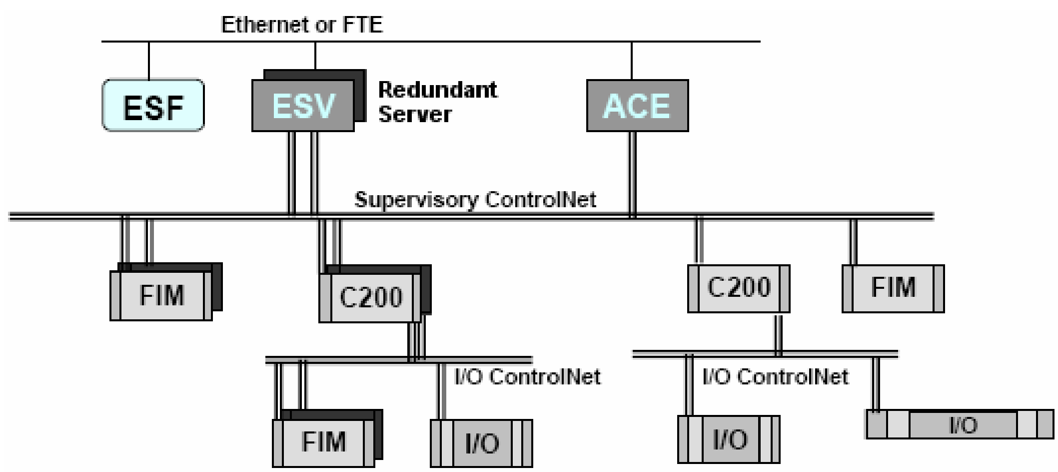


Figure 27 Basic ControlNet Topology

Configuration Rules (BCT)

Reference	Description
CR_BCT.0	An Experion server can only be configured with one (1) PCIC Module.
CR_BCT.1	The total of all physical C200s+FIMs+IOLIMs+SCADA connected ControlNet Nodes in the cluster cannot exceed 127.
CR_BCT.2	The ACE will be supported on an either: • Non-redundant Ethernet, • Redundant Ethernet (as defined in previous releases), or • An FTE segment connected to the Experion server.
CR_BCT.3	You may optionally connect the ACE node directly to the Supervisory ControlNet segment, if required to support Peer-to-Peer communication with C200 Controllers.
CR_BCT.4	All ACE to server traffic uses the Ethernet or FTE link. Only ACE Peer-to-Peer connections with C200 Controllers will use the ControlNet connected link.
CR_BCT.5	The ACE application is NOT qualified to run on the Experion server node.
CR_BCT.6	The ACE node is only qualified with the ACE CEE application with no other applications running, such as Station, Engineering Tools, and so on. Running other applications on the ACE node may affect ACE performance.
CR_BCT.7	Only 2 ACE nodes will be supported per server when configured in this type of basic ControlNet Cluster.

ControlNet Interoperable topology

There are some topology options available for integrating Programmable Logic Controllers (PLCs) into the Experion system with a ControlNet supervisory network. The following topology is an example of the ControlNet supervisory network with integrated PLC components.

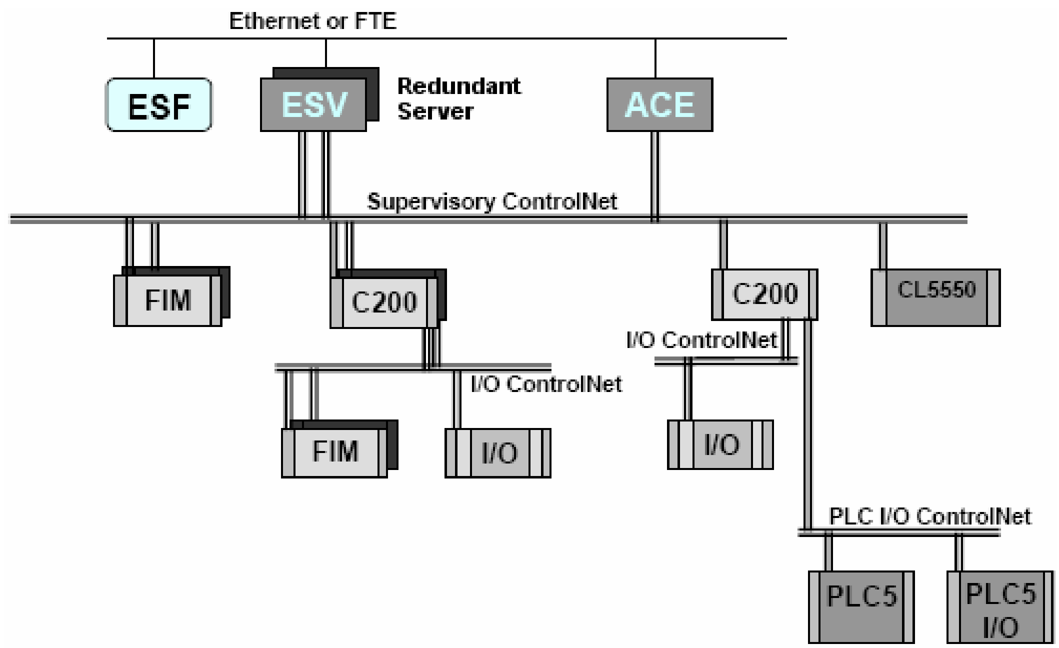


Figure 28 Experion Server Integrated with PLCs Topology

Configuration Rules (PLC)

Reference	Description
CR_PLC.0	The I/O being used by the CL5550 or PLC5/C cannot be connected to or indirectly *through* the Supervisory ControlNet segment. For PLC5/C, the 1771 I/O must be local to the PLC5/C chassis, connected through a traditional Universal Remote I/O connection, or the PLC5/C must reside on a sub-network to the C200 Controller, with its ControlNet I/O isolated from the Supervisory ControlNet.
CR_PLC.1	If SCADA Channel connections are formed to a PLC through any path that

Reference	Description
	includes the PCIC Module, then that CL5550 or PLC5/C counts as a *Controller* in the maximum calculation matrix.
CR_PLC.2	RSLinx must be configured through its menu options to allow no more than 2 PCCC connections/PLC for PLC communications from the server SCADA channels. This will limit the PLC communications to consume no more than 2 of the 127 allowed PCIC connections. This limit is only of concern when using close to the 100 maximum FIMs/server simultaneously with PLCs, as the total of Servers + Controllers + FIMs+ ACEs cannot exceed the 127 PCIC connection limit.
CR_PLC.3	A C200 I/O ControlNet segment cannot be directly connected to a PLC or to a PLC Remote I/O chassis.
CR_PLC.4	The Experion server cannot support configurations that include PLC MSG Instructions that form connections through the PCIC Module to Points configured by Quick Builder.
CR_PLC.5	The CL5550 cannot be configured to use any I/O Modules in the C200 Controller chassis or any I/O Modules in a Remote I/O chassis being used by the C200.
CR_PLC.6	The Experion server does NOT support the operation of the Rockwell PLC Configuration Tools – RSLogix5, RSLogix5000, or RSNetWorx. These Tools should be installed and operated on a separate computer, with its own PCIC Module connected to the appropriate ControlNet segment hosting the PLC.
CR_PLC.7	The ACE node does NOT support *Exchange Blocks*, allowing direct ACE to PLC peer-to-peer communications. ACE access to PLC information must use the ACE OPC Client capability to access data from an OPC Server representing the PLC data of interest.

Ethernet Supervisory Network Topologies

Small Ethernet topology

The following topology is an example of the smallest Ethernet supervisory network with non-redundant Experion server and non-redundant C200 Controller using the TC-CEN011 (obsolete) or TC-CEN021 Ethernet Module.

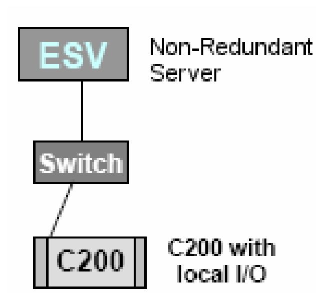


Figure 29 Small Supervisory CIP Ethernet Topology

Basic Ethernet topology

The following topology is an example of the basic supervisory CIP Ethernet network using the TC-CEN011 (obsolete) or TC-CEN021 Ethernet Module.

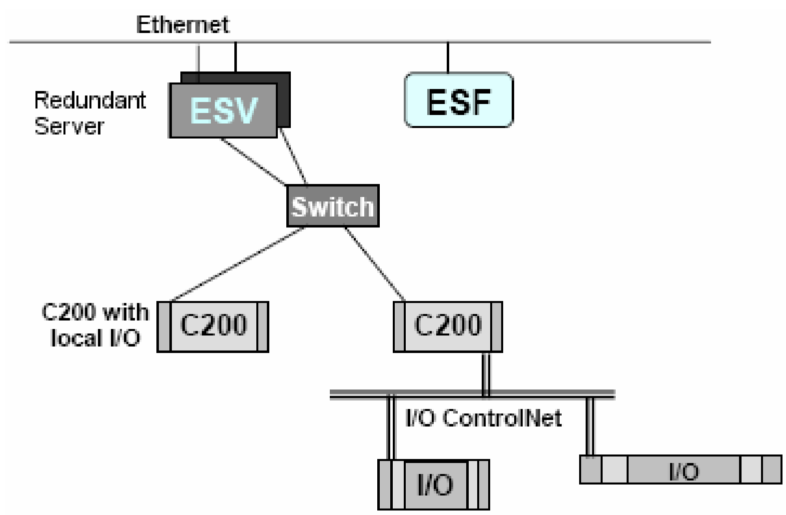


Figure 30 Basic Supervisory CIP Ethernet Topology

Configuration Rules (ENT)

Reference	Description
CR_ENT.0	Only Non-Redundant C200 Controllers may be used with an Ethernet supervisory network.
CR_ENT.1	Support for ControlNet and Ethernet to different C200 Controllers simultaneously from the same server is not supported.
CR_ENT.2	Remote I/O chassis are not supported over any Ethernet segment, supervisory or downlink. A downlink ControlNet segment must still be used to support remote I/O.
CR_ENT.3	Experion Flex Station nodes may reside on the same Ethernet segment as the C200 Controllers for small systems when the total number of Stations (not counting the server) plus C200 Controllers totals four (4) or less, for example; 1 Station + 3 C200s; or 2 Stations + 2 C200s, and so on.

Reference	Description
CR_ENT.4	The Supervisory Ethernet Network segment does not support a Redundant Ethernet configuration.
CR_ENT.5	Series A FIMs are NOT supported on Experion Clusters configured with a Supervisory Ethernet segment, as described in this section.
CR_ENT.6	The ACE Node is NOT supported connected to an Ethernet Supervisory Network configuration, as described in this section.
CR_ENT.7	FTE connected servers do NOT support CIP Ethernet Supervisory Network.

Distributed System Architecture (DSA) Topologies

Integrated SCADA and Experion ControlNet Server Topology

The following topology is an example of the Experion supervisory ControlNet network integrated with a SCADA ControlNet network

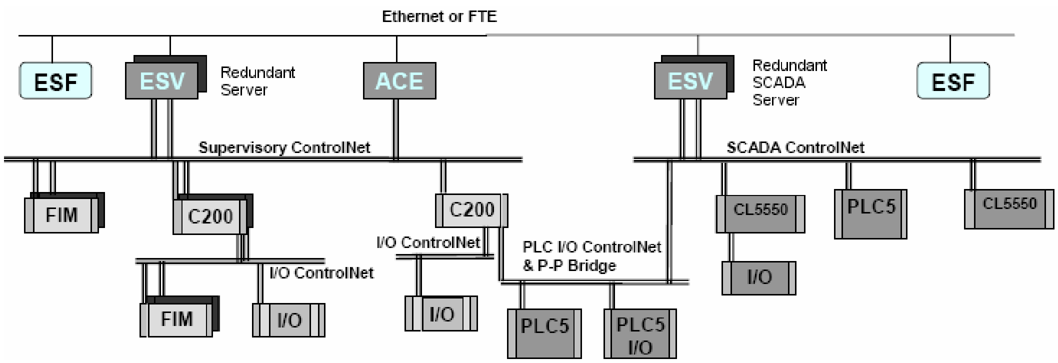


Figure 31 Integrated SCADA topology

Configuration Rules (DS1)

Reference	Description
CR_DS1.0	The Supervisory ControlNet segment cannot be directly connected to the SCADA ControlNet segment.
CR_DS1.1	The Peer-to-Peer ControlNet Bridge segment shown above cannot be used for SCADA channel connections or I/O connections in either direction. This segment can only be used for C200 to PLC *Exchange Block* Peer-to-Peer connections.
CR_DS1.2	The Network between servers can be local or Remote (WAN), but must support the necessary bandwidth required.

Multiple Experion ControlNet Server DSA Topology

The following topology is an example of integrating multiple Experion supervisory ControlNet networks.

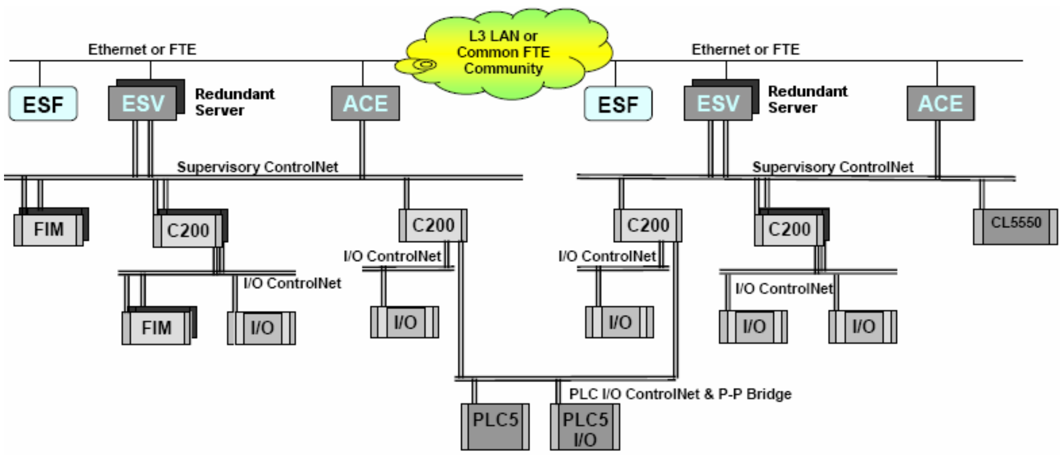


Figure 32 Multiple ControlNet server DSA topology

Configuration Rules (DS2)

Reference	Description
CR_DS2.0	The Supervisory ControlNet segments from different Experion Servers cannot be directly connected together
CR_DS2.1	The Network between Servers can be local or remote (WAN) or FTE, but must support the necessary bandwidth required.
CR_DS2.2	A PLC/Bridging ControlNet segment having CL5550, PLC5/C or Remote 1771 I/O may be interconnected to another controller chassis on another server, as shown. Both C200s may obtain PLC data using Exchange Blocks in this case. This link is also available for a C200 of one cluster to communicate with a C200 of another cluster using Exchange Blocks

Input/Output (I/O) Network Considerations

About I/O Networks

The I/O network is used for communications between Controllers and I/O modules that provide the data interface to field devices. While the chassis-mounted I/O modules and ControlNet media form the basis for the I/O network for C200 Controllers, a variety of interface modules and gateways are available to support connections to:

- Fieldbus H1 Networks
- Process Manager Input/Output
- Rail Input/Output
- PROFIBUS DP
- Allen-Bradley Drive Interface
- HART Input/Output
- DeviceNet Interface

Controller Redundancy requires separated Chassis I/O Networks and it is not supported by all available I/O interfaces.

The Series C I/O and Fault Tolerant Ethernet (FTE) media form the basis for the I/O network for C300 Controllers, which includes HART I/O interfaces. The C300 Controllers also support Process Manager I/O and the Series C FIM supports Fieldbus H1 networks.

Basic Series A Chassis I/O Topology

The following topology is an example of the basic Series A Chassis I/O used with C200 Controllers.

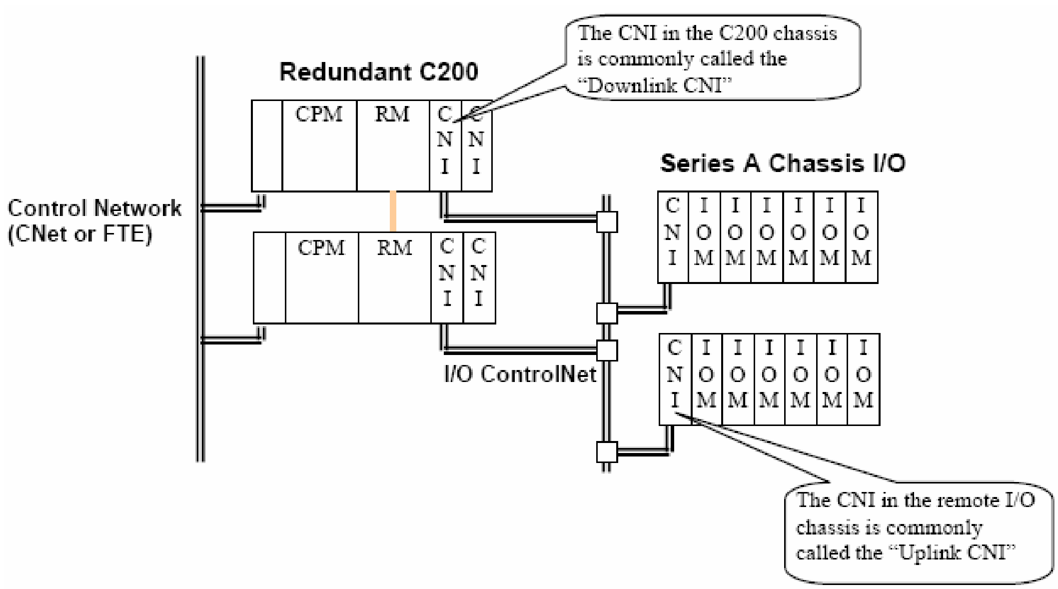


Figure 33 Basic Series A Chassis I/O Topology

Configuration Rules (*MAC*)

The following table lists rules for assigning MAC addresses (MACID) in an I/O ControlNet network.

If Assigning MACID . . .	Then, Observe These Rules:	
	Reference	***Description***
1 (ControlNet Keeper and Moderator)	CR_MAC.0	MACID number 1 must be configured on every physical I/O ControlNet segment.
	CR_MAC.1	Must be assigned to the Downlink CNI in the Controller chassis or to both Primary and Secondary Downlink CNIs in a Redundant Chassis Pair (RCP) for each physically separate I/O ControlNet segment (except for the following Rule CR_MAC.2).

If Assigning MACID . . .	**Then, Observe These Rules:**	
	Reference	***Description***
	CR_MAC.2	When the I/O ControlNet is configured with a NUT less than 10 ms. to support the AB Drive Controller, MACID number 1 should be configured ***outside*** of the Redundant Chassis Pair, on the AB Drive Controller. The RCP should then be configured starting with MACID number 3/4.
2	CR_MAC.3	Must not be assigned to any Node when using Redundant Controller with MACID number 1 assigned to the Downlink CNI in the RCP. (Note that the Secondary CNI is physically set to MAC ID number 1, but logically becomes MAC ID number 2 while in the secondary redundancy role.)
	CR_MAC.4	Should be reserved when using non-redundant Controller for future Redundant upgrade.
	CR_MAC.5	When MACID number 1 is configured as in Rule CR_MAC.2 above, MACID number 2 should also be assigned ***outside*** the RCP on another AB Drive Controller.
3	CR_MAC.6	Must not be assigned to a Downlink CNI in a Controller chassis or Redundant Chassis Pair when MACID number 1 (and 2) are used in the RCP.
	CR_MAC.7	Must be assigned to a Remote I/O chassis CNI or Remote Series A or H Rail Gateway Module, in conjunction with each MACID number 1 assignment.
	CR_MAC.8	When MACID number 1 is configured as in CR_MAC.3 above, MACID number 3 should be assigned to the first Downlink CNI in the RCP, while reserving MACID number 4 as stated in CR_MAC.11 below.
4	CR_MAC.9	Should be used by or reserved for additional Remote I/O chassis CNI or Series A or H Rail Gateway.
	CR_MAC.10	Must not be assigned to any Node when using Redundant Controller with MACID number 3 assigned to the Downlink CNI in the RCP. (Note that the Secondary CNI is physically set to MAC ID number 3, but logically becomes MAC ID number 4 while in the secondary redundancy role.)
5 and Up	CR_MAC.11	Should be used consecutively from low to high values with the following guidelines CR_MAC.12 and CR_MAC.13.

If Assigning MACID . . .	Then, Observe These Rules:	
	Reference	***Description***
	CR_MAC.12	Odd addresses should be used for additional Downlink CNIs in Controller chassis or RCP (with next even address not used), when additional Downlink CNIs are connected to a common physical I/O ControlNet segment.
	CR_MAC.13	After Downlink CNIs are assigned, remaining addresses may be used for additional Remote I/O chassis CNIs or Rail Gateways.

Configuration Rules (CNI)

The following table lists some additional rules to follow when configuring an I/O ControlNet network.

Reference	Description
CR_CNI.0	Multiple I/O ControlNet Downlink CNIs may be connected to a common physical I/O ControlNet segment and must adhere to the MAC Configuration Rules listed in the previous configuration rules (*MAC*). **Exception to this rule**: When using AB Drive Controllers, separate **isolated** physical segments must be configured for just the Drive Controllers and these **isolated** segments must follow the MACID assignment in rules CR_MAC.2, CR_MAC.3, CR_MAC.5 above and CR_CNI.5 below
CR_CNI.1	When using a common physical I/O ControlNet segment connected to more than one Downlink CNI in the Controller chassis as described in the previous rule, all I/O or all FIMs in a single remote I/O or FIM-only chassis must be assigned through the same Downlink CNI; for example, you should not ***split*** communication paths to the same remote chassis components through different Downlink CNIs. Violating this rule may cause Redundancy and On-Process Migration issues.
CR_CNI.2	PLCs or other ControlNet Devices may not reside on any I/O ControlNet segment using Series A I/O of any type connected to a C200 Controller.
CR_CNI.3	A single I/O ControlNet segment cannot be ***shared*** by more than one C200 Controller
CR_CNI.4	The ControlNet Keeper is the lowest configured MACID per physical ControlNet segment. This table assumes that MACID number 1 exists per

Reference	Description
	ControlNet segment. The ControlNet Keeper periodically broadcasts keeper information using scheduled ControlNet bandwidth. Since the default maximum number of scheduled nodes (SMAX) is set to 1, every ControlNet segment should intentionally have a keeper at MACID number 1.
CR_CNI.5	When connecting to AB Drive Controllers, the ControlNet Parameters for that segment must be configured for NUT = 6.25 ms. and SMAX = to the Highest MACID used (but less than or equal to UMAX), using Network Tools (Tools).
CR_CNI.6	The maximum number of nodes (UMAX) permitted on the I/O ControlNet is 20.
CR_CNI.7	An I/O network can have up to four downlink CNIs installed in a C200 chassis with multiple uplink CNIs and Rail Gateways physically connected to the same network. However, be sure each Rail Gateway has **configured communication paths** from only **one** downlink CNI. The downlink CNIs may have **configured communication paths** to multiple Rail Gateways and chassis mounted I/O modules through uplink CNIs. Each downlink CNI may have a maximum number of 24 **configured communication paths** with a maximum of 64 I/O modules on the controller's I/O network.

Basic Series A Rail I/O Topology

The following topology is an example of the basic Series A Rail I/O used with C200 Controllers. Also, see configuration rule CR_CNI.7 in the preceding section.

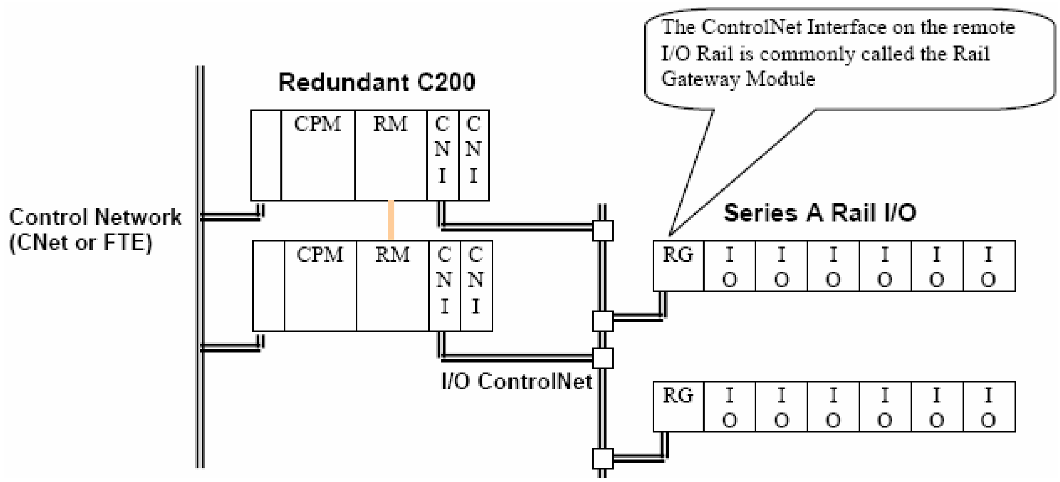
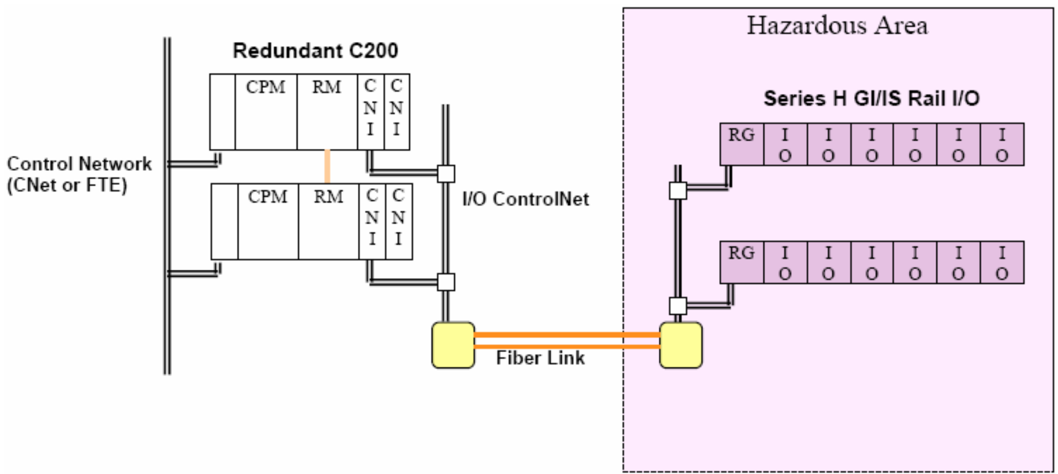


Figure 34 Basic Series A Rail I/O Topology

Basic Series H Rail I/O Topology

The following topology is an example of the basic Series H Rail I/O used with C200 Controllers. Also, see configuration rule CR_CNI.7 in the preceding section.



Process Manager I/O Topologies

PM I/O with C200 and I/O Link Interface Module (IOLIM)

The following topology is an example of how PM I/O is integrated with the C200 Controller through the chassis based IOLIM. Each IOLIM supports one PM I/O link network.

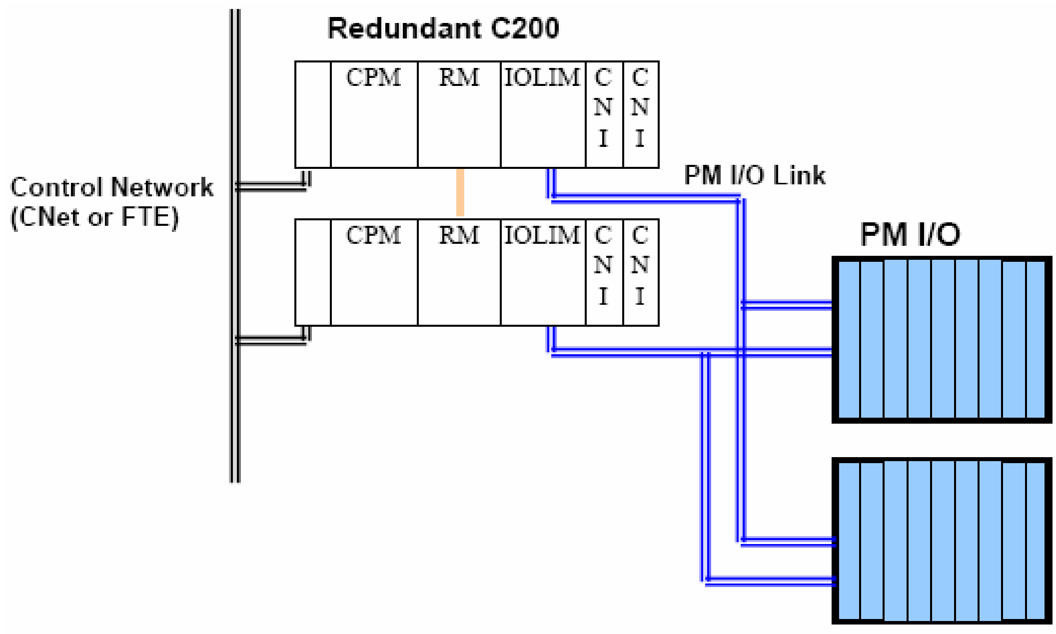


Figure 35 Basic PM I/O with C200 and IOLIM Topology

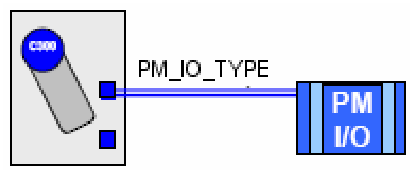
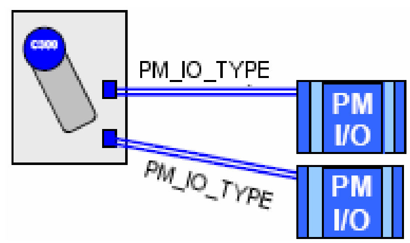
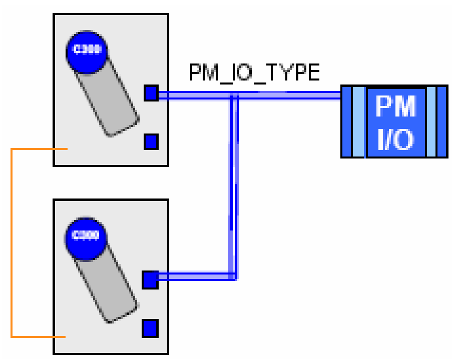
Configuration Rules (LIM)

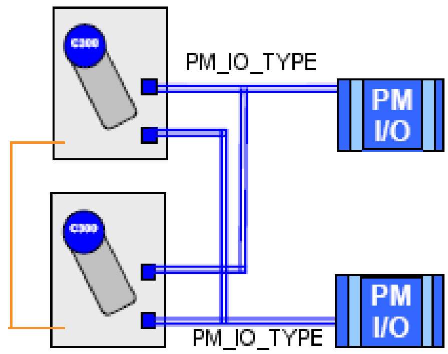
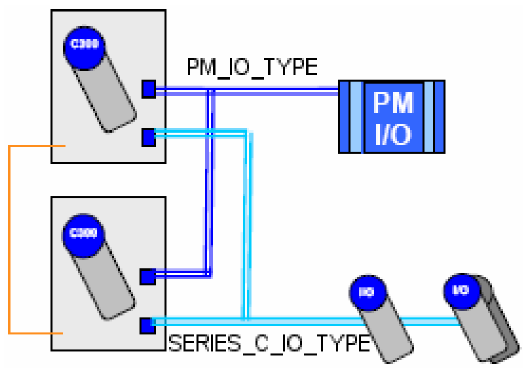
Reference	Description
CR_LIM.0	The IOLIM must reside in the same chassis as the C200 Controller. Both redundant and non-redundant chassis are supported.
CR_LIM.1	A redundant controller chassis using PM I/O must contain at least a supervisory ControlNet Interface module (CNI) (for ControlNet) or FTE Bridge module (FTEB) (for FTE supervisory network), C200CPM, RM, and IOLIM

Reference	Description
CR_LIM.2	A non-redundant controller chassis using PM I/O must contain at least a supervisory CNI (for ControlNet) or FTEB (for FTE supervisory network), C200CPM, and IOLIM.
CR_LIM.3	The maximum number of IOLIMs per controller chassis is two (2).
CR_LIM.4	Multiple I/O Links cannot be conjoined together, except for the same logical link from a Primary and Secondary IOLIM in a redundant chassis pair (RCP).
CR_LIM.5	All I/O channels assigned to an IOLIM must be contained in Control Modules that reside in the same C200CPM that resides in the chassis with that IOLIM.
CR_LIM.6	The controller chassis can contain additional CNIs connected to other Experion I/O families.
CR_LIM.7	The maximum number of Primary IOPs per IOLIM is 40, within the Link Unit specification found in *Link Unit calculations* in this document.
CR_LIM.8	The maximum number of Primary IOPs per C200CPM is 64.
CR_LIM.9	The communication update interval between the IOP Points and the Experion blocks is configurable per IOP device. The minimum update interval is 100 milliseconds and the maximum is 2 seconds.
CR_LIM.10	The maximum number of AO connections per IOLIM is 320. The maximum number of DO connections per IOLIM is 640. The maximum number of AO and DO connections per IOLIM is 640.
CR_LIM.11	ControlNet or FTE must be used for the supervisory network. Non-Redundant Ethernet supervisory networks are not qualified.
CR_LIM.12	The IOLIM is NOT qualified with the ***Remote GI/IS I/O*** family supported by the xPM that resides on an I/O Link.
CR_LIM.13	Peer-to-Peer connections from a C200 Controller to an IOLIM that is not residing in the same chassis as that C200 is NOT supported. For example, making I/O channel *named references* to remote PM I/O channels in another chassis IOLIM, is not supported.

PM I/O with C300 Controller

The following topologies are examples of how PM I/O is integrated with the C300 Controller being introduced in Experion R300. The C300 supports two I/O Link interfaces and each or both of these can be used with either the PM I/O or the Series C I/O. The PM I/O is supported when an I/O Link is configured as *PM_IO_TYPE*, and the Series C I/O is supported when the link is configured as *SERIES_C_IO TYPE*. This means that these two I/O types cannot be shared on the same I/O Link.

Description	Diagram
Non-Redundant C300 with One PM I/O Link	
Non-Redundant C300 with Two PM I/O Links	
Redundant C300 with One PM I/O Link	
Redundant C300 with Two PM I/O Links	

Description	Diagram
	
Redundant C300 with One PM I/O Link and One Series C I/O Link	

Configuration Rules (PM3)

Reference	Description
CR_PM3.0	Multiple I/O Links cannot be conjoined together, except for the same logical link from a Primary and Secondary C300 pair.
CR_PM3.1	The maximum number of Primary IOPs per C300 I/O Link is 40, within the Link Unit specification found in *Link Unit calculations* in this document.
CR_PM3.2	The communication update interval between the IOP Points and the Experion blocks is configurable per IOP device. The minimum update interval is 100 milliseconds and the maximum is 2 seconds.
CR_PM3.3	The maximum number of Primary IOPs per C300 is 64, within the constraint of

Reference	Description
	64 total IO Units per C300.
CR_PM3.4	The PM IOPs and Series C IOMs cannot reside on the same C300 I/O Link. PM IOPs must be assigned to PM_IO_TYPE (375 Kbps) link, and Series C IOMs must be assigned to SERIES_C_IO_TYPE (750 Kbps) link.
CR_PM3.5	All PM I/O channels must be contained in Control Modules that reside in the same C300 CEE that hosts the I/O Link where the PM IOPs reside. This means that two different C300s cannot ***share*** an I/O Link or the IOPs residing on that link.
CR_PM3.6	The C300 only supports the same set of PM IOPs as supported by the C200. See the Table in the following section for a list of supported IOPs.
CR_PM3.7	Either C300 I/O Link can be configured as a PM_IO_TYPE or as a SERIES_C_IO_TYPE. For example, both links can be configured for PM I/O or both can be used for Series C I/O, or one of each type in any orientation of link 1 and 2.

PM IOP/IOM support

The following table lists the PM IOPs that are supported in Experion R300 by the C200 and C300 Controllers. All other PM IOPs not listed here are NOT qualified/supported. Note that the term I/O Processor (IOP) is also referred to as I/O Module (IOM) to provide a consistent reference for the various styles of I/O interface components.

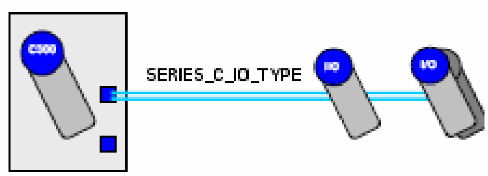
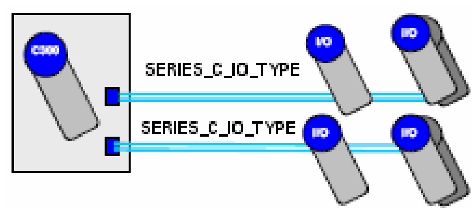
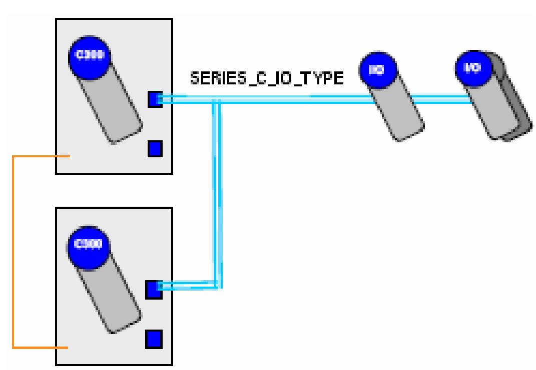
IOP Type	Description	Channels
HLAI	Analog Input – High Level	16
HLAIHART	Analog Input – High Level, HART Capable	16
LLAI	Analog Input – Low Level	8
LLMUX	Analog Input – Low Level Multiplexer	32
RHMUX	Remote Hardened Multiplexer	32
STI-MV	Smart Transmitter Interface - MV	16
AO8	Analog Output 8	8
AO16	Analog Output 16	16
AO16HART	Analog Output 16, HART capable	16

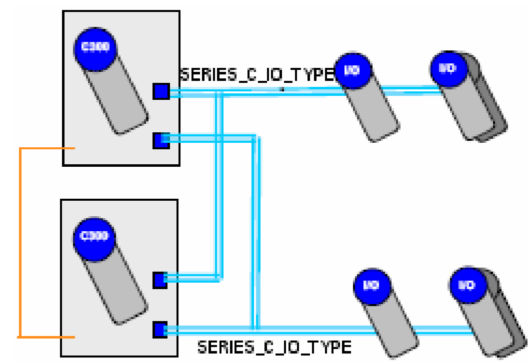
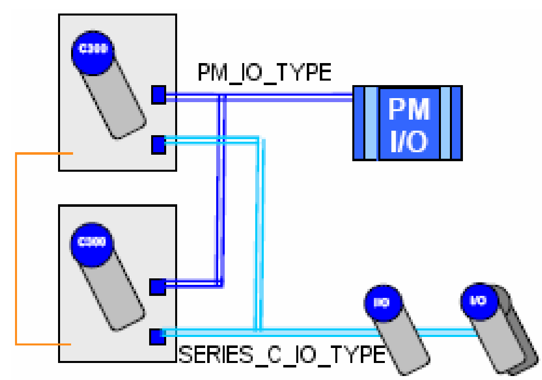
IOP Type	Description	Channels
DI	Digital Input	32
DI24	Digital Input 24 Vdc	32
DISOE	Digital Input Sequence of Events	32
DO16	Digital Output 16	16
DO32	Digital Output 32	32

Series C I/O Topologies

Series C I/O with C300

The following topologies are examples of how Series C I/O is integrated with the C300 Controller being introduced in Experion R300. The C300 supports two I/O Link interfaces and each or both of these can be used with either the PM I/O or the Series C I/O. The PM I/O is supported when an I/O Link is configured for 375 Kbps, and the Series C I/O is supported when the link is configured at 750 Kbps. This means that these two I/O types cannot be shared on the same I/O Link.

Description	Diagram
Non-Redundant C300 with One Series C I/O Link	
Non-Redundant C300 with Two Series C I/O Links	
Redundant C300 with One Series C I/O Link	
Redundant C300 with Two Series	

Description	Diagram
C I/O Links	
Redundant C300 with One PM I/O Link and One Series C I/O Link	

Configuration Rules (CIO)

Reference	Description
CR_CIO.0	Multiple Series C I/O Links cannot be conjoined together, except for the same logical link from a Primary and Secondary C300 pair
CR_CIO.1	Series C I/O has a maximum of 2000 LUs per second (double that of PM I/O).
CR_CIO.2	The maximum number of Primary Series C IOMs per C300 I/O Link is 40, within the Link Unit specification found in *Link Unit calculations* in this document.
CR_CIO.3	Each Series C IOM counts as 1 IO Unit (IOU) in the C300 I/O limit calculation.
CR_CIO.4	Any mix of the supported Series C I/O modules can be used on a Series C I/O

Reference	Description
	IOLINK.
CR_CIO.5	Either C300 I/O Link can be configured as a PM_IO_TYPE or as a SERIES_C_IO_TYPE. For example, both links can be configured for PM I/O or both can be used for Series C I/O, or one of each type in any orientation of link 1 and 2.
CR_CIO.6	All Series C I/O channels must be contained in Control Modules that reside in the same C300 CEE that hosts the I/O Link where the Series C IOMs reside. This means that two different C300s cannot **share** an I/O Link or the IOMs residing on that link

Series C IOM support

The following table lists the Series C IOMs that are supported in Experion R300 by the C300 Controllers.

IOM Model	IOM Type	Description	Number of Channels	Similar to PM I/O Type	IOM first available in Release
CU-PAIH01 CC-PAIH01	AI-HART	High Level Analog Input with HART	16	HLAIHART	R300
CU-PAIM01 CC-PAIM01	AI-LLMUX	Low Level Mux Input	64	LLMUX	R300 *Note 1*
CU-PAOH01 CC-PAOH01	AO-HART	Analog Output with HART	16	AO16HART	R300
CU-PDIH01 CU-PDIH01	DI-HV	High Voltage Digital Input (IOM supports both 120 and 240 volts AC)	32	DI	R300
CU-PDIL01 CC-PDIL01	DI-24	Low Voltage Digital Input (24 volts DC)	32	DI24	R300
CU-PDOB01 CC-PDOB01	DO-24B	Bussed Low Voltage Digital Output (24 volts DC)	32	N/A	R300 *Note 2*
Notes: 1. While other IOMs can be redundant or non-redundant, this IOM is ONLY available as a non-redundant IOM. 2. Used with Bussed and Relay IOTAs.					

FTE Bridge (FTEB) Topologies

Series A Chassis I/O and FTEB with C300

The following topology is an example of how Series A Chassis I/O can be used with C300 Controllers through a FTE Bridge module in the I/O chassis.

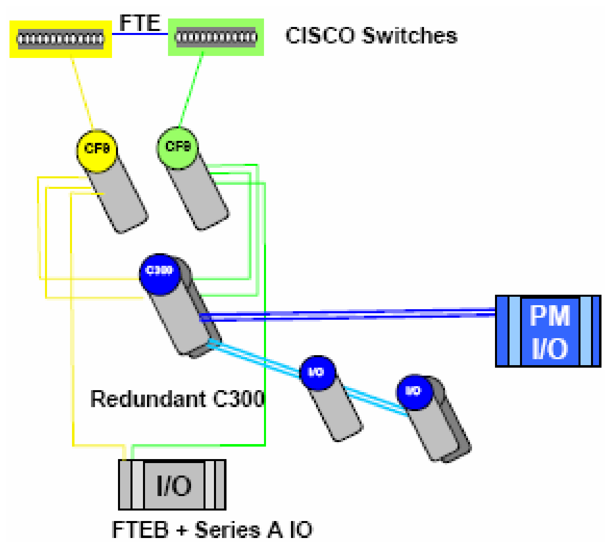


Figure 36 Basic C300 with Series A Chassis I/O Topology

Configuration Rules (SAC)

Reference	Description
CR_SAC.0	The FTEB can be used to connect Series A Chassis I/O to the C300 only in a non-redundant Series A chassis. For example, there can be no Redundancy Module (RM) in the chassis.
CR_SAC.1	When the FTEB is used to connect Series A Chassis I/O to the C300, there can be no C200s, IOLIMS, LIOMs, or FIMs in the non-redundant I/O chassis with the target I/O Modules being used by the C300.
CR_SAC.2	The FTEB, when used to connect Series A Chassis I/O to the C300, must be connected to the same control firewall module (CF9) as the C300 that is using the Series A Chassis I/O.

Reference	Description
CR_SAC.3	The C300 can connect up to 6 different FTEB modules/chassis containing Series A Chassis I/O (this limit is due to the number of available CF9 ports and the previous rule CR_SAC.2).
CR_SAC.4	Each FTEB can support 16 IO Units of Series A Chassis I/O.
CR_SAC.5	When the C300 is connected to Series A Chassis I/O, the IO Units for the Series A Chassis I/O Modules count against the C300 IO Unit limit of 64.
CR_SAC.6	The FTEB module will only support I/O connections from a single C300 or redundant C300 pair. For example, more than one C300 cannot ***share*** the Series A Chassis I/O in the same chassis.
CR_SAC.7	More than one FTEB module is not allowed in the same Series A chassis for the purpose of I/O connections from the different C300s.
CR_SAC.8	All Series A chassis sizes (4,7,10,13,17 slots) are supported by the C300 and FTEB for connections to Series A Chassis I/O.
CR_SAC.9	The FTEB module may reside in any slot in the I/O chassis.
CR_SAC.10	Only the following four Series A Chassis IOM types are qualified to be used with the C300: Serial Interface Module, SST Profibus Module, DeviceNet Interface Module, and the Pulse Input Module.
CR_SAC.11	Support for CNI Modules in the FTEB chassis connected to remote ControlNet connected Series A I/O chassis is not supported by the C300. This means that the Series A Chassis I/O being used by the C300 must reside in the same non-redundant chassis as the FTEB.

HART I/O Topologies

HART Series A Chassis I/O

The following topology represents HART devices with control integration and Field Device Manager (FDM) Tool Integration through the HART Multiplexer. The Spectrum HART Analog Input and HART Analog Output Modules may reside in the same locations as non-HART Series A Chassis Analog I/O Modules reside. The C200 Controllers can also reside on ControlNet Supervisory Network (not shown), but then no ESC node would be allowed.

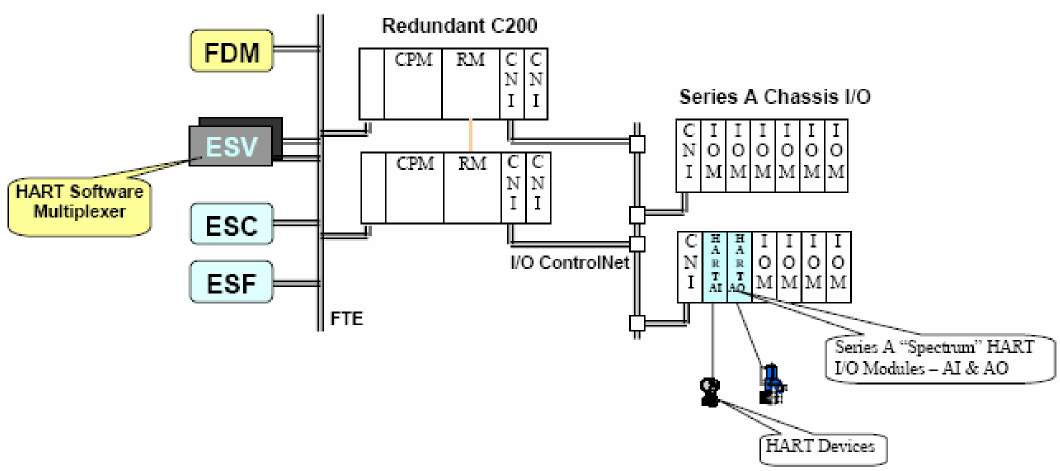


Figure 37 Series A *Spectrum* HART I/O Topology

Configuration Rules (HSA)

Reference	Description
CR_HSA.0	The HART Multiplexer resides on the Experion Server and communicates to third-party applications containing P+F HWMUX Drivers through an RS232 COM PORT connection.
CR_HSA.1	Only one HART Multiplexer per server or ERDB will be supported.
CR_HSA.2	The HART Multiplexer will permit third-party Asset Management Applications to communicate with one HART channel on one HART IO Module at a time.
CR_HSA.3	HART Multiplexer will not support more than 7936 HART devices on one

Reference	Description
	Experion server.
CR_HSA.4	The HART Multiplexer may be used with ControlNet, CIP Ethernet, or FTE Supervisory Networks.
CR_HSA.5	FDM (aka FDCM) and Emerson AMS are both qualified clients for the HART Multiplexer.
CR_HSA.6	MAXIMUM number of simultaneously OPEN AMS or FDM forms permitted per HART MUX is: • 4 for HART PM I/O or Series C HART I/O • 8 for 1756 Spectrum HART (one IOMs worth of devices) (**NOTE**: NOT ALL concurrently. Either 4 or 8 depending on IO family being tested/accessed at any one time.)

HART PM I/O

The following topology represents HART IOPs residing in the same I/O slot positions as currently supported by HLAI and AO16 IOPs, in both redundant and non-redundant IOP configurations. Access to these HART IOPs and the attached devices is fully qualified by the HART MUX application. The C200 Controllers can also reside on ControlNet Supervisory Network (not shown), but then no ESC node would be allowed.

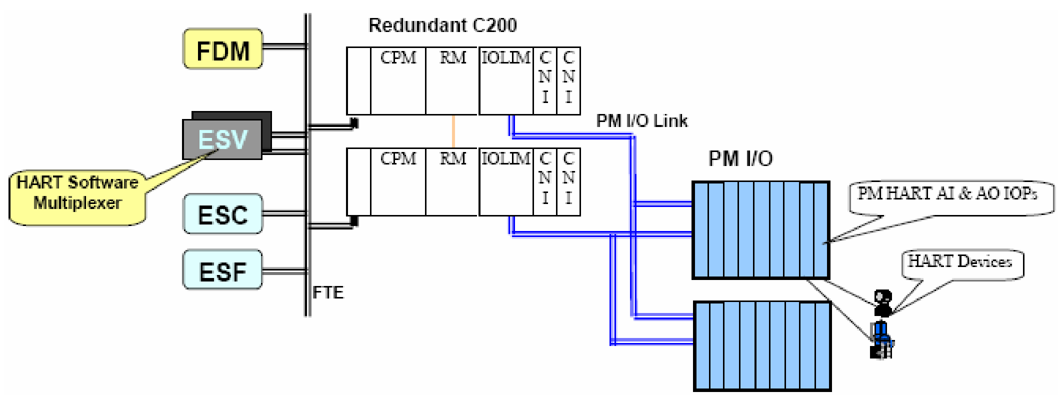


Figure 38 HART PM I/O Topology

Configuration Rules (HPI)

Reference	Description
CR_HPI.0	The HART IOP's will occupy one physical slot position in the chassis.
CR_HPI.1	The HART IOP's will support a non-redundant or redundant implementation.
CR_HPI.2	Both the HART AI and AO IOP's will provide (16) I/O channels.
CR_HPI.3	The HART AI and AO IOP will support only Point-to-Point HART connections. No multi-drop connections are supported.
CR_HPI.4	The HART AI and AO IOP will support all certifications and approvals common to the PM I/O family.
CR_HPI.5	The maximum number of IOP's per C200 or C300 will not be affected by the use of HART IOP's. The HART IOP will count as one against the maximum number of IOP's/C200 or C300.
CR_HPI.6	The HART AI and AO IOP's can be placed into any I/O chassis slot position.
CR_HPI.7	As with all PM I/O, conformal coating will be standard on the HART AI and AO IOPs.
CR_HPI.8	The two new channel blocks developed for the PMIO HART modules each have a parameter called HENABLE (HART Enabled). If set true, the channel becomes a tagged entity and counts against the maximum number of tags identified in the user's license.
CR_HPI.9	The HART IOPs have been added to the IOLINK bandwidth calculation spreadsheet. Some of the data to be entered is dependent on how many actual HART devices are configured and used. See the Link Unit specification found in *Link Unit calculations* in this document.
CR_HPI.10	To modify the following parameters, Control Modules that contain the appropriate IOP Channel Blocks must be deleted from the Control Builder Monitoring view, modified in the Project view, and then reloaded. • **HENABLE**: Enable HART – The parameter described in CR_HPI.8 above. • **HCFGDEV**: Configured HART Device – This parameter defines the HART Device type, (For example, the Honeywell STTH transmitter.)
CR_HPI.11	To modify the following parameters, the appropriate IOP Channel Block must have its PTEXECST= INACTIVE (off control). The parameter must be changed in the Project view. When modified, either the Control Module or IOP must be reloaded with contents. • **HPVCHAR**: HART PV Characterization – This allows the user to choose

Reference	Description
	range limits that are set in the HART device, or alternatively, set by the user. • **HSCANCFG**: Scan HART Variables – This is the parameter that configures the IOP to periodically collect HART variables at particular rates.
CR_HPI.12	Redundant HART IOPs track Analog Data (4-20 data) in a manner consistent with HLAI and AO16 IOPs. HART device resident data is not tracked in secondary IOPs. In particular, on failover, HART dynamic data (HART PV, SV, TV and FV) will ***hold*** until the new primary IOP establishes connection with the HART device. They do not go to NaN.

HART Series C I/O

The following topology represents Series C HART AI and AO IOMs residing on the C300 750 Kbps I/O Link in both redundant and non-redundant IOM configurations. Access to these HART IOMs and the attached devices is fully qualified by the HART MUX application.

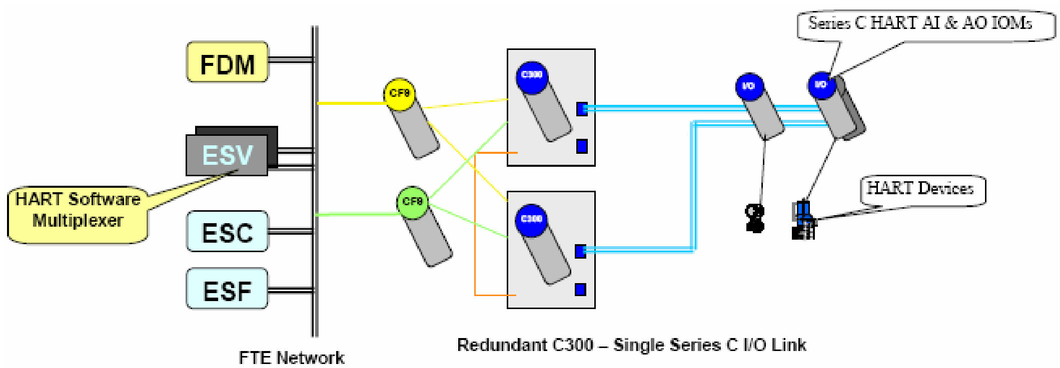


Figure 39 HART Series C I/O Topology

Configuration Rules (HSC)

Reference	Description
CR_HSC.0	Series C I/O's fundamental AI and AO channel blocks support HART.
CR_HSC.1	To enable HART, the channel must be assigned to a HART IOM and HENABLE must be set to TRUE. Aside from that difference, configuration and operation of a Series C I/O HART enabled channel is identical to a PM I/O HART enabled channel.
CR_HSC.2	The Series C HART IOMs have been added to the IOLINK bandwidth calculation spreadsheet. Some of the data to be entered is dependent on how many actual HART devices are configured and used.

DeviceNet I/O Topologies

Experion supports connection to DeviceNet I/O Networks using the Rockwell 1756-DNB Module. This module features the following characteristics.

- Provides a communication bridge between ControlNet and DeviceNet.
- Utilizes the Rockwell 1756 form factor, which is native to Experion.
- Can be located in either the non-redundant C200 Controller Rack or I/O Rack.
- Supports the three DeviceNet baud rates: 500 KBps, 250 KBps and 125KBps.
- Is configured from a computer running the RSNetWorx for DeviceNet configuration tool connected to either DeviceNet through a 1770-KFD Interface Module or ControlNet through a CNI.
- Input and output messages from/to the various DeviceNet devices are ***bundled*** at the ControlNet level into 2 assemblies (data objects) which are available for transport across ControlNet from/to the C200 or C300 Controller:
  - As configured with the DeviceNet network configuration, all input data messages (from DeviceNet input devices) are packed into a 496 byte **input** assembly. Input data is bound from input devices to the C200 Controller.
  - As configured with the DeviceNet network configuration, all output data messages (to DeviceNet output devices) are packed into a 492 byte **output** assembly. Output data is bound from the C200 Controller to the output device.
  - As configured with the DeviceNet network configuration, all output data messages (to DeviceNet output devices) are packed into a 492 byte **output** assembly. Output data is bound from the C200 Controller to the output device.

DeviceNet with C200

The following topology is an example of DeviceNet integration with C200 through the 1756-DNB Module in an I/O chassis.

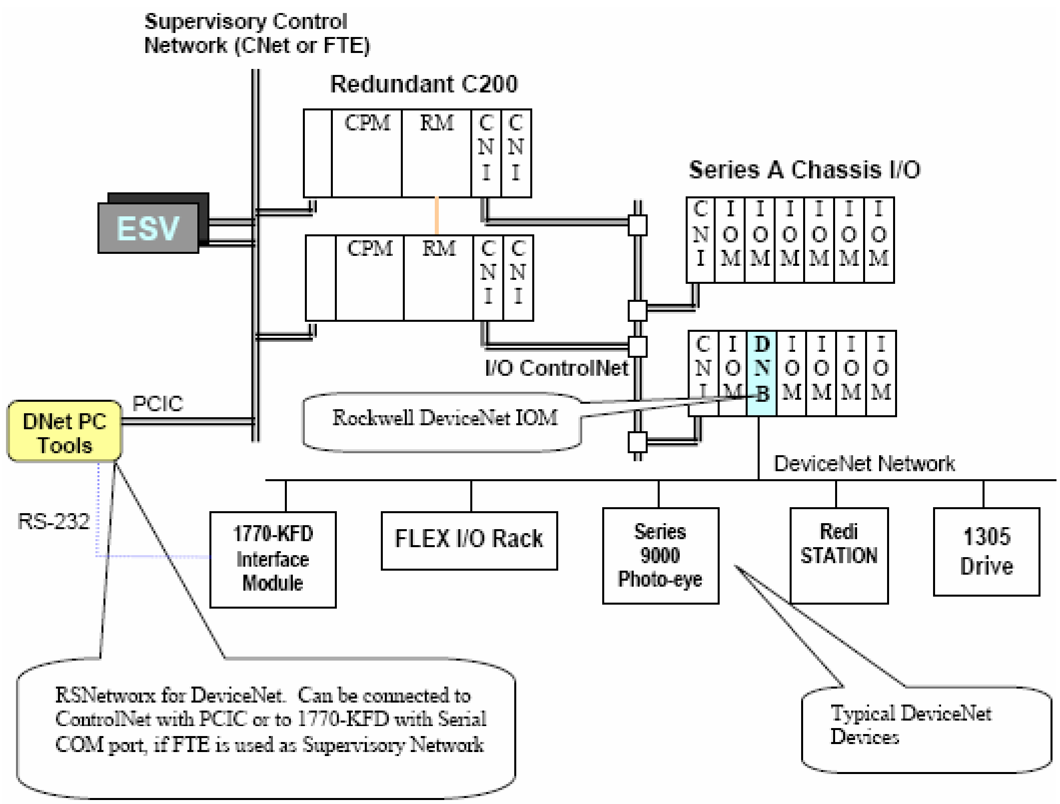
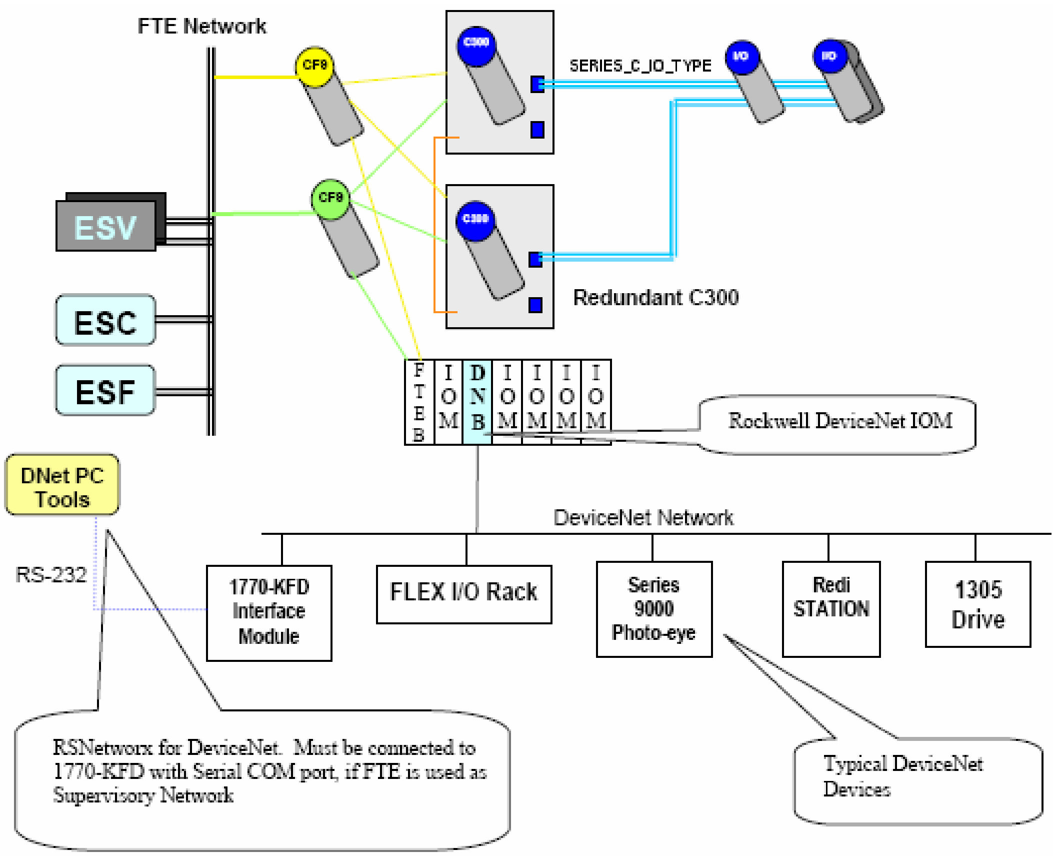


Figure 40 C200 DeviceNet I/O Topology

DeviceNet with C300

The following topology is an example of DeviceNet integration with C300 through the FTE Bridge module and 1756-DNB Module in an I/O chassis.



Configuration Rules (DNT)

Reference	Description
CR_DNT.0	The 1756-DNB is not a redundancy compliant device and therefore cannot be introduced into a controller chassis of a redundant controller configuration. However, in non-redundant applications, the module can be deployed in either the controller chassis or a downlink I/O chassis.

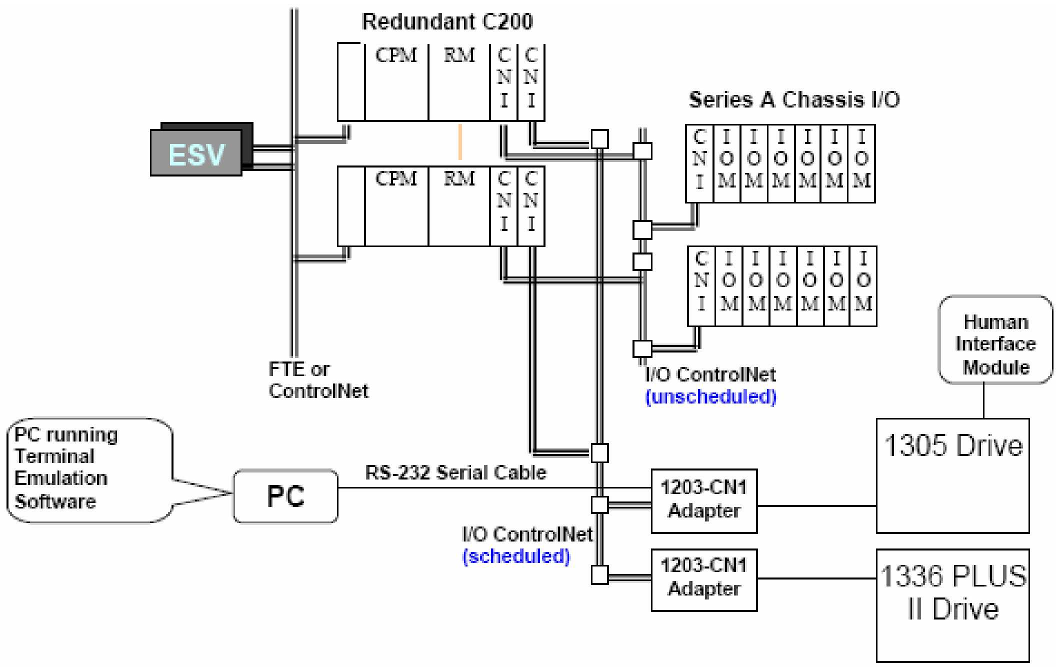
<table>
<tr><th>Reference</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">CR_DNT.1</td><td colspan="3">The communication update interval between the DeviceNet Interface and the DNET_IM block is not configurable, but is dependant upon the Base Execution Rate of the CEE in which the block is running.</td></tr>
<tr><td>CEE Base Execution Rate</td><td>Input Rate</td><td>Output Rate</td></tr>
<tr><td>50 ms</td><td>25 ms</td><td>50 ms</td></tr>
<tr><td>5 ms</td><td>2.5 ms</td><td>5 ms</td></tr>
<tr><td>CR_DNT.2</td><td colspan="3">The DNET_IM block supports communication to a maximum of 64 unique devices, identified by a unique network address within the valid network address range of 0-63.</td></tr>
<tr><td>CR_DNT.3</td><td colspan="3">The DNet Interface imposes the following constraints, which may restrict the number of DeviceNet devices supported:
• The sum of all input message sizes from all input devices cannot exceed 496 bytes.
• The sum of all output message sizes from all output devices cannot exceed 492 bytes.</td></tr>
<tr><td>CR_DNT.4</td><td colspan="3">Regarding the existing cluster limit of 64 IOM connections per CPM and 24 IOM’s per downlink CNI:
• The DNET_IM block is the equivalent of 2 IOM’s in this calculation.
(NOTE: The DNET_DEVICE blocks that are associated with a given DNET_IM block are not counted in these limits. Only the associated DNET_IM block is counted.)</td></tr>
<tr><td>CR_DNT.5</td><td colspan="3">The three DeviceNet baud rates: 500 KBps, 250 KBps and 125KBps are supported.</td></tr>
<tr><td>CR_DNT.6</td><td colspan="3">The DNET_DEVICE block supports up to 16 DNET_INCHAN blocks and up to 16 DNET_OUTCHAN blocks.</td></tr>
<tr><td>CR_DNT.7</td><td colspan="3">The DNET_INCHAN block supports up to 32 Discrete inputs and up to 8 Numeric inputs.</td></tr>
<tr><td>CR_DNT.8</td><td colspan="3">The DNET_OUTCHAN block supports up to 32 Discrete outputs and up to 8 Numeric outputs.</td></tr>
<tr><td>CR_DNT.9</td><td colspan="3">The DeviceNet network is configured using the RSNetWorx for DeviceNet configuration tool. A license is required for each DeviceNet network employed.</td></tr>
</table>

Reference	Description
CR_DNT.10	The RSNetWorx for DeviceNet Configuration Tool may be supported on a computer node containing either a PCIC Module connected to the Supervisory ControlNet segment or using an RS-232 COM port connected to a 1770 –KFD Module residing on the DeviceNet network.
CR_DNT.11	The DeviceNet network is configured using the RSNetWorx for DeviceNet configuration tool. A license is required for each DeviceNet network employed.
CR_DNT.12	The RSNetWorx for DeviceNet configuration tool may be supported on a computer node containing either: • A PCIC Module connected to the Supervisory ControlNet segment, or • An RS232 COM port connected to a 1770-KFD module residing on the DeviceNet network.

Allen-Bradley Drive Interface Topologies

A-B Drive with C200

The following topology is an example of the integrated Experion /Allen-Bradley drive hardware with the C200 Controller.



Configuration Rules (ABD)

Reference	Description
CR_ABD.0	Each 1203-CN1 module supports only one drive.
CR_ABD.1	The 1203-CN1 module and the attached drive must reside on an I/O ControlNet segment that is physically isolated from unscheduled I/O communications.
CR_ABD.2	The 1203-CN1 module provides a connection for terminals capable of RS232 serial communications. This port can be used to edit the module's parameter and to upgrade the module's firmware. An Allen-Bradley 1203-SFC serial cable is required to use this port. As pictured, a dedicated computer (PC) can be used for configuration operations, or alternatively, a Experion Client Station node can be used for this purpose.
CR_ABD.3	The Human Interface Module is used to program the drive and to view various operating parameters.
CR_ABD.4	ControlNet or FTE is depicted for the supervisory network; however, Ethernet supervisory networks are also possible using non-redundant C200s only.
CR_ABD.5	Single or dual media ControlNet configurations are permitted for both the Supervisory Control Network and/or the I/O Network.
CR_ABD.6	A redundant controller configuration is depicted; however, non-redundant configurations are also permitted.

Fieldbus Interface Topologies

Fieldbus H1 network with non-redundant Series A FIM topology

The following figure shows a typical topology using a non-redundant Series A Fieldbus Interface Modules (FIMs) to interface with fieldbus devices on H1 networks.

ATTENTION

- The Series A Fieldbus Interface Modules are not supported over Ethernet segments.
- The Series A Fieldbus Interface Modules are supported in Fault Tolerant Ethernet networks.
- The Series A Fieldbus Interface Modules(FIM) can be used in a Redundant Chassis Pair to provide fieldbus redundancy. The Series A FIM can be located in redundant C200 Controller chassis or remote I/O chassis with Redundancy Module and no I/O Modules.

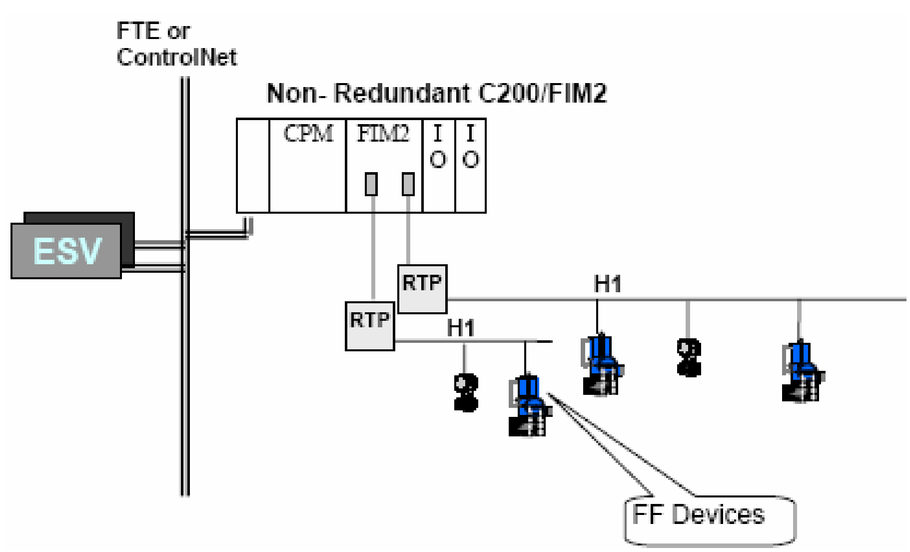


Figure 41 Non-Redundant Series A FIM topology

Configuration Rules (AF1)

Reference	Description
CR_AF1.0	The Series A FIM (also known as FIM2) is a **doublewide** module, utilizing two chassis positions and may be located in any pair of chassis slots in any size Series A chassis.
CR_AF1.1	FIM2s may co-reside with a controller, within the power constraints of a chassis.
CR_AF1.2	FIM2s may reside in a Series A **FIM-only chassis**. This chassis may reside on a Supervisory ControlNet or FTE Network or on an I/O ControlNet.
CR_AF1.3	Each C200 Controller can support FIM2s (redundant or non-redundant up to the maximums allowed per controller and per server) connected either to the Supervisory Network (ControlNet or FTE) or to an I/O ControlNet *under* the Controller, but not to both concurrently. In other words, **all** of the FIM2s connected to a single controller must reside either on the Supervisory Network or on the I/O Network, but not split between the two locations. Different C200s in the same Cluster may use either of these configurations simultaneously; for example, one C200 uses FIM2s on the Supervisory Network, and another uses FIM2s on its I/O Network.
CR_AF1.4	FIMs are **not** supported on any Experion Cluster (in any location) using Ethernet Supervisory network; for example, using TC-CEN011 (obsolete) or TC-CEN021 Ethernet Modules in the C200s.
CR_AF1.5	The use of FIMs by a controller will reduce the allowed I/O used by that controller based upon the IO Unit loading limits.
CR_AF1.6	All FIM2 capacity limits must be observed.
CR_AF1.7	The recommended maximum number of **single-variable publications per second** on an H1 link is **16**. The maximum **percentage of publications** permitted in the schedule is **50%,** guaranteeing time for alerts and client-server communications. (Each Pub requires a Compel Data (CD) to kick it off + the Analog pub time. The two consume about 28ms. So 28ms x 16 = 448ms. When housekeeping functions like token passing and time distributions are included, the total is ~ 50% of bandwidth.
CR_AF1.8	The macrocycle is the longest cyclic period on the link. It may have a maximum of **4 sub-schedules**. For example, a 2000 ms macrocycle could have sub-schedule periods of 1000 ms, 500 ms, and 250 ms. (Sub-schedule periods must be exactly divisible into the macrocycle period.)

Reference	Description
CR_AF1.9	A given FIM2 can connect to a maximum number of 5 C200 controllers (using peer-to-peer connections).
CR_AF1.10	Non-redundant FIM2s may be co-resident in a chassis with I/O modules, keeping in mind the capacity displacement of two (2) IO Units for each FIM2 for the 64 I/O limit, and 3 IO Units for the 24 IO/CNI limit.
CR_AF1.11	**FF H1 Wiring rules:** The ISA SP50.02 standard and the Fieldbus Foundation specify rules for maximum wire and spur lengths based on cable type. Although the rules have some complexity, there are simplified guidelines that apply in most instances.
CR_AF1.12	The FIM2 is **not** intended for use with the **5 ms CEE** execution because CEE execution generally exceeds FF sampling and transport rates.
CR_AF1.13	The FIM2 is **not** intended for use with any CEE that executes more frequently than the FF device sampling and transport rate and CDA transport rate.
CR_AF1.14	A FIM2 can communicate to a single or to **multiple controllers** using CDA services. **Notes:** Rule CR_AF1.15 will constrain FIM2 communications to multiple controllers only when the FIM2 chassis is resident in the Supervisory ControlNet or FTE.
CR_AF1.15	FIM2 Peer-to-Peer connections are limited to a **single "hop**" (network segment) from one network node to another node on a ControlNet or FTE network. For example, a C200 or ACE cannot talk to a FIM2 on a remote ControlNet I/O segment belonging to another C200, because it would have to go across the Supervisory Network (first hop) and then across the I/O Network (second hop).
CR_AF1.16	Series D or E CNI modules must be used in conjunction with the FIM2 on any ControlNet segment.
CR_AF1.17	FIM2s may be used in systems that also contain Experion Console Station-TPS (EST) nodes, but the number of Console Stations in such a mixed system cannot exceed 10.

Redundant Series A FIM topology

The Series A FIM supports redundancy by being located in a Redundant Chassis Pair (RCP) along with a Redundancy Module (RM) located in each chassis, along with another FIM2 located in the same slot position in the other (secondary) chassis. These Series A FIM pairs are then connected to a common RTP (Remote Termination Panel) and then to the H1 segment for each of the two H1s supported. Redundant Series A FIMs can reside on the Supervisory Network - ControlNet or FTE (not shown) or they can reside on an I/O ControlNet segment *below* a C200, as shown in the following figure.

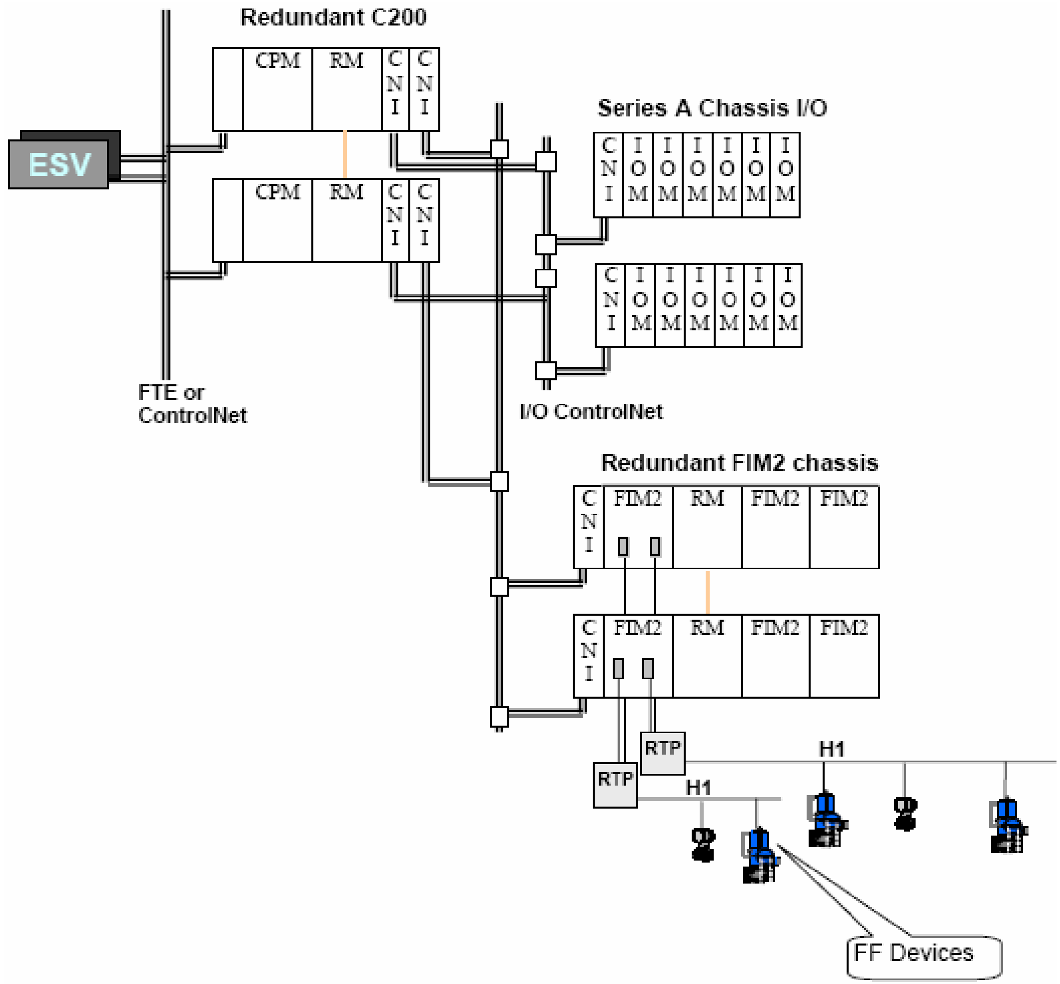


Figure 42 Redundant Series A FIM topology

Configuration Rules (AF2)

Reference	Description
CR_AF2.0	Redundant Chassis Pairs must be configured identically - same size chassis, same Redundancy compliant module types located in the same slots in each chassis, and one Redundancy Module per chassis connected with an RM Fiber cable. This rule applies to Controller Redundant chassis with Series A FIMs, as well as Redundant Series A FIM-only chassis.
CR_AF2.1	Quantity of FIM2s per chassis is subject to available slots and power. CNI(s) and RMs must be considered. A remote I/O chassis, for example, will support a CNI, RM and up to 6 FIM2s. A C200 Controller chassis will support a CNI, C200, and RM and up to 4 FIM2s and up to two more CNIs or up to 3 FIM2s and an additional IOLIM within power constraints.
CR_AF2.2	Series A FIM-only redundant chassis CNI modules will follow the same ControlNet MACID address assignment rules as those applied to Controller RCP chassis.
CR_AF2.3	A Redundant Series A FIM-only chassis can support only one CNI module that is connected to either the Supervisory ControlNet or to a Remote I/O ControlNet segment under a C200 Controller chassis.
CR_AF2.4	FTE Bridge module based Series A FIM-only or Redundant Series A FIM-only chassis may only be connected to the FTE supervisory network, and must follow the same FTE Device Index assignment rules as FTE Bridge module based C200 chassis.
CR_AF2.5	Redundant FIM2s must use the new redundant compliant Fieldbus RTP – part number TC-FSU01.
CR_AF2.6	Cannot mix redundant and non-redundant FIM2s in the same chassis.
CR_AF2.7	The number of FIM2s per downlink CNI must be calculated using **3 IO Units** for each non-redundant FIM2 and **4 IO Units** for each Redundant-FIM2 with a maximum of **24 IO Units** maximum allocated for each downlink CNI.
CR_AF2.8	The following table describes the allowable combinations of redundant and non-redundant FIM2s per C200.

Table 1 Allowable combinations of redundant and non-redundant Series A FIMs per C200

Redundant FIM2s	Non-Redundant FIM2s	Active (Primaries)	Total Physical FIM2s	Total IO Units To Be Divided Into 24 CNI	Downlink CNIs Required
0	21	21	21	63	3
1	20	21	22	64	3
2	19	21	23	65	3
3	18	21	24	66	3
4	16	20	24	64	3
5	14	19	24	62	3
6	12	18	24	60	3
7	10	17	24	58	3
8	8	16	24	56	3
9	6	15	24	54	3
10	4	14	24	52	3
11	2	13	24	47	2
12	0	12	24	48	2

Series C FIM topology

The Series C FIM (also known as FIM4) resides on FTE and supports 4 H1 segments. It can be configured in a non-redundant or redundant configuration. Redundant FIM4s are configured by placing pairs of FIM4s in a redundant IOTA (I/O Termination Assembly) as show in the following figure.

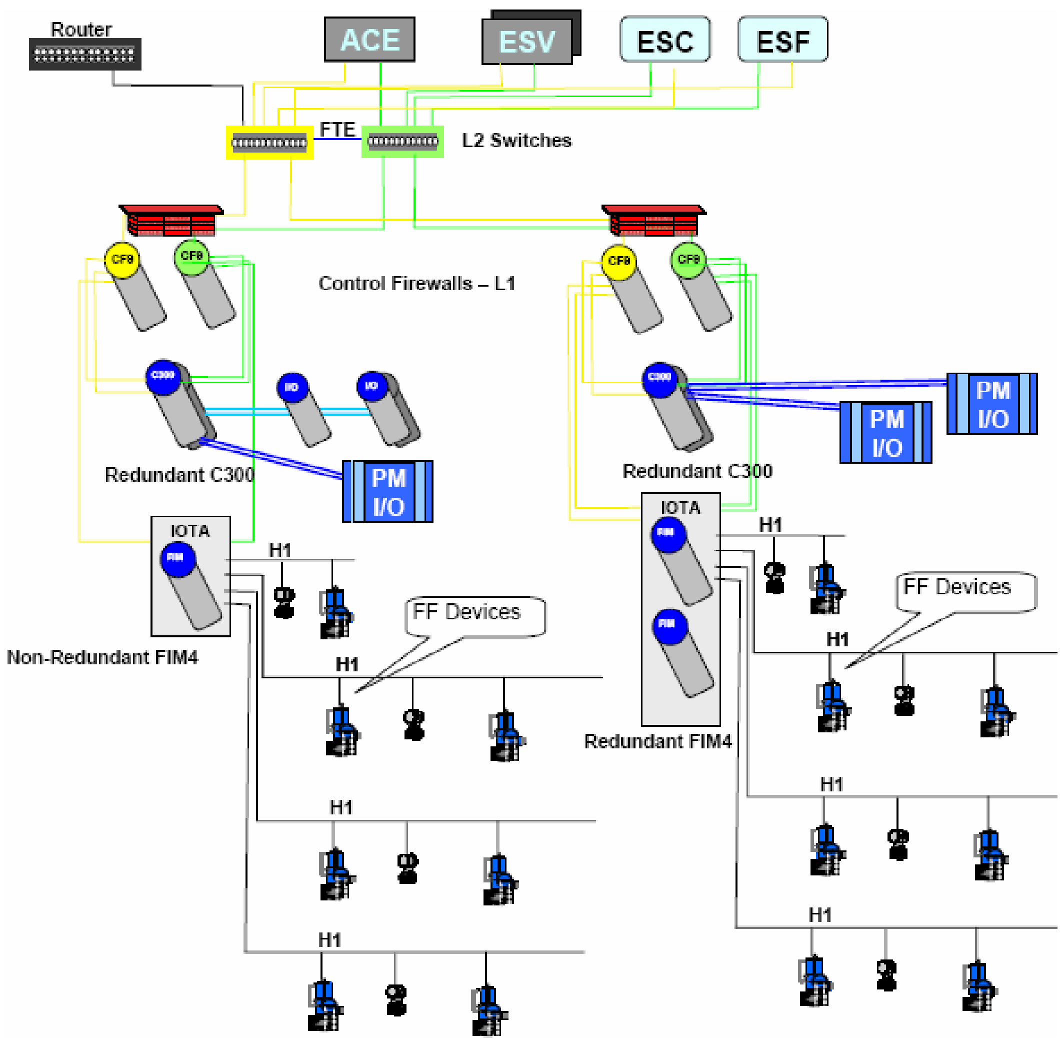


Figure 43 Basic Series C FIM topology

Configuration Rules (CF1)

Reference	Description
CR_CF1.0	The Series C FIM (aka FIM4) is a standalone module that will be present directly on the supervisory FTE network through the control firewall (CF9).
CR_CF1.1	The C200 Controller does not support the FIM4.
CR_CF1.2	Each C300 Controller can support FIM4s (redundant or non-redundant up to the maximums allowed per controller AND per server) connected to the L1 FTE Network.
CR_CF1.3	The use of FIM4s by a controller will reduce the allowed I/O used by that controller based upon the IO Unit loading limits specified.
CR_CF1.4	All FIM4 capacity limits must be observed.
CR_CF1.5	The recommended maximum number of **single-variable publications per second** on an H1 link is **16**. The maximum **percentage of publications** permitted in the schedule is **50%,** guaranteeing time for alerts and client-server communications. (Each Pub requires a Compel Data (CD) to kick it off + the Analog pub time. The two consume about 28ms. So 28ms x 16 = 448ms. When housekeeping functions like token passing and time distributions are included, the total is ~ 50% of bandwidth).
CR_CF1.6	The macrocycle is the longest cyclic period on the link. It may have a maximum of **4 sub-schedules**. For example, a 2000ms macrocycle could have sub-schedule periods of 1000ms, 500ms, and 250ms. (Sub-schedule periods must be exactly divisible into the macrocycle period.
CR_CF1.7	A given FIM4 can connect to a maximum number of 5 C300 controllers (using peer-to-peer connections).
CR_CF1.8	**FF H1 Wiring rules:** The ISA SP50.02 standard and the Fieldbus Foundation specify rules for maximum wire and spur lengths based on cable type. Although the rules have some complexity, there are simplified guidelines that apply in most instances.
CR_CF1.9	The FIM4 is **not** intended for use with any CEE that executes more frequently than the FF device sampling and transport rate and CDA transport rate.
CR_CF1.10	A FIM4 can communicate to a single or to **multiple controllers** using CDA services.
CR_CF1.11	FIM4s may be used in systems that also contain Experion Console Station-TPS (EST) nodes, but the number of Console Stations in such a mixed system cannot exceed 10.
CR_CF1.12	Redundant FIM4 Pairs require a redundant IOTA. A non-redundant IOTA cannot be used for FIM4 redundancy.

Maximum redundant Series C FIM topology

Since each Series C FIM or Redundant Series C FIM must be connected to a control firewall (CF9), the following topology example shows how 15 redundant Series C FIMs would be configured with one redundant C300 using the minimum number of CF9 modules. This is just one example, and therefore variations using more CF9s or connecting to different CISCO switches is also allowed. Also, since the CF9 supports Fiber, the link from the CF9 to the CISCO Switches may also be a Fiber link for remote geographies.

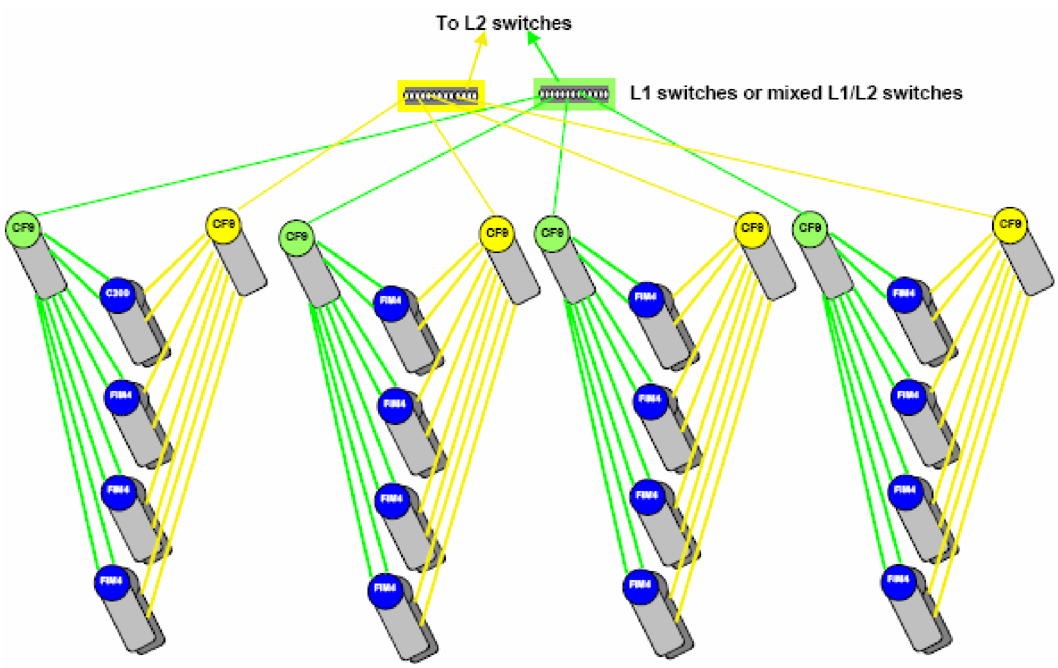


Figure 44 Maximum C300, Series C FIM and Control Firewall topology

Simulation Topologies

The following figures show how C200 and ACE simulation nodes may be configured in an Experion Cluster. Both the SIM-C200 and the SIM-ACE are loaded on a server node commonly called an SCE node (Simulation Control Environment). SIM-C200 and SIM-ACE Nodes are supported on both ControlNet and FTE based systems. Example topologies and configuration rules for both system types are shown below.

ControlNet simulation topology

The following figure shows a typical simulation topology using ControlNet media.

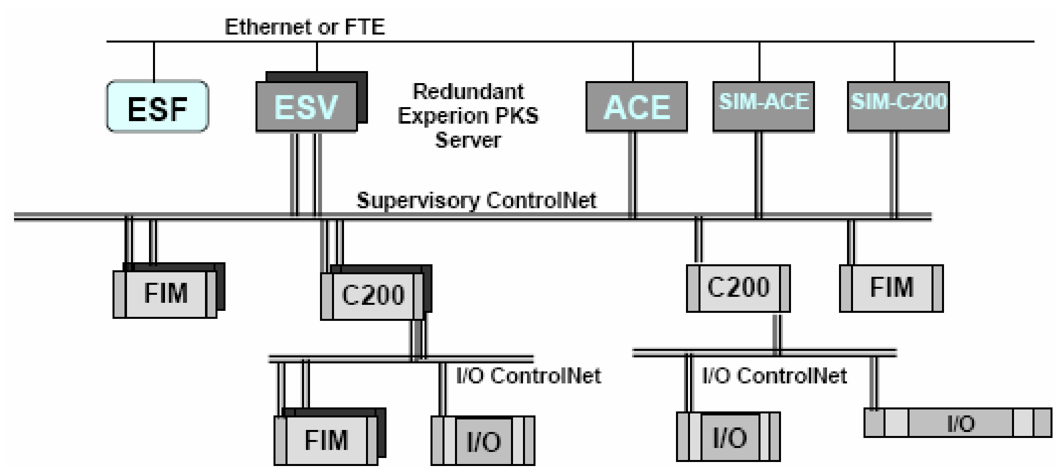


Figure 45 Typical ControlNet Simulation Topology

FTE simulation topology

The following figure shows a typical simulation topology using FTE media.

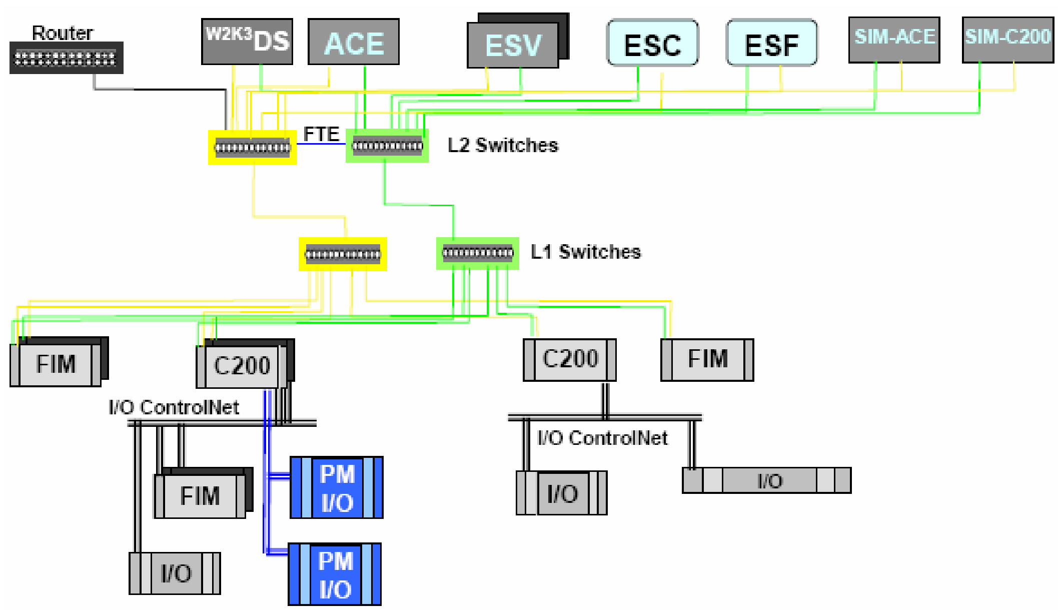


Figure 46 Typical FTE Simulation Topology

Configuration Rules (SC2)

Reference	Description
CR_SC2.0	Licensed per Experion server. Can license up to 10 SIM-C200s per server.
CR_SC2.1	Each SIM-C200 counts as a controller against the 16-controller/server limit.
CR_SC2.2	Requires a *server-grade* computer platform (uses Windows Server 2003). If loading more than one SIM-C200 per computer, then an MZ-NTPC05 or MZ-NTPC07 (dual processor server) is required.
CR_SC2.3	Multiple SIM-C200 instances are supported on the same hardware node. Up to two per CPU are supported with guaranteed determinism (4 per dual CPU server).
CR_SC2.4	The computer can support FTE or Ethernet and/or ControlNet. Data Access to the SCE will always be to the server (or Console Station) through Ethernet or FTE.
CR_SC2.5	The SIM-C200 supports peer-to-peer to an on-process C200s, FIMs, or ACEs on a ControlNet or FTE Supervisory Network. For ControlNet, a PCIC card is

Reference	Description
	required. If the Supervisory Network is FTE, no PCIC card is required.
CR_SC2.6	SIM-C200 peer-to-peer with a C200 on non-redundant CIP Ethernet is not supported.
CR_SC2.7	A SIM-C200 node can read data from a C200, FIM, or ACE, but it cannot write data to any of these nodes
CR_SC2.8	The SIM-C200 license does not include Experion server software. That must be purchased separately. **For on-process systems**, the server is a separate computer and Experion server software and SIM-C200 software cannot be loaded on the same platform.

Configuration Rules (SAE)

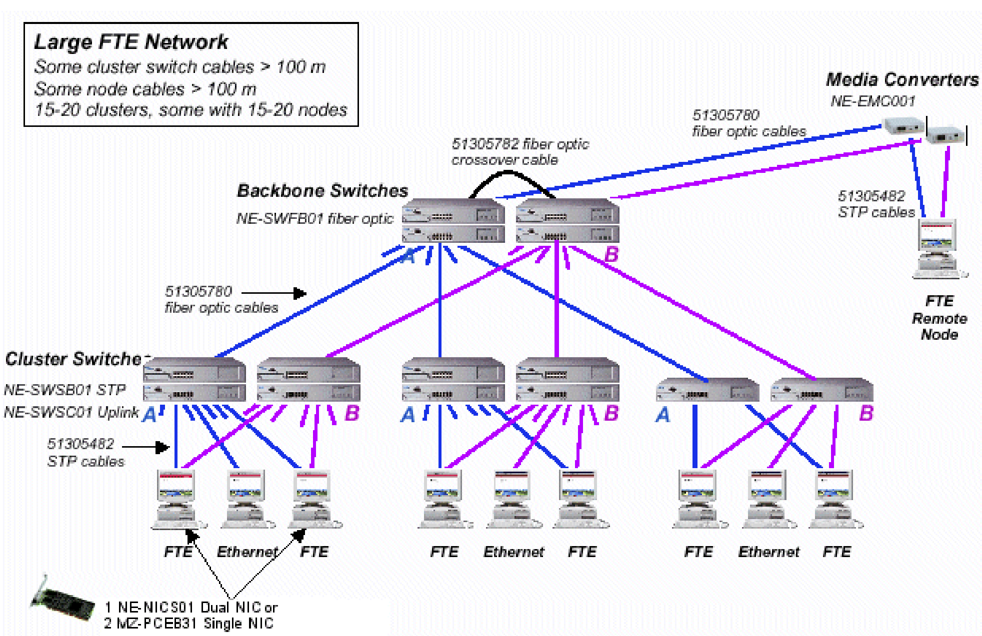
Reference	Description
CR_SAE.0	CAB and CDB blocks can run on the SIM-ACE platform, but will not run on the C200 embedded controller.
CR_SAE.1	Up to 5 ACEs (Both ACE and SIM-ACE together 5) are supported per Experion server.
CR_SAE.2	If SIM-ACE is used as a standalone simulation system, the number of SIM-ACEs shall not exceed 5 (the number of ACEs supported on an on-process system).
CR_SAE.3	Multiple SIM-ACE instances are supported on the same hardware node. Up to two per CPU are supported with guaranteed determinism (4 per dual CPU server).
CR_SAE.4	Only one Visual Studio debug session at a time can be attached to a SIM-ACE for CAB debugging.
CR_SAE.5	SIM-ACE and ACE must not be configured on the same hardware node.
CR_SAE.6	SIM-ACEs and SIM-C200s are not supported on the same hardware node.
CR_SAE.7	SIM-ACE or SIM-C200 executables may not run on the physical Experion server node. Each requires a dedicated hardware platform.
CR_SAE.8	Up to 2 SIM-ACEs are supported directly connected to the same ControlNet.
CR_SAE.9	A single ACE can have a maximum of 30 connections to components connected through FTE Bridge or ControlNet. Connected components include C200s and FIMs. The SIM-ACE shall not reduce the number of SIM-C200 nodes currently supported per Experion server (currently 16).

Communication Media

Fault Tolerant Ethernet

Honeywell's unique Fault Tolerant Ethernet (FTE) solution offers a full function replacement for present control networks using common Ethernet equipment. FTE technology creates a network with no single point of hardware or software failure. It is transparent to open applications and supports TCP, UDP, IP Multicast, and Broadcast. Honeywell supplies the patented software, the dual network interface card, switches, a media converter, CAT5 and fiber optic cables, as shown in the following figure. Some general installation considerations are:

- An FTE base switch has 12 ports, expandable up to 96 ports in 12-port increments
- The FTE network can consist of up to 511 FTE nodes (dual-connected) plus up to 511 Ethernet nodes (singly-connected)
- A firewall is required between an FTE network and any other network.
- The cable options include shielded twisted pair (STP) and fiber optic. These cables are recommended for best noise immunity and network performance, and are required for CE Mark.



REFERENCE - EXTERNAL

For more information about Honeywell's Fault Tolerant Ethernet, please refer to the *Fault Tolerant Ethernet (FTE) Specification and Technical Data EP03-500-110*. Note that the document number may be different for the most current issue.

Ethernet

While Ethernet TCP/IP is used worldwide in general industrial and office environments, it has only recently been introduced as a viable communications media for control components on the plant floor due to performance enhancements in switching technology.

Benefits of Ethernet

The following are some benefits derived from using Ethernet.

- Has become the industry standard network.
- Widely supported by a host of third party hardware and software manufacturers.
- The support of many media types to allow almost limitless topologies.
- Wide range of off-the-shelf network management tools to aid in system setup, trouble-shooting, and integration.
- Can be easily expanded in the future, if the needs of the user grow. The key to the seamless interoperability of Ethernet devices is standards compatibility. By leveraging a standards-based solution, a network can grow without sacrificing initial investments.

Ethernet as applied to Process Control

An application that could be well suited for real-time control on an Ethernet network is a machine with a well-defined, cyclic process that could tolerate occasional fluctuations in inter-message timing and message response time. The key is to manage the following four major elements:

- Number of devices in the system,
- Frequency of data exchanges,
- Sizes of data packets that are delivered, and
- Traffic management

The greater the control over these elements, the greater the likelihood of successfully implementing an Ethernet-based solution. Keep in mind that Ethernet networks are not deterministic, are subject to collisions, deferred transmissions, and other anomalies, which may delay the arrival of critical data packets. Traffic management is somewhat minimized by the incorporation of per port switching devices.

CAUTION	It may not be appropriate to use Ethernet communications in high-speed control applications. Be sure your control application can tolerate occasional fluctuations in inter-message timing and message response time.

Ethernet Networking

Ethernet networking is governed by the IEEE 802.3 specification. Refer to this specification for cabling and interconnection detail information.

Ethernet Switching and Routing

Because of the nature of collision detection of Ethernet, the Ethernet network is particularly susceptible to performance degradation during sustained high load conditions, particularly when the high load is distributed among a large number of nodes. When a network is experiencing a large number of collisions due to increased load, it is common to segment the network into separate collision domains.

Segmenting networks allows the network to be separated into a series of multiple collision domains. This is done by identifying the traffic patterns on the network and putting in devices to better isolate the traffic. Routing is typically used to separate the traffic between LANs. Switching is incorporated to manage the traffic within one LAN. When you deploy a switch on every port, each port is then its own collision domain. Collisions between devices attached to the switch do not occur. Through the proper use of switches, a user can assure proper load balancing and reduce the number of collisions and deferred transmissions. Depending upon traffic patterns, this may restore an overloaded network to a reasonable level of performance.

Please note that under light or moderate network loading conditions, (network utilization less than 30 percent), collisions will not greatly adversely affect the overall system performance. Users can lessen the load on a single collision domain by separating the highest transmitting nodes into separate collision domains. It is important that the sustained load on the Ethernet network not exceed 30% network utilization.

ControlNet

ControlNet is a deterministic real time control network, which provides a high degree of protocol efficiency by utilizing an implied token passing mechanism on a high-speed (5 Mbps) serial communication system. By allowing all devices on the network equal access to the network within a specified time slice, time critical data can be guaranteed network time to produce repeatable and predictable results.

Network access is controlled by a time-slice algorithm called Concurrent Time Domain Multiple Access (CTDMA), which regulates a node's opportunity to transmit in each network interval. You configure how often the network interval repeats by selecting a network update time (NUT) interval. The fastest interval you can specify is 2 ms.

Information that is time-critical is sent during the scheduled part of the network update time interval. Information that can be delivered without time constraints (such as configuration data) is sent during the unscheduled part of the network update time interval.

Benefits of ControlNet

The following are some benefits derived from using ControlNet.

- Bandwidth for I/O, real-time interlocking, peer-to-peer messaging and programming.
- Deterministic, repeatable performance for both discrete and process applications.
- Multiple controllers controlling I/O on the same link.
- Multicast of both inputs and peer-to-peer data.
- Media redundancy and intrinsically safe options.
- Simple installation requiring no special tools to install or tune the network.
- Network access from any node.
- Flexibility in topology options (bus, tree, star) and media types (coax, fiber, other).

ControlNet Networking

A ControlNet Network is a single coax trunk cable broken up into segments interconnected by links. Node Connections to the network is through a Tap and drop cable. Repeaters are used to link segments together and for changes in media from coax to fiber optic. All points on the network must either have an interface card or a Terminator. Terminators are comprised of Termination resistors, which are used to mark the beginning and end of a trunk segment and TDLs (Tap Dummy Load) which terminate a drop cable when no node is present.

ControlNet Network Residency Reference

The following table summarizes supported uses of various nodes on the ControlNet networks. The terms “rack” and “chassis” are used interchangeably.

ControlNet Chassis and Node Network Residency					
Node:	***Super-visory CNet***	***Super-visory E'Net***	***I/O Net***	***Auxiliary Downlink Net***	***Con-joined Net***
Application Control Environment (ACE) Supervisory Controller	**Yes (optional)**	**No**	**No**	**No**	N/A
SIM-C200 Node	**Yes (optional)**	**No**	**No**	**No**	N/A
Non-Redundant C200 Controller Chassis	**Yes**	**Yes**	No, except as master of Net	**Yes** (Only as downlink)	N/A
Redundant C200 Controller Chassis Pair	**Yes**	No	No, except as master of Net	**Yes** (Only as downlink)	**Yes** (1 only)
Remote I/O Chassis	No	No	**Yes**	No	**Yes**
Rail I/O Adapters	No	No	**Yes**	No	**Yes**
FIM-Only Chassis	**Yes**	No	**Yes**	No	**Yes**
Redundant FIM Chassis Pair (RFP)	Yes	No	**Yes**	No	**Yes**
Remote Mixed Chassis	No	No	**Yes**	No	**Yes**
Supported AB Drive Controllers	No	No	**Yes** But only Drive Controllers and LD Nodes	No	No
PLCs, etc.	**Yes**	**Yes**	No	**Yes**	No

System Configuration Examples Using ControlNet

Small-scale system example

The following figure illustrates an example of a small-scale system configuration using chassis I/O. This example configuration is defined as:

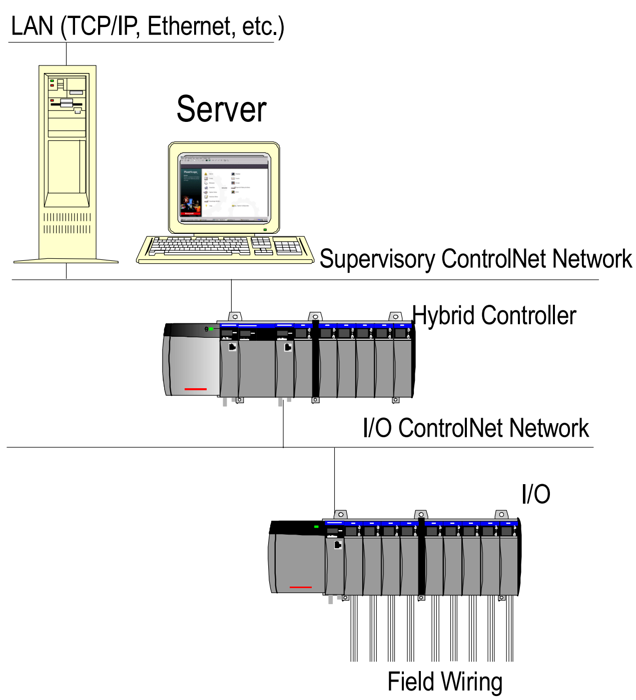
1 Experion Server—

providing both server and client (operator/
engineering) functionality

1 Process Controller—

providing 92 points, configured as:

- 32 AI points
- 12 AO points
- 32 DI points
- 16 DO points



Small scale system configuration rules

- The use of the Microsoft Loopback Adapter Driver is required, if the system does not include a configured Ethernet card.
- The Application Control Environment (ACE) supervisory controller is **not** qualified to run on the Experion Server Node.

Medium-scale system configuration example

The following figure illustrates an example of a medium-scale system configuration using chassis I/O. This example configuration is defined as:

1 Experion Server—

providing non-redundant system server functionality

1 C200 Controller—

providing 222 points, configured as:

- 60 AI points
- 18 AO points
- 96 DI points
- 48 DO points

1 C200 Controller—

providing a total of 150, points configured as:

- 16 AI points
- 6 AO points
- 96 DI points
- 32 DO points

3 Experion Clients—

providing operator and engineering station functionality

1 C200 Controller pair—

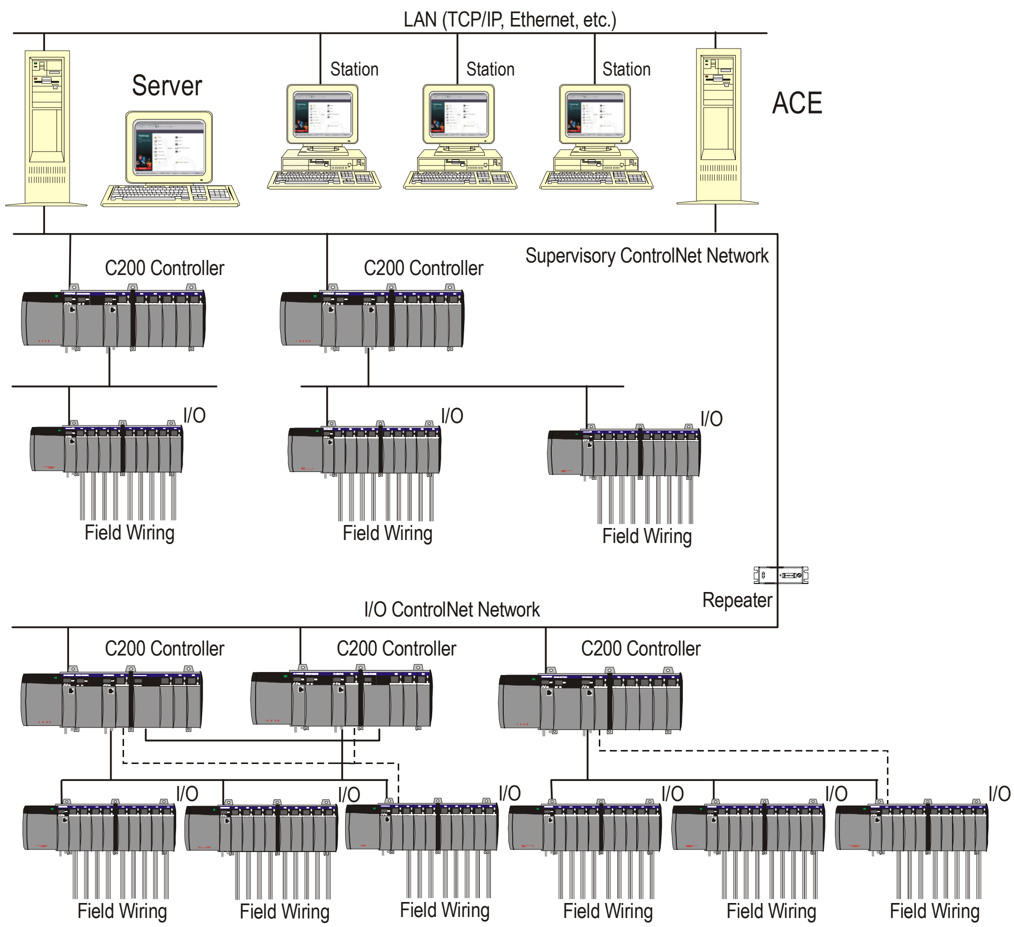
providing 360 points, configured as:

- 128 AI points
- 40 AO points
- 128 DI points
- 64 DO points

1 C200 Controller pair—

providing 492 points, configured as:

- 22 AI points
- 6 AO points
- 320 DI points
- 144 DO points


LAN (TCP/IP, Ethernet, etc.)
Server
Station
Station
Station
ACE
Supervisory ControlNet Network
C200 Controller
C200 Controller
I/O
I/O
I/O
Field Wiring
Field Wiring
Field Wiring
Repeater
I/O ControlNet Network
C200 Controller
C200 Controller
C200 Controller
I/O
I/O
I/O
I/O
I/O
I/O
Field Wiring
Field Wiring
Field Wiring
Field Wiring
Field Wiring
Field Wiring

Large-scale system example

The following figure illustrates an example of a large-scale system configuration using chassis I/O. This example configuration is defined as:

1 redundant Experion Server pair—

providing redundant system server functionality

5 Experion Clients—

providing operator and engineering station functionality

1 C200 Controller—

providing 92 points, configured as:

- 32 AI points
- 12 AO points
- 32 DI points
- 16 DO points

1 C200 Controller—

providing 222 points, configured as:

- 60 AI points
- 18 AO points
- 96 DI points
- 48 DO points

1 C200 Controller pair—

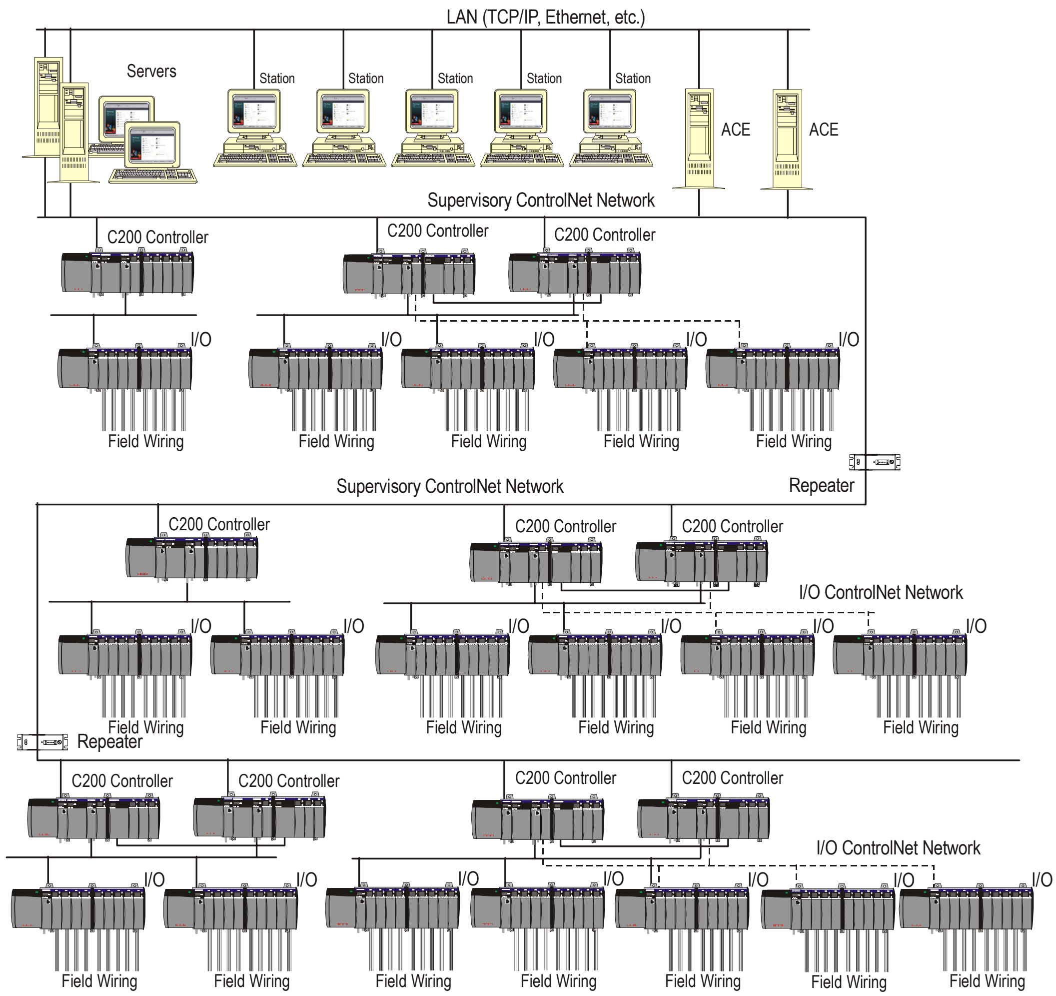
providing 360 points, configured as:

- 128 AI points
- 40 AO points
- 128 DI points
- 64 DO points

1 C200 Controller pair—

providing 360 points, configured as:

- 128 AI points
- 40 AO points
- 128 DI points
- 64 DO points



General configuration rules

- An Experion Server can only be configured with one (1) PCIC Module for a ControlNet supervisory network, a network interface card for an Ethernet supervisory network, or dual network interface cards for Fault Tolerant Ethernet (FTE) supervisory network.
- Support for, Fault Tolerant Ethernet, ControlNet, and Ethernet to different C200 Controllers simultaneously from the same Server is not supported.

- Only non-redundant C200 Controllers can be used with an Ethernet supervisory network.
- Remote I/O chassis are **not** supported over any Ethernet or FTE segment, supervisory or downlink. A downlink ControlNet segment must still be used to support remote I/O.
- Experion Station nodes may reside on the same Ethernet segment as the C200 Controllers for small systems when the total number of Stations (not counting the Server) plus C200 Controllers totals four (4) or less. For example, 1 Station plus 3 C200s; or 2 Stations plus 2 C200s, etc.
- The Ethernet supervisory network segment does **not** support a redundant Ethernet configuration.
- Fieldbus Interface Modules (FIMs) are **not** supported on Experion systems configured with an Ethernet supervisory network.
- The ACE node is **not** supported connected to an Ethernet supervisory network configuration.
- FTE connected Servers do **not** support Ethernet supervisory network, since FTE does **not** run on nodes with three network interface card ports,
- The ACE supervisory controller is supported on either:
  - Non-redundant Ethernet,
  - Redundant Ethernet, or
  - Fault Tolerant Ethernet segment connected to the Experion Server.
- The ACE node can be directly connected to the supervisory ControlNet or Fault Tolerant Ethernet segment, if required to support peer-to-peer communication with C200 Controllers.
- All ACE to Server traffic uses the Ethernet or FTE media link. Only ACE peer-to-peer connections with C200 Controllers will use the ControlNet or FTE supervisory network link.
- The ACE application is **not** qualified to run on the Experion Server node.
- Only two (2) ACE nodes can be supported per Server.

C200 and PM I/O Hardware Configuration

Planning Your Control and I/O Hardware

ATTENTION

All hardware modules are loaded with the latest firmware version at the factory. This firmware may not be qualified for Experion releases earlier than the current revision, and may require that you down grade the firmware rev applicable to your specific release of Experion or Experion software using the NetworkTools utility. See the Software Change Notice and the Software Installation Guide provided with your Experion software for applicable firmware version and download details.

C200 Controllers

You can install C200 Controllers in a non-redundant or redundant configuration. The redundant configuration includes a second chassis with matching Control Processor Module (CPM) and Redundancy Module hardware in a configuration referred to as a Redundant Chassis Pair (RCP). Since redundancy provides the most security, it should be used wherever possible. However, it is not mandatory and it is not supported by all Input/Output interface options as noted in the following table.

ATTENTION

You **cannot** use a Redundant Chassis Pair in a supervisory Ethernet network.

If Controller Configuration Is. . .	Then, These Modules Are Controller Chassis Compatible. . .
Redundant	Fault Tolerant Ethernet (FTE) Bridge module
	ControlNet Interface Module (CNI, Latest Version)
	Control Processor Module (CPM, C200 Version)
	Redundancy Module (RM)
	Fieldbus Interface Module (FIM)
	I/O Link Interface Module (IOLIM)
	Battery Extension Module (BEM)

If Controller Configuration Is. . .	Then, These Modules Are Controller Chassis Compatible. . .
Non-redundant	Fault Tolerant Ethernet (FTE) Bridge module ControlNet Interface Module (CNI) Ethernet Module Control Processor Module (CPM, C200 Version and obsolete C100 Version – if applicable) Chassis I/O Module I/O Link Interface Module (IOLIM) Fieldbus Interface Module (FIM) PROFIBUS Interface Module (PBIM) Pulse Input Module (PIM) Serial Interface Module (SIM)

The maximum combination of non-redundant Control Processors, redundant Control Processors and third-party PLC's per Supervisory ControlNet is 10.

Application Control Environment (ACE) supervisory controller

The ACE supervisory controller mirrors the basic operations of a Control Processor Module (CPM); it provides the additional capability of communicating with OPC Servers through a Fault Tolerant Ethernet (FTE) or redundant or non-redundant Ethernet network. The ACE program runs on a personal computer using a Windows 2000 Server operating system. Users can optionally connect an ACE supervisory controller directly to a ControlNet or Fault Tolerant Ethernet (FTE) supervisory network to support peer-to-peer communications with a C200 Controller.

The following is a summary of some things to consider when implementing an ACE supervisory controller.

- ·The ACE supervisory controller requires system Server and Station programs to support Operator Interface, History, and other functions, just like the Control Processor Module (CPM).
- ·The ACE supervisory controller and its control strategies are configured using the Control Builder application.

- ·Only one ACE environment is supported per dedicated computer running Windows 2000 Server operating system.
- ·Do **not** load system Server/Client, Station, or Control Builder program on a dedicated ACE computer.
- ·A maximum of two ACE supervisory controllers is supported per system Server.
- ·Redundant ACE supervisory controllers are **not** supported.
- ·The CEE supports execution of a set of function blocks for solving control applications and runs in the ACE supervisory controller as a subsystem in conjunction with the Control Data Access - supervisory platform (CDA-sp) subsystem.
- ·Only one CEE per ACE supervisory controller is supported.
- The ACE supervisory controller can peer-to-peer with other ACE supervisory controllers connected to the same Server over Fault Tolerant Ethernet or Ethernet network.
- The ACE supervisory controller that has a direct connection to the ControlNet or FTE supervisory network can peer-to-peer with C200 Controllers that belong to the same Server.

Third-Party controllers

When connecting third-party controllers to your system consider:

- How many controllers are there.
- Their type and model.
- You may use the communication interfaces provided with Experion for supported non-Experion controllers.
- You will need to use the User Scan Task Kit to write interfaces to communicate with controllers not supported by Experion. You may do this yourself, or contract with your Honeywell representative for this service.
- Will the controllers be connected to the server database directly, or by terminal servers, Ethernet, or by modems? Using terminal servers can help to save cabling costs, as multiple controllers can be connected to the terminal server; the terminal server is connected to the server database by a single cable. For that are geographically dispersed, you can also use links provided by X25, ISDN, microwave, fiber optics, satellite, radio, or leased line.

- What field devices will connect to the third-party controllers?
- Your scanning strategy for these third-party controllers.

ControlNet Interface (CNI)

The ControlNet Interface module (CNI) enables communication by way of the ControlNet network between the Server and its associated databases to the C200 Controllers, and between the C200 Controllers and I/O Modules. Also, the ACE supervisory controller is included in the communications path when it is connected to the supervisory ControlNet.

A maximum of five CNIs are allowed in the configured controller chassis, consisting of one uplink CNI to the Server and up to four optional downlink CNIs to optional remote I/O chassis.

CNI models TC-CCN014 and TC-CCR014 or TK-CCR014 are required for use in redundant controller chassis. Earlier CNI models TC-CCN013 or TC-CCN012 and TC-CCR013 or TK-CCR013 or TC-CCR012 or TK-CCR012 may be used but they may not fully support the latest enhancements.

ATTENTION

The model numbers beginning with the prefix "TK" are for the coated version of the module.

CNI model numbers using N, as in TC-CCN014, are for non-redundant ControlNet cable only and are the configuration default due to lower user cost. When redundant ControlNet cable configuration is necessary for greater network security, model numbers using R, as in TC-CCR014, must be used.

Refer to *Planning Your Chassis Configurations* for more information about CNI placement in your chassis.

Fault Tolerant Ethernet Bridge

The Fault Tolerant Ethernet (FTE) Bridge module (model TC-FTEB01/TK-FTEB01) enables communication by way of Honeywell's Fault Tolerant Ethernet network between the Server and its associated databases to the C200 Controllers and/or Fieldbus Interface Module (FIM) only chassis. Also, the ACE supervisory controller is included in the communications path when it is connected to the ControlNet or FTE supervisory network.

Only one FTE Bridge module is allowed per C200 Controller or FIM only chassis.

I/O Input Modules

Input modules convert ac or dc On/Off signals from user devices to appropriate logic level for use within the Control Processor. Typical input devices include:

- proximity switches
- limit switches
- selector switches
- float switches
- pushbutton switches
- Field transducers such as tachometers and flow meters.

I/O Output Modules

Experion output modules may be used to drive a variety of output devices. Typical output devices compatible with the Experion outputs include:

- motor starters
- solenoids
- indicators

When designing a system using output modules, you must consider:

- the voltage necessary for your application
- whether you need a solid state device
- current leakage
- if your application should use sinking or sourcing circuits.

When designing a system, make sure that the outputs can supply the necessary surge and continuous current for proper operation. Take care to make sure that the surge and continuous current are not exceeded. Damage to the module could result.

When sizing output loads, check the documentation supplied with the output device for the surge and continuous current needed to operate the device.

Some digital outputs have internal electronic or mechanical fusing to prevent too much current from flowing through the module. This feature protects the module from electrical damage. Other modules require external fusing.

Some chassis output modules are capable of directly driving chassis input modules. The exceptions are the ac and dc diagnostic input modules. When those modules are used, a shunt resistor at each input is required for leakage current.

ATTENTION

For more information about chassis I/O's see the *Control Hardware Installation Guide*:

- *Preparing to Install I/O Modules*.
- *Installing I/O Modules*.
- *Removing I/O Modules*.

And refer to the *Control Builder Components Theory*:

- Some Underlying Concepts.

I/O configuration

Experion uses Control Builder, an object-oriented software tool to configure I/Os in the form of I/O Module Blocks and I/O Channel Blocks.

I/O redundancy

The chassis I/O system does not currently support redundant I/O. Redundancy of the control system is achieved at the controller level.

The Process Manager I/O does support redundant I/O through the I/O Link Interface Module.

To provide overall redundancy for maximum security, a redundant ControlNet network is recommended when redundant controllers are used.

REFERENCE - INTERNAL

Please refer to one or more of the following Knowledge Builder references for more information on a given version of I/O that is available with the system.

- *Control Hardware Installation GuideFieldbus Interface Module User's GuideRail I/O Series H Implemenation Guide*
- *Rail I/O Series A Implementation Guide*
- *PROFIBUS Interface Implementation Guide*
- Serial *Interface Module Implementation Guide*

Planning Your Chassis Configurations

Background

The Experion system supports chassis of 4, 7, 10, 13, or 17 slots. All chassis may be used as a controller chassis or an I/O chassis if enough slots are available for the application.

Power supplies

A power supply always attaches to the left-end of a chassis. It does not use a slot in the chassis. The Experion system provides power supplies for both AC (120/240 Vac) and DC (24 Vdc) supply voltage inputs. An optional redundant power supply configuration is also available. Refer to the *Redundant Power Supply Installation Guide*

CAUTION

Modules assigned to a chassis must not overload its power supply. Refer to the Experion specifications to ensure that no power supplies are overloaded.

The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm Just follow the Experion product links.

C200 Controller chassis configuration

The factory default size for a redundant C200 Controller (also known as Process Controller) chassis is 10 slots. This provides room for the minimum of necessary modules, typical option modules, and several spare slots. Other chassis sizes are permitted. Your selection is ultimately dependent on the mounting space available and the number of slots desired for other modules. The 7-slot chassis provides sufficient space for the minimum necessary modules and is more economical, when expansion of the controller chassis' module set is not anticipated.

Slot numbers are labeled on the chassis' motherboard as zero through N-1. For example, zero through nine for a 10-slot chassis.

Table 1 defines the recommended module slot locations.

The Control Processor module (Model Number TC-PRS021) version C200 is required for controller redundancy.

All CNI modules used in redundant controller chassis must be capable of supporting controller redundancy. CNI modules in I/O chassis connected to those controller chassis, however, do not have to be capable of supporting controller redundancy.

Table 2 Redundant controller chassis slot configuration rules

Rules	7- or 13-slot chassis slot number	10- or 17-slot chassis slot number
• Fault Tolerant Ethernet Bridge module for connection to the Supervisory FTE network. (The module can be mounted in any slot and only one module is allowed per C200 Controller or FIM chassis.) • ControlNet Interface (CNI) module for connection to the Supervisory ControlNet. – Non-Redundant media version TC-CCN014 must be used if network cable redundancy is not required. – Redundant Media version TC/TK-CCR014 is the default and is also recommended when using redundant controllers.	0	0
• Double-wide Control Processor module (CPM) TC-PRS021. One CPM per controller chassis.	1 & 2	1 & 2
• CNI for connection to the I/O ControlNet. – Non-Redundant media version TC-CCN014 must be used if network cable redundancy is not required. – Redundant Media version TC/TK-CCR014 is the default and is also recommended when using redundant controllers.	3	3
• Placement of the optional Battery Extension Module is dependent on the chassis used.	6	4
• Double-wide Redundancy Module (RM)	4 & 5	5 & 6
• Optional CNIs (in addition to slot 3) for connection to I/O ControlNet (maximum of 4 CNIs allowed). Model numbers and rules are the same as for CNI in slot 0.	7, 8, 9	7, 8, 9
• Optional non-I/O modules such as communications / special function modules, but after any modules listed above.	7 and higher	7 and higher

ATTENTION

The partner RMs in redundant controller chassis are connected by a Redundancy Cable of one, three, or 10 meters in length. Your redundant chassis must be installed within proximity to one another that will permit the use of one of the three cables.

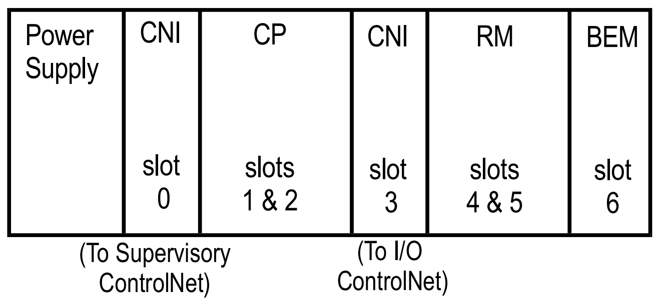
CAUTION

When planning your redundant process controller configuration, be aware that:

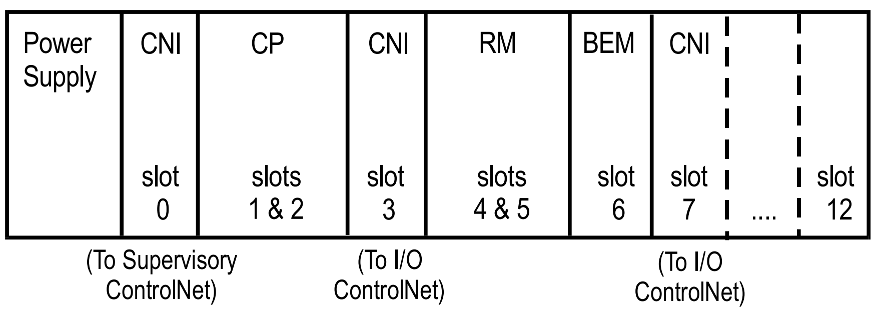
- each controller chassis must be identical in configuration.
- I/O modules are not permitted in the controller chassis, as their points could fail in the event of a failover or switchover to the backup controller.
- any unused slot of any chassis must have a Blank Cover Module installed. Two Blank Cover Modules are provided with modules TC-PRS021 and TC-PNX021.
- The CP contains a non-rechargeable Lithium battery that will provide memory backup time of 6 days. The non-rechargeable Lithium battery should be removed when a Battery Extension Module (BEM, TC-PPD011/TK-PPD011) is also present. If both batteries are present, the BAT(tery) LED will turn red instead of green when the CPM goes through startup diagnostics and enters the IDLE state. We recommend that you replace the Lithium battery annually to assure full backup capacity. Be sure you adhere to published regulations for the handling and disposing of Lithium batteries in your region.

CAUTION

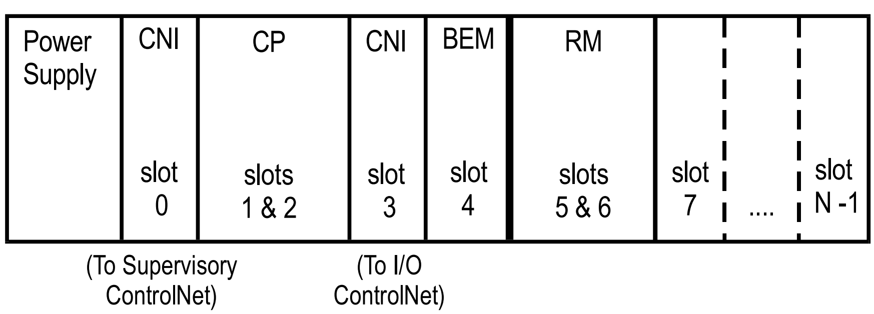
While control hardware modules are designed to permit removal and insertion under power (RIUP) without damaging the module, Honeywell recommends that you do **not RIUP** any module in an Experion control system since it may cause an indeterminable upset in the process.



Default Module Placement for a 7-slot redundant controller chassis



Default Module Placement for a 13-slot redundant controller chassis



Default Module Placement for 10 and 17-slot redundant controller chassis (N = 10 or 17)

Minimum requirements for redundant controller network

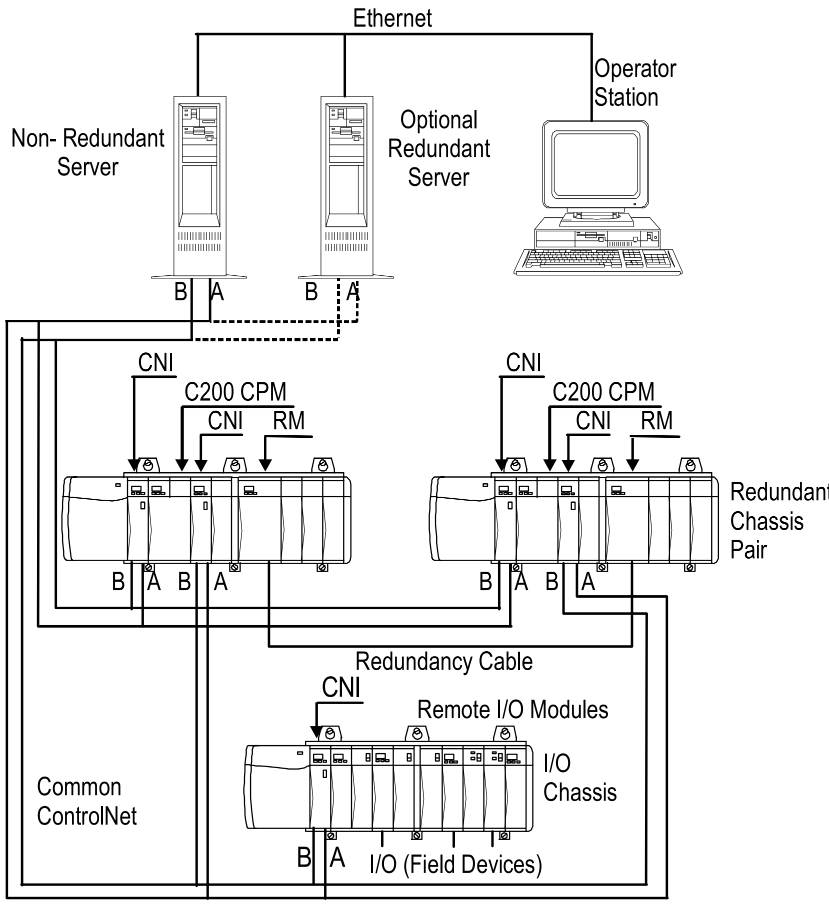
Upon redundant controller switchover, the CNIs within the Redundant Chassis Pair (RCP) are temporarily not visible on their respective ControlNet segments. To ensure that the network is maintained, a minimum of two other ControlNet Nodes must remain on the ControlNet segment during the switchover operation.

A method to avoid a single ControlNet node from going lonely during RCP switchover is to add another CNI module, or another Series A/H Rail Gateway module, or another Foundation Fieldbus Linking Device to the same ControlNet segment. This additional ControlNet device is commonly known as a "Buddy Node".

Redundant controller small system examples

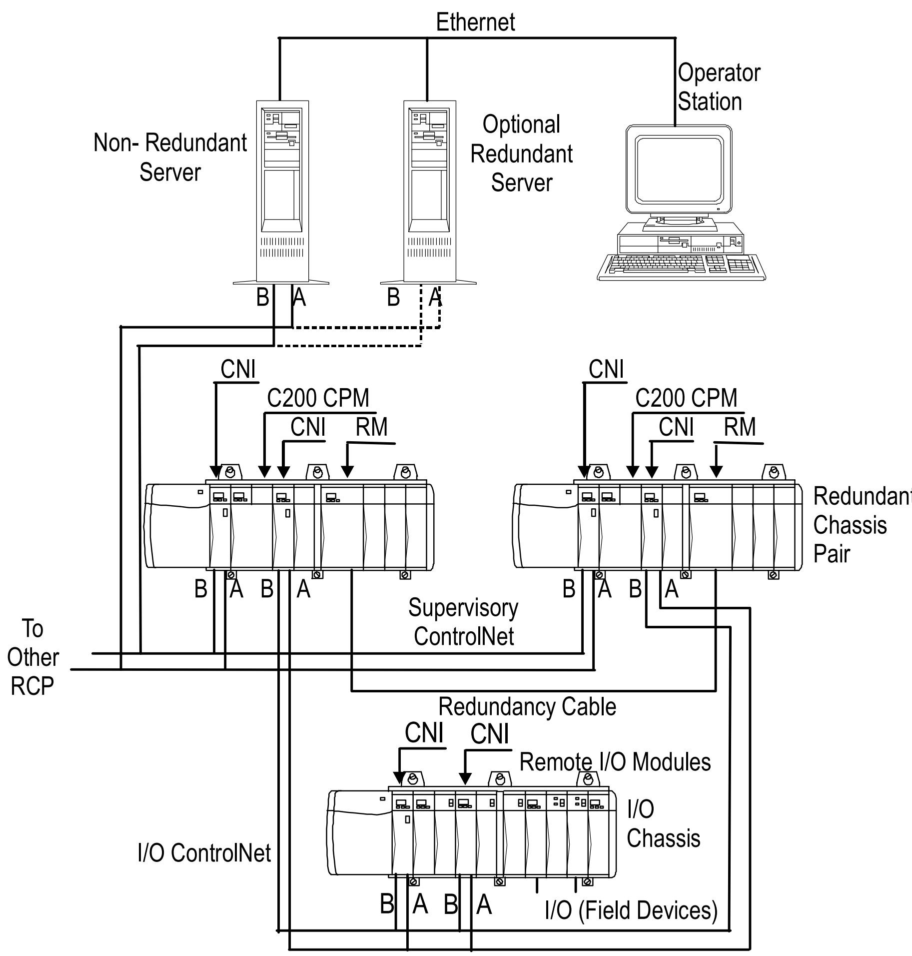
The following sample system configurations show how you can adapt a given small system architecture to meet minimum redundant controller system requirements.

- If your system only consists of a non-redundant Server or redundant Servers, one RCP, and one I/O chassis, you must link the Supervisory ControlNet with the I/O ControlNet though a trunk cable to form a common ControlNet as shown in the figure below. In this case, the default addresses are as follows.
  - Default address for CNI in slot 0 is 1.
  - Default address for CNI in slot 3 is 5.
  - Note that the default address for the I/O Chassis CNI in slot 0 is 3.



- If your system only consists of a non-redundant Server or redundant Servers, two RCPs, and one I/O chassis per RCP, you can add another CNI in the I/O chassis to increase the nodes in the I/O ControlNet to a given RCP as shown in the figure below. In this case, the default MAC ID addresses for CNIs are as follows. (Note that addresses must be incremented accordingly in the other RCP. The default addresses are shown for example purposes only. You are free to set the addresses you want within the constraints of the ControlNet addressing rules.)
  - Default address for CNI in slot 0 is 1.
  - Default address for CNI in slot 3 is 1.

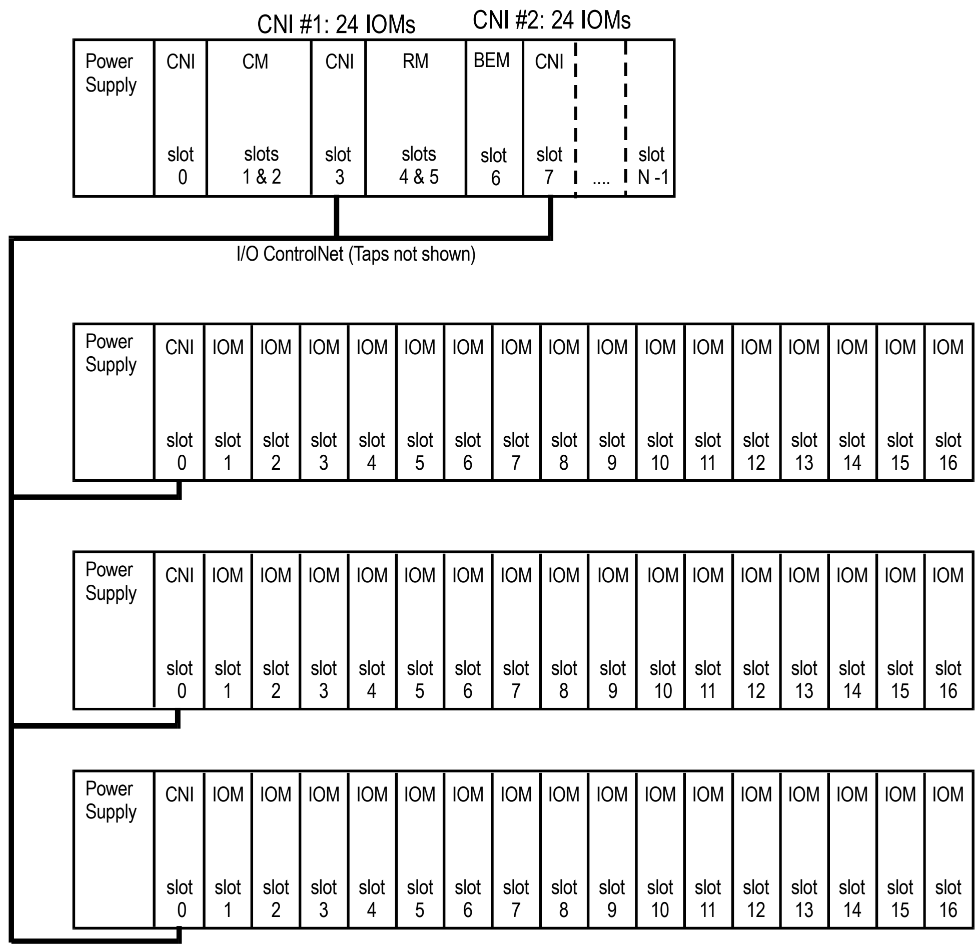
- Note that the default address for the I/O Chassis CNI in slot 0 is 3.
- Note that the default address for the I/O Chassis CNI in slot 4 is 4. (Note that the slot 4 location was chosen for example purposes only.)



I/O chassis configuration

The factory default size for an I/O chassis is 13 slots. Other chassis sizes (4-, 7-, 10-, or 17-slot) are permitted. Your selection is ultimately dependent on the mounting space available and the number of slots desired for other modules.

Two CNIs in a controller chassis may address different IOMs located in the same I/O chassis, with each IOM assigned to only one CNI. This can be used to take full advantage of the maximum 24 IOMs allowed per CNI with the greatest chassis efficiency. See the figure below for an example where the CNI in controller chassis slot 3 communicates with 24 IOMs and the CNI in controller chassis slot 7 communicates with 24 other IOMs in the 3 I/O chassis.



Slot numbers are labeled on the chassis' motherboard as zero through N-1; for example, zero through 12 for a 13-slot chassis. Table 2 defines the slot module defaults in this chassis.

CNI modules in I/O chassis connected to redundant controller chassis do not have to be capable of supporting controller redundancy.

Table 3 I/O chassis configuration

Rules	Slot(s)
ControlNet Interface (CNI) for connection to the I/O ControlNet • Non-redundant Media version TC-CCN014 is the default. • Redundant Media version TC/TK-CCR014 is required if ControlNet cable redundancy is required.	0
Chassis I/O Modules (IOMs) provide connections to process connected field devices.	1 & up

TIP

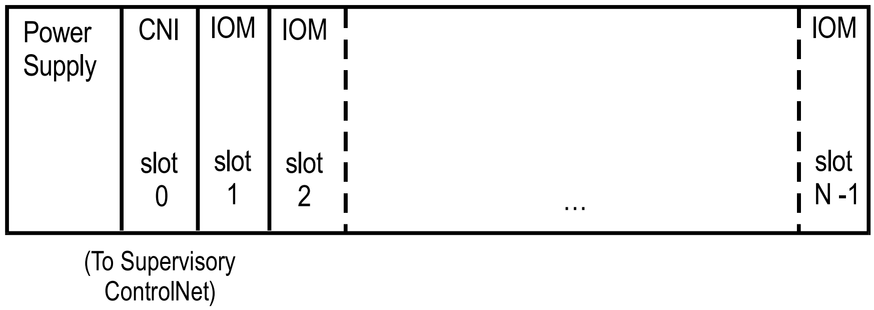
Slot 0 is preferred for the CNI because the ControlNet cables can be routed to the left without being routed past IOMs (and their field wiring) to the right. If more than one CNI module is required in the I/O chassis, the additional CNI module(s) should be placed in the left-most slots (after slot 0) for the same reason.

CAUTION

Any unused slot in any chassis must have a Blank Cover Module installed.

CAUTION

While control hardware modules are designed to permit removal and insertion under power (RIUP) without damaging the module, Honeywell recommends that you do **not RIUP** any module in an Experion control system since it may cause an indeterminable upset in the process.



Default Module Placement for an I/O module.

ATTENTION

Thermocouple IOM model number TC-IXL061 must not be placed in an open environment if field wiring is reconnected directly to its front panel terminal block (rather than to an associated RTP) and its +/-3 degrees C. reference junction accuracy specification is to be realized.

Instead, it should be placed in a chassis inside a fully-enclosed (door shut) NEMA enclosure. Otherwise its reference junction specification could degrade to +/-5 degrees C.

A solution other than an enclosure for the IOM is to connect field wiring to an RTP associated with TC-IXL061 and ensure that the RTP (which then contains the reference junction) is not in an open environment.

Chassis addressing

The ControlNet address of each CNI module must be set. Certain considerations are needed for non-redundant controller, redundant controller, and I/O chassis. For details on addressing, refer to *Planning Your ControlNet Addressing*.

Planning Your I/O Modules and Remote Termination Panels

Chassis I/O module planning

There are few restrictions to Chassis I/O module (IOM) placement. The restrictions (and recommendations) that do apply are as follows.

Restrictions

- Non-Redundant Controller Chassis — slots 0 through 2 are reserved for CNI modules and the Control Processor module. Additional slots beyond slot 2 may be reserved for optional CNIs, BEM, etc.
- Redundant Controller Chassis — no I/O is permitted.
- I/O Chassis — slot 0 is reserved for the CNI module.

Recommendations

- Group together IOMs of the same type such as Analog Output IOMs.
- Group IOMs with AC field wiring voltages separately from those with DC field wiring voltages.
- Group together IOMs with field wiring voltages of 30 Vdc or less.
- Group together IOMs with field wiring voltages greater than 30 Vdc.

REFERENCE - EXTERNAL

Refer to the Experion specifications for capacities and model numbers: The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm. Just follow the links for Product Information - Technical Specifications.

Remote Termination Panel planning

Remote Termination Panels are optionally supplied from Honeywell as part of the Experion system.

REFERENCE - INTERNAL

Refer to the *Control Hardware Installation Guide* for more information about installing and wiring chassis I/O modules and Remote Termination Panels.

HART I/O Module planning

REFERENCE - INTERNAL

Refer to the *HART I/O Implementation Guide* for complete information on planning, installing, and wiring the HART AI and AO modules and Remote Termination Panels.

Fieldbus Interface Module (FIM) planning

REFERENCE - INTERNAL

- Refer to the Series A *Fieldbus Interface Module User's Guide* for complete information on planning, installing, and wiring the FIM and its companion Remote Termination Panel.
- Refer to *Configuration Rules for Fieldbus Interface Module (FIM) Topology* in Appendix H for Series A FIM configuration rules and performance related information.

Rail I/O Series A planning

REFERENCE - INTERNAL

Refer to the *Rail I/O Series A Implementation Guide* for complete information on planning, installing, and wiring Rail I/O Series A modules.

Rail I/O Series H planning

REFERENCE - INTERNAL

Refer to the *Rail I/O Series H Implementation Guide* for complete information on planning, installing, and wiring Rail I/O Series H modules.

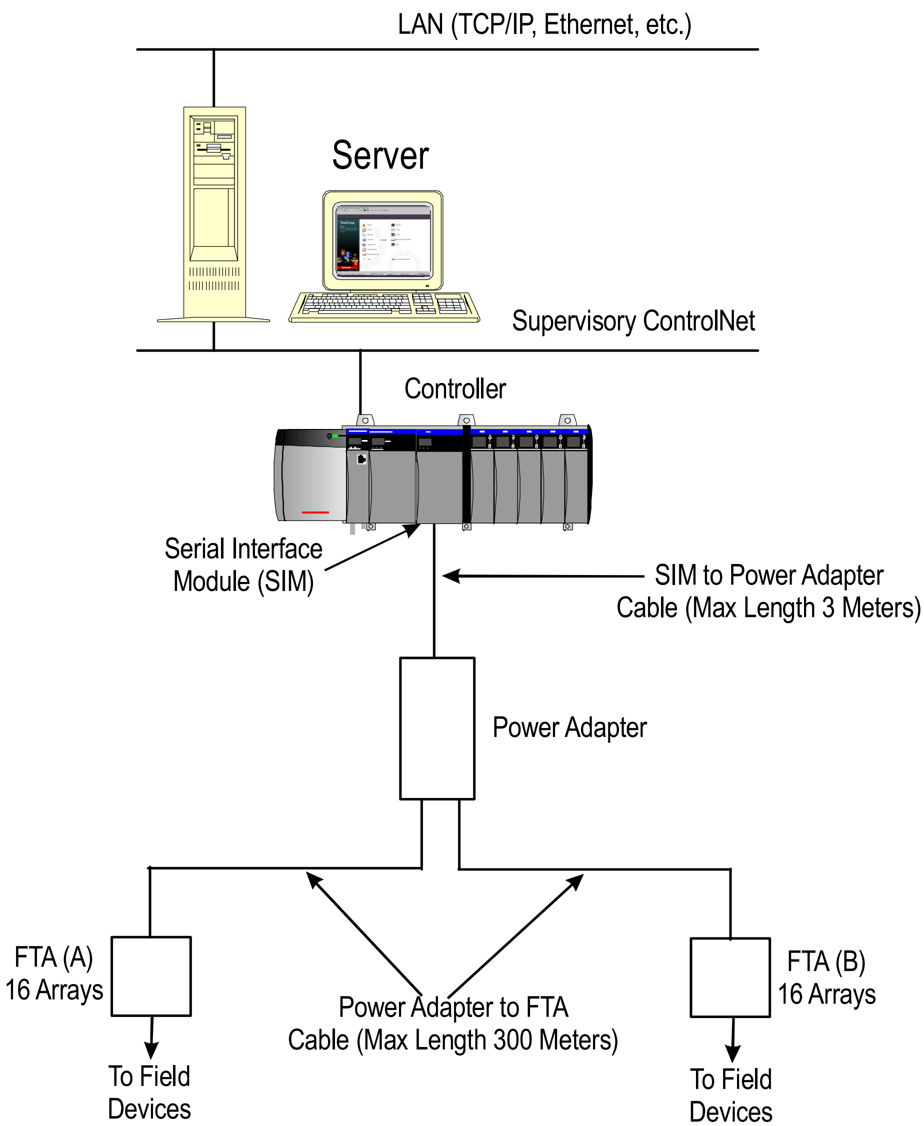
PROFIBUS Interface Module (PBIM) planning

REFERENCE - INTERNAL

Refer to the *PROFIBUS Interface Implementation Guide* for more information about interfacing Profibus devices with the system.

Serial Interface Module (SIM) planning

Provides configuration and communication software to enable devices to communicate via an ASCII serial protocol to perform bi-directional data exchange directly with the Control Processor module.



There are few restrictions to Serial Interface Module (SIM) placement. The restrictions (and recommendations) that do apply are as follows.

Restrictions

- The SIM to Power Adapter (TC-KSM003) cable can be no longer than 3 meters (10 feet). *
- The Power Adapter to Field Termination Assembly (FTA) cable (TC-KLAMxx, TC-KSXxxx) can be no longer than 300 meters (1000 feet). *
- Up to two FTAs can be connected to a single SIM through the Power Adapter.
- There is a maximum of 3 SIMs allowed per CPM with CEE-50ms.
- A SIM can only support a maximum of 32 Serial Devices, depending on the application protocol(s) chosen.

* Ensure during mounting and planning that maximum distances are observed.

Recommendations

- The Serial Interface Module can be installed in any available chassis slot pair excluding slot zero.
- The Power Adapter can be installed on a standard FTA mounting channel (DIN Rail) or directly mounted to a surface.
- Any combination of FTAs certified by Honeywell may be used.
- Cables are available in standard product model number lengths, with custom lengths available upon request.

REFERENCE - INTERNAL

Refer to the Serial *Interface Module Implementation Guide* for more information about using the Serial Interface Module to interface serial devices with the system.

Pulse Input Module (PIM) planning

The TC-MDP081 (uncoated)/TK-MDP081 (coated) Pulse Input Module (PIM) is a single-wide I/O module that serves as the interface board between the Process Controller and field transducers that provide pulse inputs. Typically the PIM might be used to accept pulse inputs from:

- Tachometers, to determine required speeds of rotation for motors, fans and pumps
- Flowmeters, to determine totalized process flows such as inputs to batch dosing operations

The PIM provides up to eight input channels and two output channels. Each of the eight channels has a 32-bits counter to perform pulse counting and frequency calculation for signals up to 100 KHz. Six of the eight channels also have a second 32-bits timer counter for pulse period and pulse width measurements. The remaining channels provide pulse counting and frequency calculations and have associated outputs that can be used for fast cut-off applications. The PIM provides channel-to-channel and terminal-to-backplane isolation.

The PIM uses the standard 36-pin terminal block and interfaces directly to single-ended devices. The threshold level for each channel is software configurable and selections are either LOW (approx. 2V) or HIGH (approx. 8V) for a high-level voltage level. The PIM interfaces directly to 5 to 24 V signal values.

Planning Your Process Manager I/O Card Files

Card file models

The following table lists the available card file models by name and model number. Three models are not CE Compliant and three models are CE Compliant.

ATTENTION

All card file models are available with conformal coating. A model that is "coated" has a model number prefix of MC instead of MU.

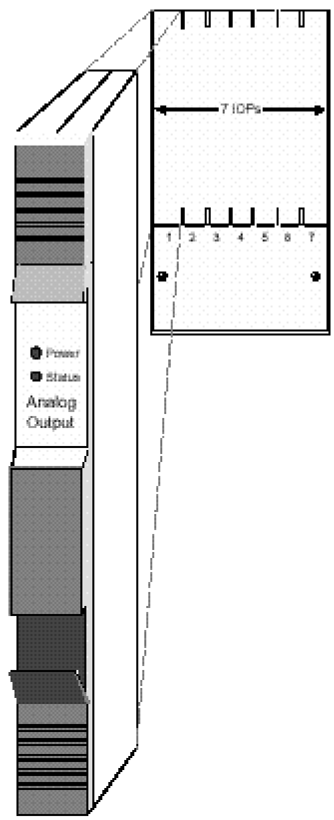
Card File Name	CE Compliant Model	Non-CE Compliant Model
Left 7-Slot IOP	MU-HPFI03	MU-HPFH01
Right 7-Slot IOP	MU-HPFI13	MU-HPFH11
15-Slot IOP	MU-HPFI23	MU-HPFX02

REFERENCE - INTERNAL

Refer to Appendix A for more information about conformal coating and corrosion protection planning.

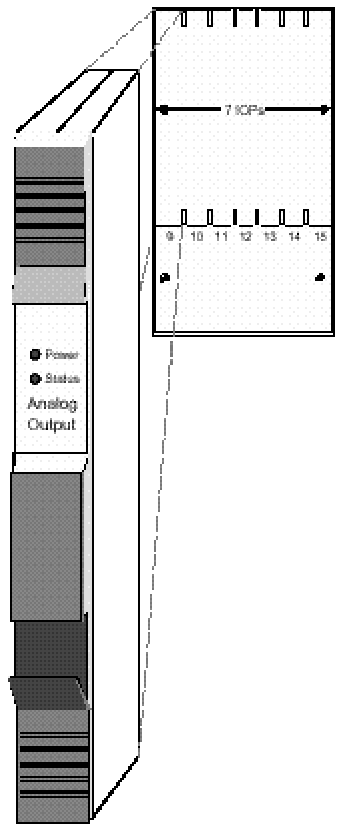
Left 7-Slot IOP

The Left 7-Slot Input/Output Processor (IOP) card file accepts up to seven IOP cards. The card slots are numbered 1 through 7, starting at the left-most slot as shown in the following figure.



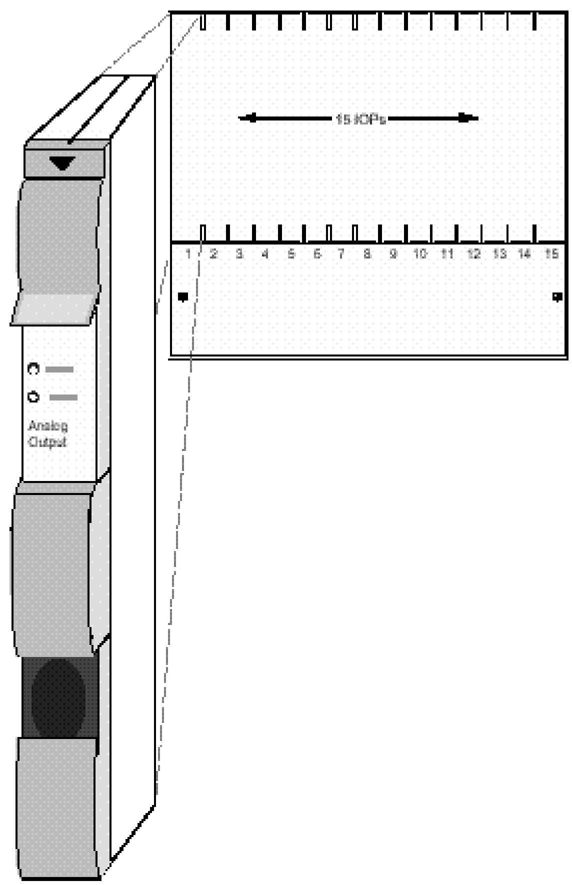
Right 7-Slot IOP

The Left 7-Slot Input/Output Processor (IOP) card file accepts up to seven IOP cards. The card slots are numbered 9 through 15, starting at the left-most slot as shown in the following figure.



15-Slot IOP

The 15-Slot Input/Output Processor (IOP) card file accepts up to 15 IOP cards. The card slots are numbered 1 through 15, starting at the left-most slot as shown in the following figure.



Planning Your Input/Output Processor (IOP) Cards

IOP types

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

- High Level Analog Input (HLAI)
- HART High Level Analog Input (HLAIHART)
- Low Level Analog Input (LLAI)
- Low Level Analog Multiplexer (LLMux)
- Remote Hardened Low Level Analog Multiplexer (RHMUX)
- Digital Input (DI)
- Analog Output (AO)
- HART Analog Output (AO16HART)
- Digital Output (DO)
- Smart Transmitter Interface Multivariable (STIM)
- Digital Input Sequence of Events (DISOE)

Card file configurations

The IOP cards can be installed in 15-Slot card files and right and left 7-Slot card file pairs per a users individual configuration needs. Each 15-Slot card file and 7-Slot card file pair must be assigned and I/O link interface address between 0 and 7.

Each I/O Link Interface Module (IOLIM) can support 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). The maximum number of IOLIMs per Control Processor module is 2. The maximum number of primary IOPs per Control Processor module is 64. In terms of Experion system capacities, this means each IOP block is the equivalent of one IOM block.

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 Process Controller.

IOP redundancy

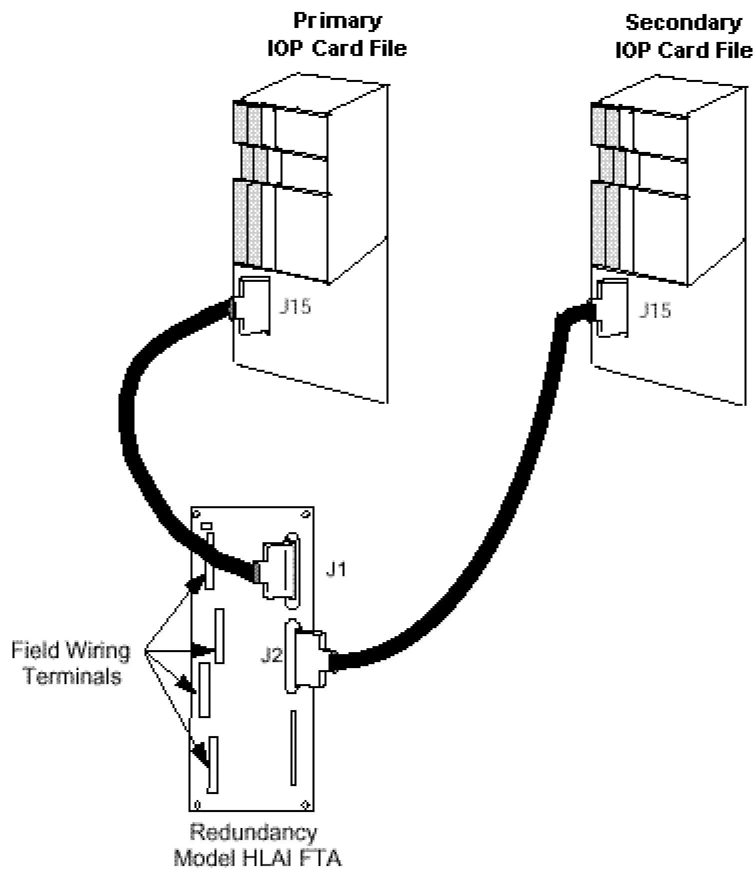
The I/O Link Interface Module supports IOP redundancy for the following types of IOPs:

- High Level Analog Input (HLAI)
- HART High Level Analog Input (HLAIHART)
- Smart Transmitter Interface (STI or STIM)
- Analog Output (AO)
- HART Analog Output (AO16HART)
- Digital Input (DI)
- Digital Input Sequence of Events (DISOE)
- Digital Output (DO)

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

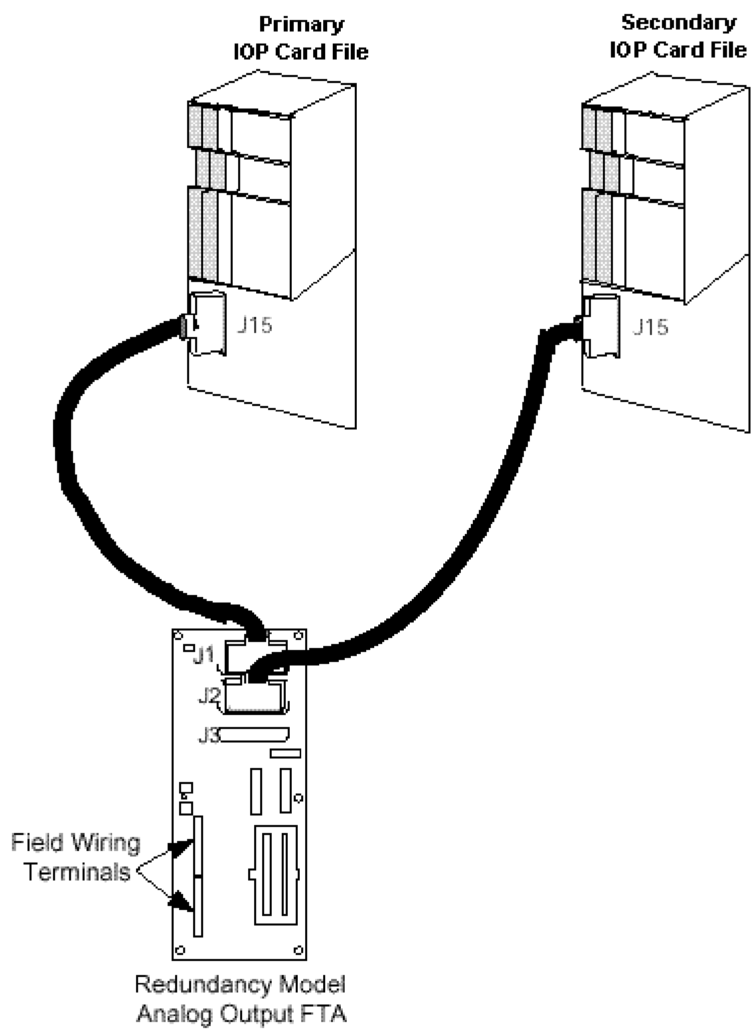
Redundant HLAI IOPs

A pair of IOPs can be connected in a redundant configuration with both IOPs connected by separate cables to the same FTA. The IOPs can be mounted in different slots in the same card file or in separate card files designated as primary and secondary. The following figure illustrates an HLAI FTA that interfaces with a pair of HLAI IOPs that are installed in separate card files.



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. The IOPs can be mounted in different slots in the same card file or in separate card files designated as primary and secondary. The following figure is an illustration of an Analog Output (AO) FTA interface with two Analog Output IOPs in separate card files.



IOP card models

The following table lists the available Input/Output Processors by model number and part number.

ATTENTION

- Only the model MU-PAOX03/MC-PAOX03 Analog Output IOP is available in a CE Compliant and non-CE Compliant version. All other IOP models are CE Compliant only. If you order by model number only, the CE-Compliant version will be supplied as the default.
- All IOP cards are available with and without conformal coating except for model MC-PHAI01 and model MC-PHAO01, which are only available in a coated version.

IOP Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number
Without Conformal Coating			
AO	MU-PAOX03	51304672-100	51309152-125
AO	MU-PAOY22	N/A	80363969-100
DI	MU-PDIX02	N/A	51304485-100
DI	MU-PDIY22	N/A	80363972-100
DISOE	MU-PDIS12	N/A	51402625-125
DO	MU-PDOX02	N/A	51304487-100
DO	MU-PDOY22	N/A	80363975-100
HLAI	MU-PAIH03	N/A	51304754-100
LLAI	MU-PAIL02	N/A	51304481-100
LLMUX	MU-PLAMO02	N/A	51304362-100
RHMUX	MU-PRHM01	N/A	51404109-125
STIM	MU-PSTX03	N/A	51304516-200
With Conformal Coating			

IOP Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number
AO	MC-PAOX03	51304672-150	51309152-175
AO	MC-PAOY22	N/A	80363969-150
AO16HART	MC-PHAO01	N/A	51403476-150
DI	MC-PDIX02	N/A	51304485-150
DI	MC-PDIY22	N/A	80363972-150
DISOE	MC-PDIS12	N/A	51402625-175
DO	MC-PDOX02	N/A	51304487-150
DO	MC-PDOY22	N/A	80363975-150
HLAI	MC-PAIH03	N/A	51304754-150
HARTHLAI	MC-PHAI01	N/A	51403479-150
LLAI	MC-PAIL02	N/A	51304481-150
LLMux	MC-PLAM02	N/A	51304362-150
RHMUX	MC-PRHM01	N/A	51404109-175
STIM	MC-PSTX03	N/A	51304516-250

Planning for Low Level Multiplexer IOP

LLMux versions

There are two versions of the LLMux and their assemblies are not compatible with each other. For clarity, the two versions are described as an LLMux and a Remote Hardened Multiplexer (RHMUX).

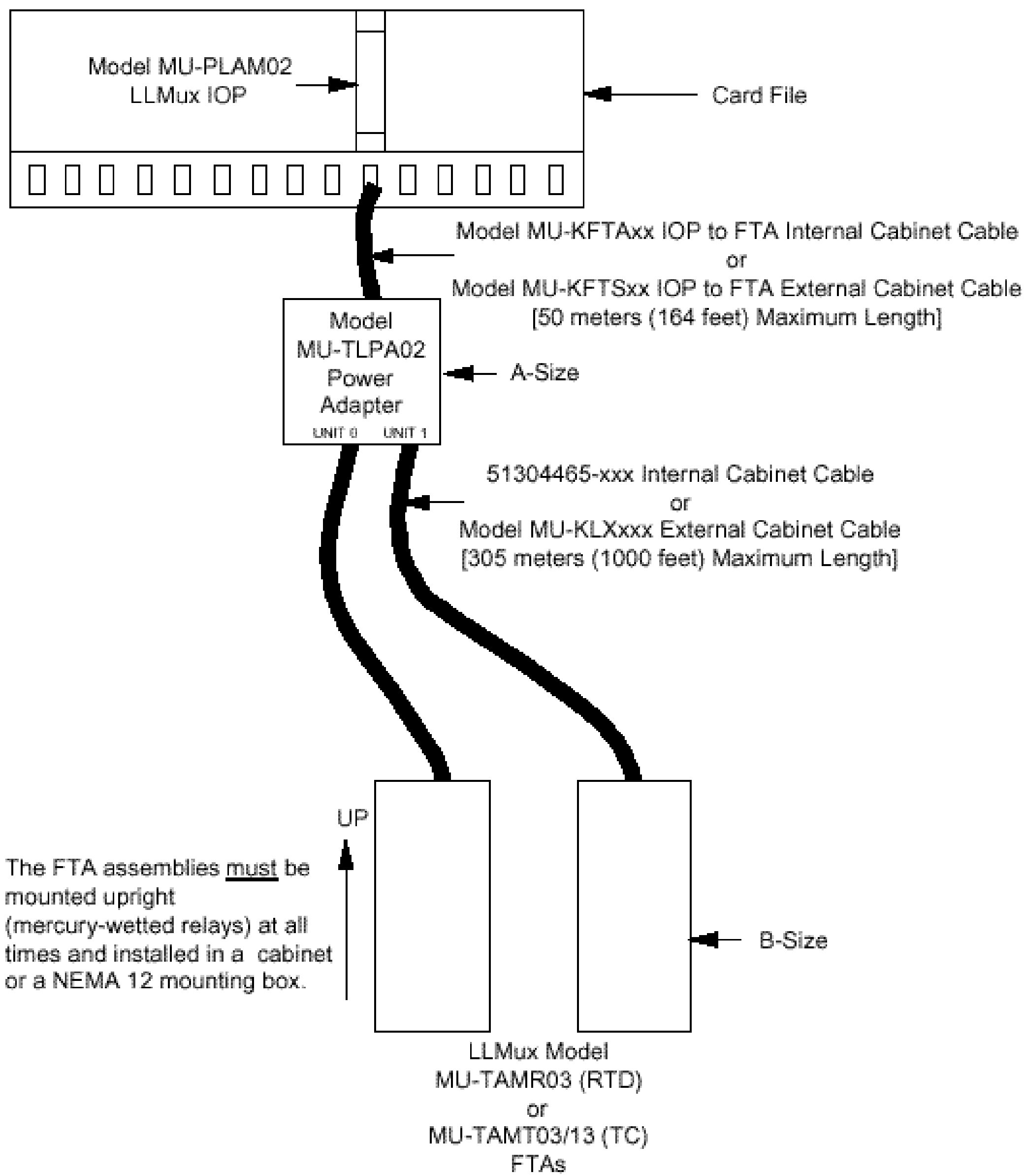
The RHMUX is Approved as Intrinsically Safe and Nonincendive for use in hazardous locations. However, the RHMUX assemblies can also be used in areas that are classified as nonhazardous. The RHMUX subsystem has the added advantage that the FTA can be located up to 2 kilometers from its Power Adapter.

Typical LLMux configuration

Low Level Analog Input Multiplexer (LLMux) is comprised of three assemblies. They are:

- an IOP
- a Power Adapter
- an FTA

The following figure shows a typical Low Level Analog Input Multiplexer (LLMux) configuration. In this figure, the LLMux FTA, model MU-TAMR03 or MU-TAMT03/13, communicates with a model MU-PLAM02 LLMux IOP through the model MU-TLPA02 Power Adapter. The IOP can be located in any Card File slot. This can be a non-CE Compliant or CE-Compliant application depending upon the model of the card file that is used.


Model MU-PLAM02
LLMux IOP
Card File
Model MU-KFTAxx IOP to FTA Internal Cabinet Cable
or
Model MU-KFTSxx IOP to FTA External Cabinet Cable
[50 meters (164 feet) Maximum Length]
Model
MU-TLPA02
Power
Adapter
UNIT 0
UNIT 1
A-Size
51304465-xxx Internal Cabinet Cable
or
Model MU-KLXxxx External Cabinet Cable
[305 meters (1000 feet) Maximum Length]
UP
The FTA assemblies must be mounted upright (mercury-wetted relays) at all times and installed in a cabinet or a NEMA 12 mounting box.
B-Size
LLMux Model
MU-TAMR03 (RTD)
or
MU-TAMT03/13 (TC)
FTAs

LLMux Power Adapter location

The LLMux Power Adapter can be installed on any available FTA Mounting Channel that is within 50 meters (164 feet) of the LLMux IOP. The restriction is that the longest IOP to FTA cable cannot exceed 50 meters (164 feet).

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

LLMux IOP to Power Adapter cable

The IOP to Power Adapter interconnection is provided by a model MU-KFTAxx nonshielded cable (the suffix "xx" in the model number represents the length of the cable in meters) in 12 sizes, up to 50 meters (164 feet) in length for internal cabinet applications. A model MU-KFTSxx shielded cable is used for external cabinet applications. See the IOP to FTA cable models section for the lengths that are available.

LLMux FTA location

The LLMux FTA is designed to be mounted in a shielded enclosure. This can be accomplished in either of two ways

- Install the FTA in a standard High-Performance Process Manager cabinet on an FTA Mounting Channel. The FTA must be grounded to the cabinet and the cabinet must be grounded to Safety Ground (building ground).
- Install the FTA in a NEMA 12 box with the FTA Mounting Channel grounded to the box, and the box connected to Safety Ground.

The LLMux FTA is a B-size (12 inches) FTA.

WARNING

The practice of mounting an FTA on panel rails is not acceptable because the installed FTA can not be adequately shielded. The FTA must mount on an FTA Mounting Channel.

ATTENTION

LLMux FTAs contain relays with mercury-wetted contacts and must be positioned with the LLMux power connector-side up.

Remote LLMux FTA cabinet restrictions

The remote LLMux FTA cabinet or NEMA 12 box can be located up to 305 meters (1000 feet) from the Power Adapter. The restriction is that the longest Power Adapter to FTA cable cannot exceed 305 meters (1000 feet).

CAUTION The remotely-installed FTA's environment must meet the same environmental conditions imposed on equipment installed in IOP cabinets.

Local FTA to Power Adapter cabling

When the LLMux FTA is installed in the same cabinet, or cabinet complex, as the Power Adapter FTA, a 51304465-xxx cable ("xxx" represents five sizes – 30, 66, 100, 200, and 300 centimeters) with stripped wire ends is used for the interconnection.

The cable can be used for both non-CE Compliant and CE Compliant applications.

The cable has two individually shielded, twisted-pair wires. For non-CE Compliant applications, the shields must be connected to ground at the Power Adapter end only, and for CE Compliant applications, the shields must be connected to ground at both ends of the cable. The wire connections are made using the compression terminals in a 6-pin connector at the Power Adapter end and in a 4-pin or 6-pin connector at the FTA end.

The following table lists general cable specifications for reference.

Manufacturer Type	Belden 9406
Configuration	Shielded double pair
Flame Resistance Conformity	CSA FT 4
CSA Type	CMG
NEC Type	CMG

External Power Adapter to FTA cabling

When LLMux FTA is not installed in the same cabinet, or cabinet complex, as the Power Adapter and up to 305 meters (1000 feet) from the Power Adapter, a model MU-KLXxxx cable ("xxx" represents three sizes – 76, 152, and 305 meters for external cabinet installation). This is a single-twist, four-conductor Belden type 83654 cable with a braided shield and must be used for the interconnection for a CE Compliance application.

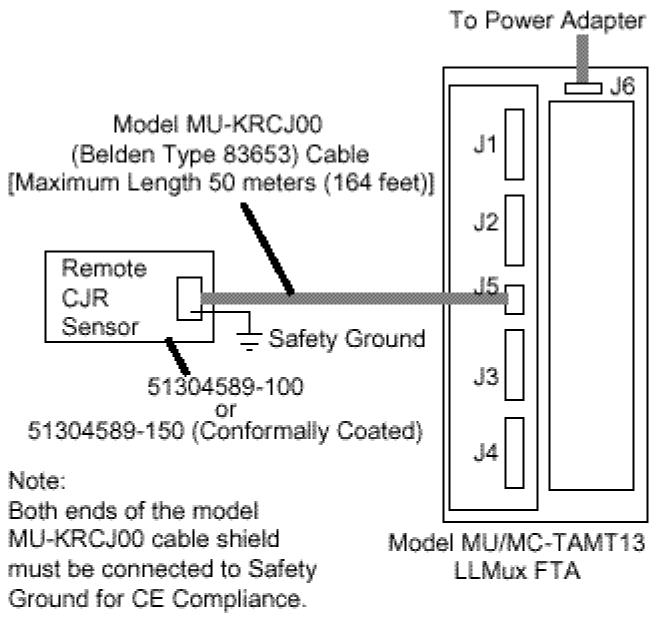
The following table lists general cable specifications for reference.

Manufacturer Type	Belden 83654
Configuration	Shielded 18-gauge four-conductor single twist (TEFLON jacket)
Flame Resistance Conformity	CSA FT4/FT6 and UL910
CSA Type	CMP
NEC Type	CMP
Temperature Rating	-70°C to +200°C (-94°F to +392°F)

Remote CJR installation

The following figure illustrates remote CJR installation requirements. model MU-KRCJ00 cable must be used between the remote CJR sensor and the model MU-TAMT13 or MC-TAMT13 FTA. Its length is restricted to 50 meters (164 feet). The cable shield must be connected to Safety Ground at both ends of the cable.

The installation as illustrated is CE Compliant.



The following table lists general model MU-KRCJ00 cable specifications for reference.

Manufacturer Type	Belden model 83653
Conductors	Three 1.0 mm 2 (18 AWG) conductors
Insulation and Jacket	Teflon conductor insulation and jacket
Shielding	Braid over foil
Flame Resistance Conformity	CSA PCC FT4/FT 6 and UL910
Use	Air plenum
NEC Type	CMP

Typical RHMUX configuration

The Remote Hardened Low Level Analog Input Multiplexer (RHMUX) is comprised of four assemblies. They are:

- an IOP
- a Power Adapter
- an FTA
- a Sealed Enclosure

One or two RHMUX Thermocouple (TC) FTAs can be connected to either an Intrinsically Safe (IS) Power Adapter or a Non-Incendive (NI) Power Adapter. The Power Adapter also connects to a model MU/MC-PRHM01 RHMUX IOP that can be mounted in any Card File slot.

The model MU/MC-GRPA01 Intrinsically Safe RHMUX Power Adapter and the model MU/MC-TRPA01 Non-Incendive Power Adapter are functionally the same.

The RHMUX FTA supports 0 to 100-millivolt and thermocouple inputs. RTD inputs are not supported.

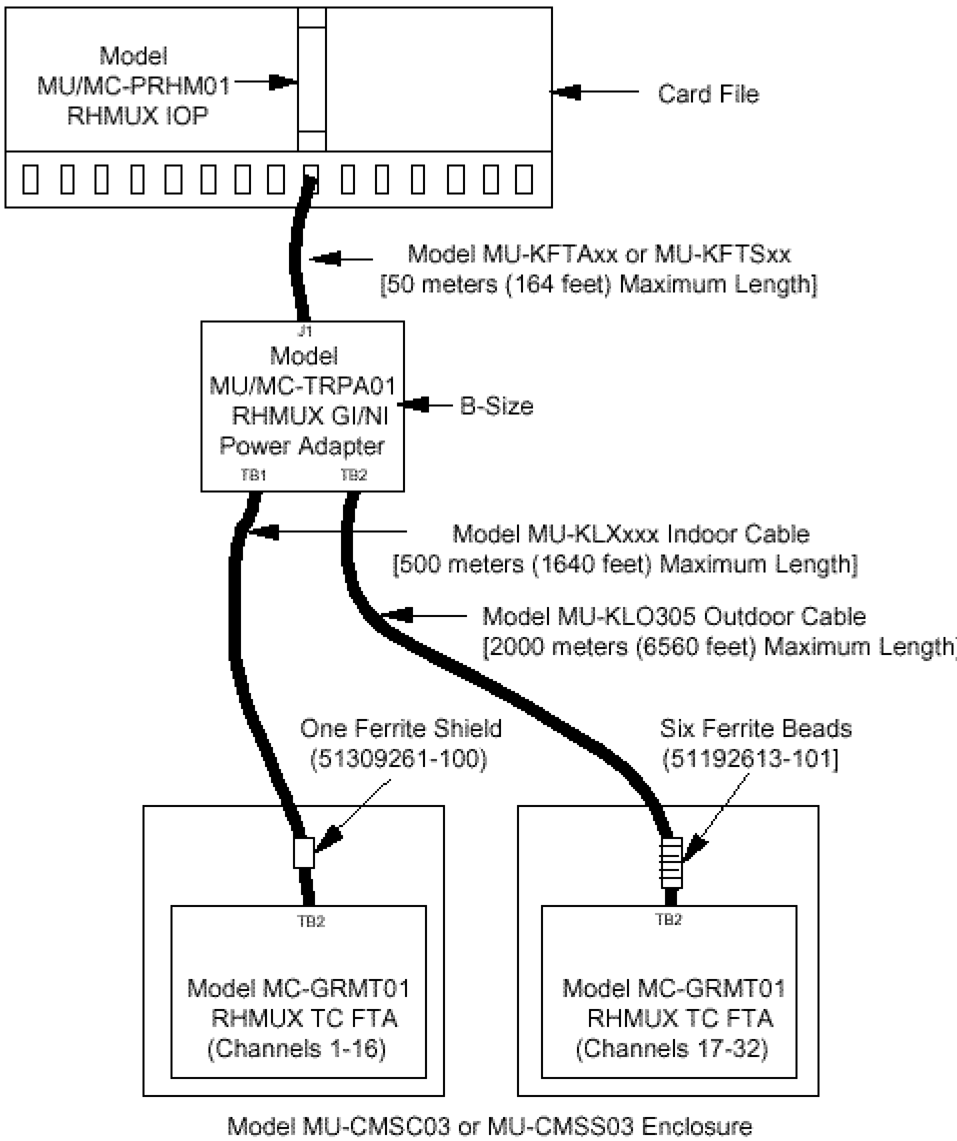
The model MU/MC-PRHM01 IOP supports 32 inputs from two RHMUX FTAs.

The following figures show typical RHMUX configurations for Nonincendive and Intrinsically Safe applications, respectively.

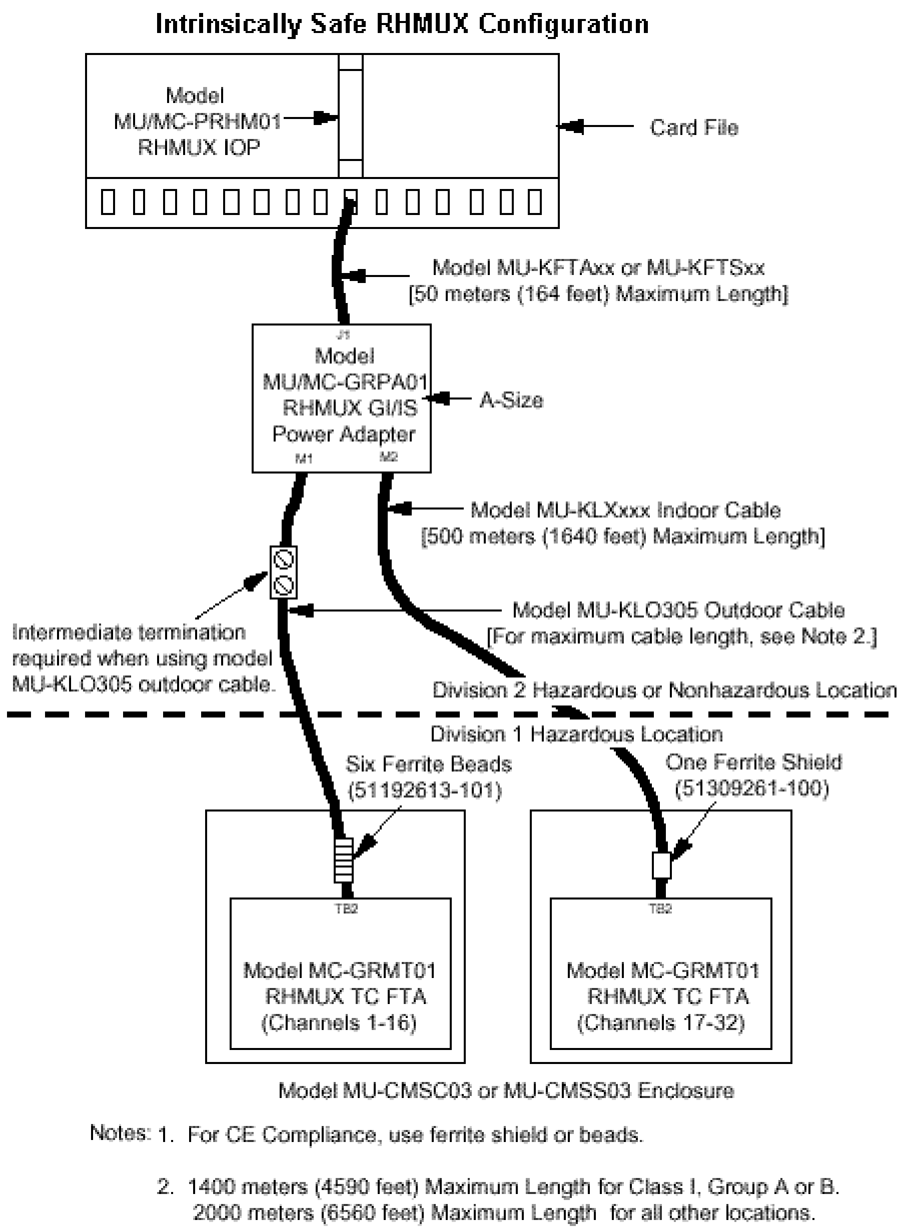
ATTENTION

- For valid agency approvals, the Nonincendive installation must comply with Honeywell control drawing 51204185.
- For valid agency approvals, the Intrinsically Safe installation must comply with Honeywell control drawing 51204105.

NonIncendive RHMUX Configuration



Note: For CE Compliance, use ferrite shield or beads.


Intrinsically Safe RHMUX Configuration
Model
MU/MC-PRHM01
RHMUX IOP
Card File
Model MU-KFTAxx or MU-KFTSxx
[50 meters (164 feet) Maximum Length]
J1
Model
MU/MC-GRPA01
RHMUX GI/IS
Power Adapter
M1
M2
A-Size
Model MU-KLXxxx Indoor Cable
[500 meters (1640 feet) Maximum Length]
Intermediate termination
required when using model
MU-KLO305 outdoor cable.
Model MU-KLO305 Outdoor Cable
[For maximum cable length, see Note 2.]
Division 2 Hazardous or Nonhazardous Location
Division 1 Hazardous Location
Six Ferrite Beads
(51192613-101)
One Ferrite Shield
(51309261-100)
TB2
TB2
Model MC-GRMT01
RHMUX TC FTA
(Channels 1-16)
Model MC-GRMT01
RHMUX TC FTA
(Channels 17-32)
Model MU-CMSC03 or MU-CMSS03 Enclosure
Notes: 1. For CE Compliance, use ferrite shield or beads.
2. 1400 meters (4590 feet) Maximum Length for Class I, Group A or B.
2000 meters (6560 feet) Maximum Length for all other locations.

CE Compliance

All models of the Remote Hardened Low Level Analog Input Multiplexer Field Termination Assembly (FTA), Power Adapters, and IOP can be used in a CE Compliant application. However, they must be used with the model MU-KFTSxx IOP to FTA cable and the IOP must be installed in a CE Compliant card file. A model MU-KLXxxx or MU-KLO305 Power Adapter to FTA four-conductor cable must also be used with a single ferrite shield or six solid ferrite beads, respectively, installed inside the remote enclosure at the FTA end of the cable. Both types of ferrites are included with the Honeywell enclosure.

Non-CE Compliance

The RHMUX FTA, Power Adapters, and IOP can also be used for non-CE Compliant applications. The model MU-KFTAxx IOP to FTA cable can be substituted for the model MU-KFTSxx cable and a ferrite shield or ferrite beads are not required for the model MU-KLXxxx or MU-KLO305 Power Adapter to FTA cable.

RHMUX Power Adapter location

The Intrinsically Safe RHMUX and NonIncendive RHMUX Power Adapters can be installed on any available FTA Mounting Channel that is within 50 meters (164 feet) of the RHMUX IOP. The restriction is that the longest IOP to FTA cable cannot exceed 50 meters (164 feet).

The model MU/MC-GRPA01 Intrinsically Safe Power Adapter is the same size as an A-size (6-inch) FTA.

The model MU/MC-TRPA01 NonIncendive Power Adapter is the same size as a B-size (12-inch) FTA.

RHMUX IOP to Power Adapter cable

The IOP to Power Adapter interconnection is provided by a model MU-KFTAxx nonshielded cable (the suffix “xx” in the model number represents the length of the cable in meters) in 12 sizes, up to 50 meters (164 feet) in length in a non-CE Compliance application. A model MU-KFTSxx shielded cable must be used for a CE Compliant application. See the IOP to FTA cable models section for the lengths that are available.

RHMUX FTA location

The RHMUX FTA is designed to be mounted in a shielded enclosure.

The recommended method is to install the FTA in one of the Honeywell enclosures listed in the following table with the enclosure connected to Safety Ground.

Model Number	Description	Part Number
MU-CMSS03	NEMA 4X Stainless Steel Enclosure (35.6 cm/14 in wide x 40.7 cm/16 in high x 15.2 cm/6 in deep)	51309250-100
MU-CMSC03	NEMA 4 Painted Carbon Steel Enclosure (35.6 cm/14 in wide x 40.7 cm/16 in high x 15.2 cm/6 in deep)	51309250-200

The RHMUX FTA dimensions of approximately 13 inches (33 centimeters) by 13 inches (33 centimeters) cannot be accommodated by an FTA Mounting Channel in an IOP cabinet and is not intended to be mounted in an IOP cabinet.

The RHMUX agency approvals are valid only when the FTA is mounted in one of the enclosures listed in the table above.

The model MU-CMSS03 enclosure is approved for Division 1 and Division 2, Class I, II, and III locations. The model MU-CMSC03 enclosure is approved for Division and Division 2, Class I locations only.

Remote RHMUX FTA cabinet restrictions

Depending on the type of cable used, the remote RHMUX FTA enclosure can be located up to 2000 meters (6560 feet) from the Power Adapter. The restriction is that the longest Power Adapter to FTA cable cannot exceed 2000 meters (6560 feet).

The model MU-KLXxxx or MU-KLO305 cable can be used in any location for runs of up to 500 meters (1640 feet) between the Power Adapter and the FTA, as long as the cable is does not get wet. If the cable is exposed to precipitation, the model MU-KLO305 cable must be used.

For Division 1, Class I, Group A and B hazardous locations, the model MU-KLO305 cable is used for runs of up to 1400 meters (4590 feet) between the Power Adapter and the FTA. For all other locations, the model MU-KLO305 cable is used for runs of up to 2000 meters (6560 feet).

ATTENTION

The environmental conditions imposed on remotely-installed RHMUX FTA's are less restrictive than the environmental conditions imposed on equipment that is installed in IOP cabinets. The RHMUX FTA has a wider temperature range and can tolerate a condensing atmosphere.

Indoor environment FTA to Power Adapter cabling

When the Power Adapter to RHMUX FTA cable will be less than 500 meters in length and will be installed indoors or in conduit without the threat of moisture, the model MU-KLXxxx cable ("xxx" represents three lengths – 76, 152, and 305 meters) with stripped wire ends can be used for the interconnection. Custom lengths of the cable can also be ordered with the 51192139-104 assembly number.

The cable can be used for non-CE Compliant, CE Compliant, Intrinsically Safe, Nonincendive, and nonhazardous applications.

The cable's shield must be connected to the shield ground terminals (S) that are provided at both the Power Adapter and FTA ends of the cable. The shield must not be connected to Safety Ground. For CE Compliant applications, a single snap-on ferrite shield (Honeywell part number 51309261-100) must be attached to the cable at the FTA end of the cable, inside the remote enclosure.

The following table lists general cable specifications for reference.

Manufacturer Type	Belden 83654
Configuration	Shielded 18-gauge four-conductor single twist (TEFLON jacket)
Flame Resistance Conformity	CSA FT4/FT6 and UL910
CSA Type	CMP
NEC Type	CMP
Temperature Rating	-70°C to +200°C (-94°F to +392°F)

Outdoor environment Power Adapter to FTA cabling

When the Power Adapter to RHMUX FTA cable will be installed outdoors with the threat of moisture, or a cable length greater than 500 meters is required, a 305-meter model MU-KLO305 cable with stripped wire ends is used for the interconnection.

The cable can be used for non-CE Compliant, CE Compliant, Intrinsically Safe, Nonincendive, and nonhazardous applications.

The cable will tolerate moisture from normal precipitation, but the cable must not be submerged and is not suitable for direct burial in this application.

The cable's shield must be connected to the shield ground terminals (S) that are provided at both the Power Adapter and FTA ends of the cable. The shield must not be connected to Safety Ground. For CE Compliant applications, six ferrite beads (Honeywell part number 51192613-100) must be installed on the cable at the FTA end of the cable, inside the remote enclosure.

The cable's 12-gauge conductors will not fit the terminals on the Power Adapter. An intermediate terminal block, such as a Weidmuller DIN-rail terminal block, is required. No intermediate termination is required for the RHMUX FTA if crimp terminals are used.

The following table lists general cable specifications for reference.

Manufacturer Type	Belden YC41926
Configuration	Shielded, 12-gauge, four-conductor, single twist (armored jacket) CE Compliant PLTC or ITC, 300 volts
Vertical Tray Flame Test	UL1581/IEEE383
Temperature Rating	-30°C to +90°C (-22°F to +194°F)

Planning for I/O Link Extender (Fiber Optic Link)

I/O Link Extender types

An I/O Link Extender consists of two I/O Link Extender card pairs, one pair for Link A and the other for Link B, and associated fiber optic couplers at each end of the fiber optic link. The cards and couplers occupy two slots in an IOP card file. The following Two types of I/O Link Extenders are available.

- The "Standard" I/O Link Extender that provides up to a 1.3 kilometer (4000 feet) link,
- 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.

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 (3000 to 4000 feet) for the Standard I/O Link Extender and 8 kilometers (5 miles) for the Long Distance I/O Link Extender.

REFERENCE - INTERNAL

Refer to Appendix B for information about routing fiber optic cables.

Standard type extender

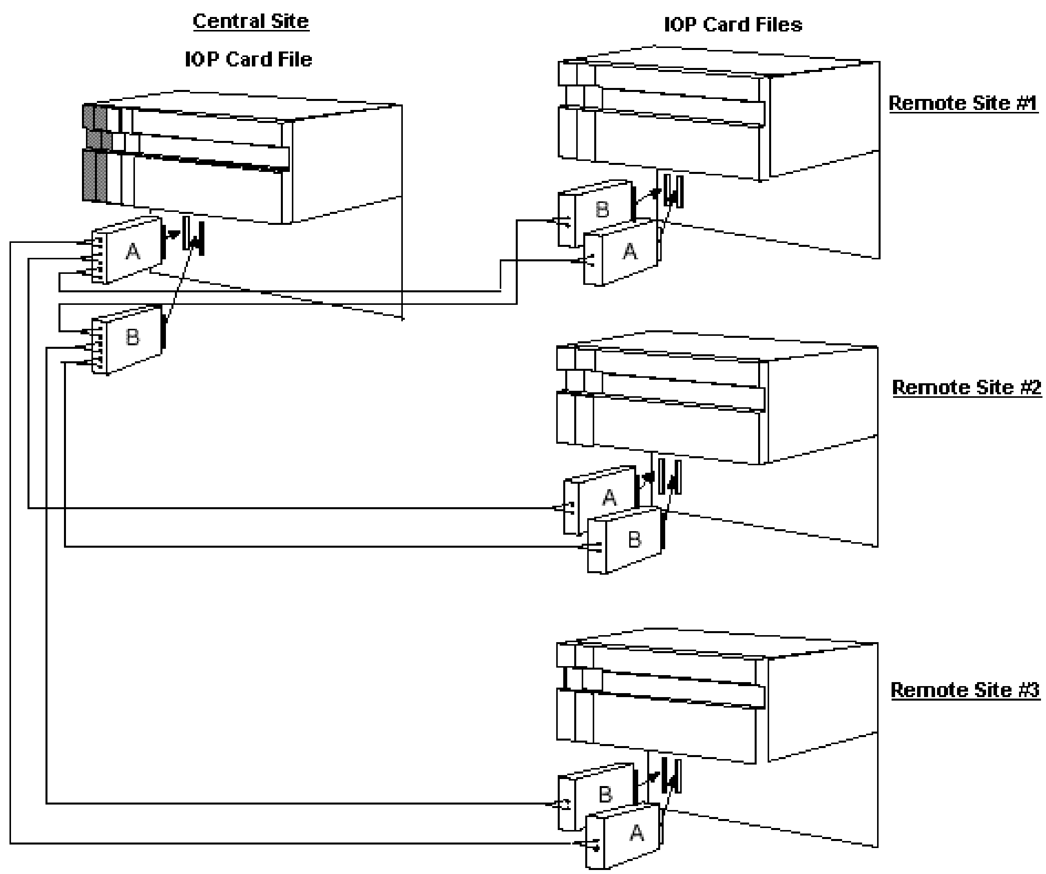
The Standard I/O Link Extender card will drive and terminate Link A or Link B, depending upon the number of the card file and the slot. If the number of the card file and the slot are both odd or both even, the card will drive Link A. If the number of the card file and the slot are not both odd or both 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 an IOP card file, but the maximum number of primary IOPs is still 40 (plus 40 secondary IOPs) per I/O Link Interface Module.

Standard type extender with single IOP example

The following figure illustrates the interconnections for a Standard I/O Link Extender in a system that contains a single IOP. The following IOP subsystem configuration is assumed:

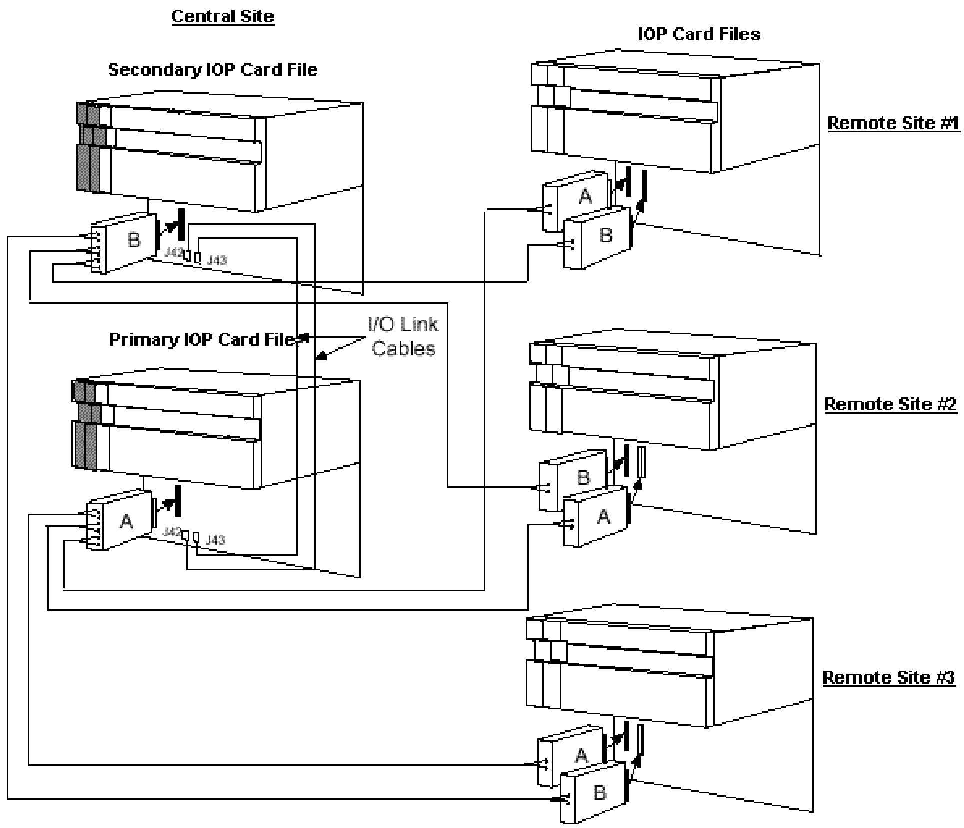
- The local IOP card file is configured as card file #1 (I/O Link Interface address of 0).
- Remote site # 1's I/O card file is configured as card file # 2 (I/O Link Interface address of 1).
- Remote site # 2's I/O card file is configured as card file # 3 (I/O Link Interface address of 2).
- Remote site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


Central Site
IOP Card File
IOP Card Files
Remote Site #1
Remote Site #2
Remote Site #3
A
B

Standard type extender with redundant IOPs example

The following figure illustrates the interconnections for a Standard I/O Link Extender in a system that contains redundant IOP card files. The following IOP subsystem configuration is assumed:

- The primary IOP card file is configured as card file #1 (I/O Link Interface address of 0).
- The secondary IOP card file is configured as card file #2 (I/O Link Interface address of 1).
- Remote site # 1's IOP card file is configured as card file # 3 (I/O Link Interface address of 2).
- Remote site # 2's IOP card file is configured as card file # 4 (I/O Link Interface address of 3).
- Remote site # 3's I/O card file is configured as card file # 5 (I/O Link Interface address of 4).


Central Site
Secondary IOP Card File
IOP Card Files
Remote Site #1
B
J42
J43
A
B
Primary IOP Card File
I/O Link Cables
Remote Site #2
B
A
A
J42
J43
Remote Site #3
A
B

Long Distance type 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.

Configuration of the A and B Long Distance I/O Link Extender is determined by a jumper on the I/O Link Extender card.

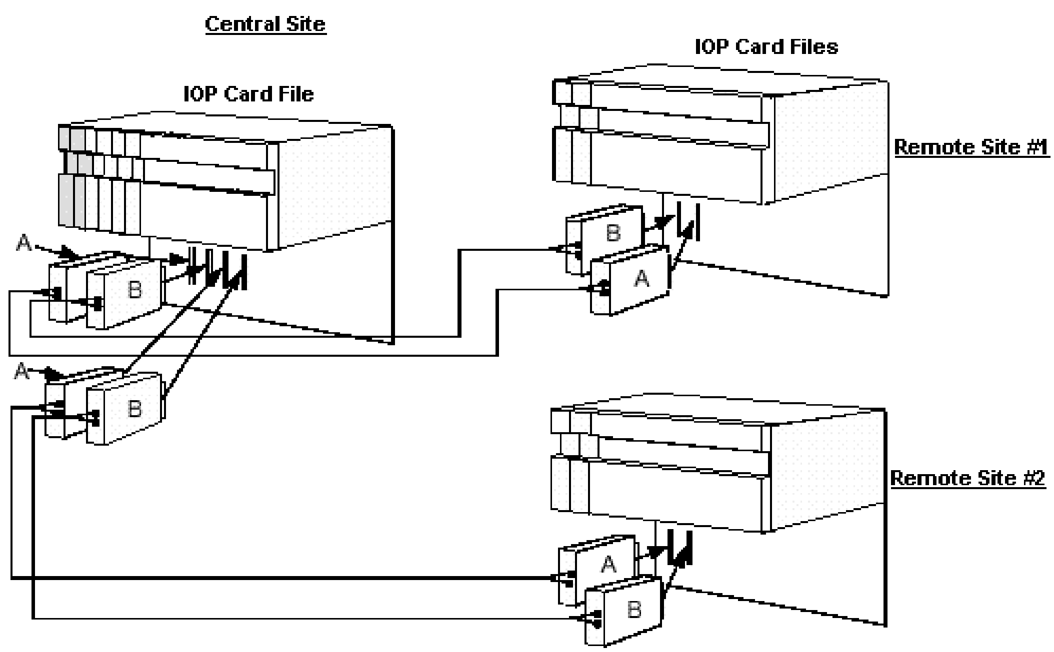
ATTENTION

A metallic I/O Link Interface cable is required between redundant IOP card files for communications with the IOP card slots in the secondary IOP card file.

Long Distance type extender with single IOP example

The following figure illustrates the interconnections for a Long Distance I/O Link Extender in a system that has a single IOP card file. The following IOP subsystem configuration is assumed:

- The local IOP card file is configured as card file #1 (I/O Link Interface address of 0).
- Remote site # 1's I/O card file is configured as card file # 2 (I/O Link Interface address of 1).
- Remote site # 2's I/O card file is configured as card file # 3 (I/O Link Interface address of 2).

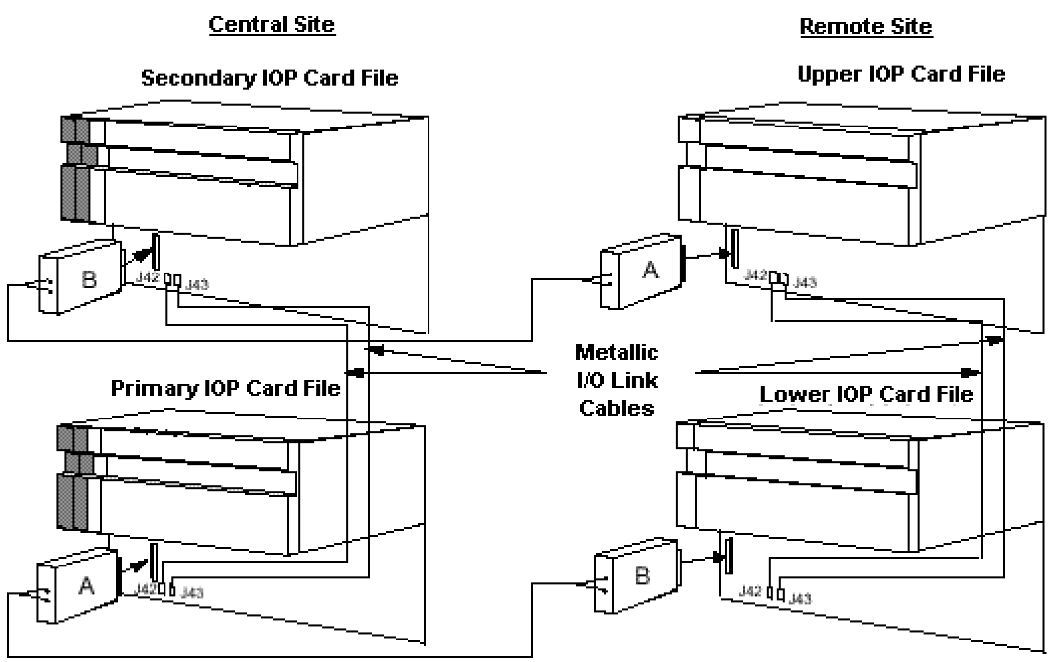


Multiple IOPs at remote site example

For remote locations consisting of more than one IOP card file, the A and B I/O Link Extender cards are installed in separate card files. Use the standard metallic I/O link cables to connect the IOP card files together at both the central and remote sites as shown in the following figure.

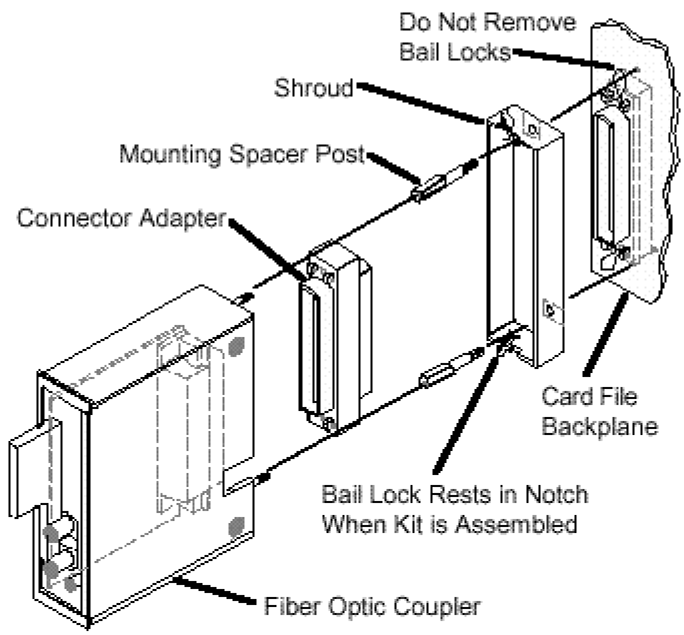
The following IOP subsystem configuration is assumed:

- The Primary IOP card file is configured as card file #1 (I/O Link address of 0).
- The Secondary IOP card file is configured as card file #2 (I/O Link address of 1).
- The remote site's Lower IOP card file is configured as card file #3 (I/O Link address of 2).
- The remote site's Upper IOP card file is configured as card file #4 (I/O Link address of 3).



I/O Link Extender adapter kit

Use the model MU-ILES01 adapter kit to install the Fiber Optic Coupler module in the CE Compliant card files. The kit includes a connector adapter, shroud, and mounting spacers as shown in the following figure.



I/O Link Extender models

The following table lists the available I/O Link Extenders by model number and component part number.

ATTENTION

All I/O Link Extender models are CE Compliant only.

Model Number	Description	CE Compliant Part Number
MC-IOLM02	Standard I/O Link Extender - Local Card File	
	Standard I/O Link Extender Card	51304419-150
	Standard I/O Link Extender Coupler	51201557-350
MC-IOLX02	Standard I/O Link Extender - Remote Card File	
	Standard I/O Link Extender Card	51304419-150
	Standard I/O Link Extender Coupler	51201557-150
MC-ILDX03	Long Distance I/O Link Extender	
	Long Distance I/O Link Extender Card	51304532-150
	Long Distance I/O Link Extender Coupler	51309208-150

I/O Link Interface cables

The following table lists the part numbers of I/O Link Interface cable sets. Two cables are provided when ordered by the part number.

ATTENTION

- For CE Compliance, the shield of an I/O Link Interface cable must be grounded to the card file's metal chassis. FASTON terminals are used to provide the connection.
- DO NOT use the 51204042-xxx I/O Link Interface cables with the I/O Link protection network.

Connector Drops	CE/Non-CE Compliant Part Number (Used with I/O Link Protection Network)	CE Compliant Part Number (Used without I/O Link Protection Network)
2	51195479-100	51204042-100
3	51195479-200	51204042-200
4	51195479-300	51204042-300
5	51195479-400	51204042-400
6	51195479-500	51204042-500

Planning for Field Termination Assemblies (FTAs)

FTA types

The following table lists the types of Field Termination Assemblies that are available to complement associated IOPs and the process equipment. They are broadly defined as either Standard type or Galvanically Isolated type, since some FTAs provide Galvanic Isolation for use in Intrinsically Safe applications. All communicate with an associated IOP, which in turn communicates with a Process Controller through the I/O Link Interface Module.

FTA Type	Description
Standard	
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.
120 Vac/125 Vdc Relay Digital Output (DO)	Provides independent electromechanical relays for ac or dc digital outputs.
120/240 Vac Solid-State Digital Output (DO)	Provides solid-state ac digital outputs that 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.
24 Vdc Nonisolated Digital Output (DO)	Provides nonisolated digital outputs to loads such as lamps and relays. The signals are referenced to logic common.
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.
240 Vac/125 Vdc Relay	Digital Output (DO) Provides independent electromechanical relays for ac or dc digital outputs.
31-200 Vdc Solid-State Digital Output (DO)	Provides dc digital outputs that are isolated from each other.

FTA Type	Description
3-30 Vdc Solid-State Digital Output (DO)	Provides dc digital outputs that are isolated from each other.
Analog Output (AO)	Provides 4-20 mA analog outputs to proportioning loads such as valves.
High Level Analog Input (HLAI)	Accepts high level analog inputs. The inputs are configurable as single-ended or differential in relation to logic ground. Some models also support HART device interface.
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. Some models also support HART device interface.
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.
Smart Transmitter Interface (STI)	Interfaces with Smart Transmitter devices. The interface is referenced to logic ground. The Smart Transmitter provides field isolation.
Galvanically Isolated	
24 Vdc Digital Input (DI)	The 24 Vdc DI FTA accepts contact inputs. All inputs are isolated from each other.
24 Vdc Digital Output (DO)	The 24 Vdc DO FTA provides isolated digital outputs to loads such as solenoid valves or lamps.

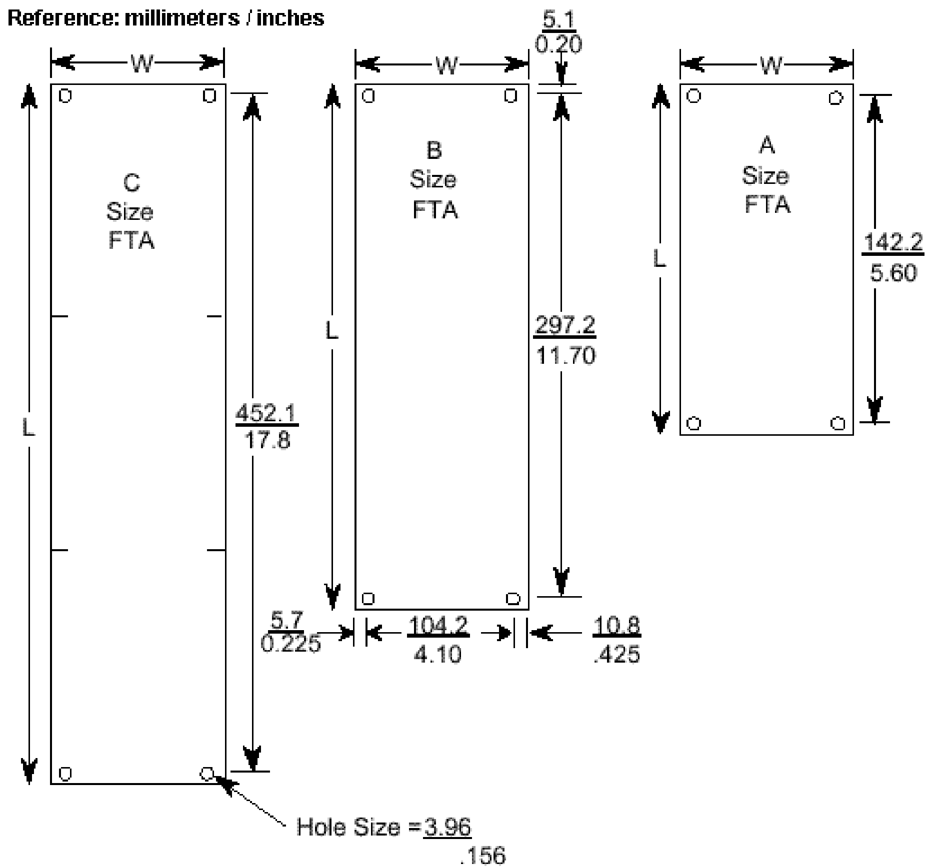
FTA Type	Description
Analog Output (AO)	The AO FTA provides isolated 4-20 mA outputs to proportioning loads such as valves.
Analog Output (AO) HART	The above AO functionality plus the ability to connect HART devices to the FTA without external filtering. This FTA also provides a connector to interface to an external HART multiplexer system.
High Level Analog Input (HLAI)	The HLAI FTA accepts high level analog inputs. All inputs are isolated from ground and each other. Some models also support HART device interface.
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.
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 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.
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.

FTA dimensions

The Standard type FTAs come in one of three sizes, depending on circuitry requirements, as shown in the following figure. The Galvanically Isolated type FTAs come in only the "B" size.

ATTENTION

- The center of the mounting hole 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.



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

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 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 the standard or wide FTA mounting channels are installed. The FTA Mounting Channels also function as cable and wiring channels, or troughs.

CAUTION

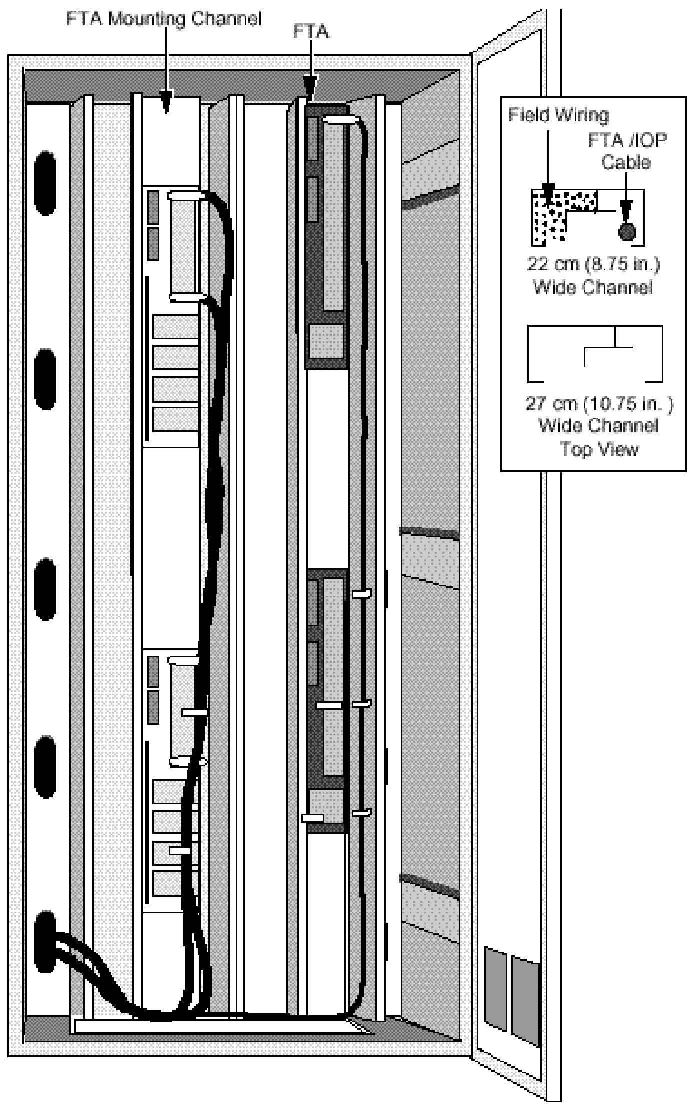
Do not mount Standard type and Galvanically Isolated type FTAs on the same FTA Mounting Channel

FTA mounting orientation

Can mount both Standard and Galvanically Isolated type FTAs on vertically oriented 3-foot long FTA Mounting Channel segments. Galvanically Isolated FTAs can be mounted on an FTA Mounting Channel that is above or below an FTA Mounting Channel that has Standard type FTAs mounted on it.

Typical cabinet layout

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



Cable routing

The Standard type 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 , since the FTA Mounting Channel is installed in an inverted position.

ATTENTION

Route field wiring to Galvanically Isolated FTAs so a strict 2 inch (51 millimeter) minimum is maintained between other wiring, cable, or electrical part , or separated by a divider that is grounded metal or nonconductive material.

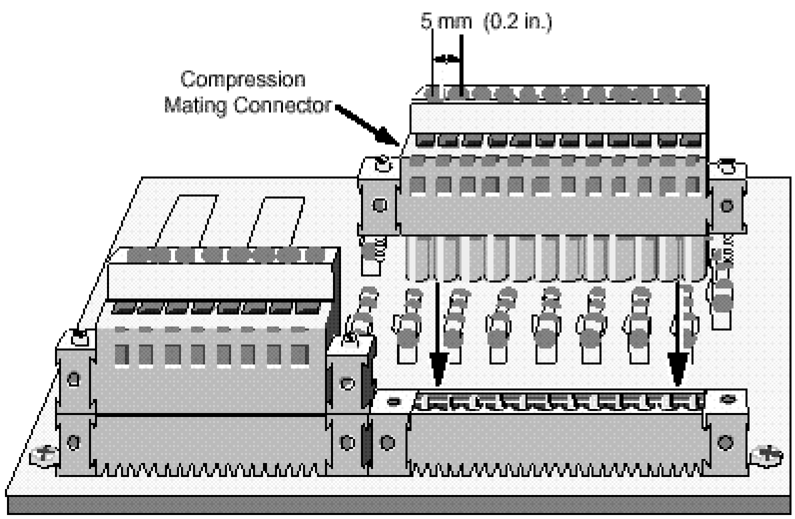
FTA terminal types

Most Standard type FTAs 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 type 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.

FTA compression-type terminal Connector

Compression-type terminal connectors mate with the Standard type FTA's connectors, as shown in the following figure, and accept 0.3 to 2.5 mm2 (14 to 22 AWG) stranded wire. They also accept two 1.0 mm 2 (18 AWG) stranded wires, or a single 3.5 mm 2 (12 AWG) solid wire.

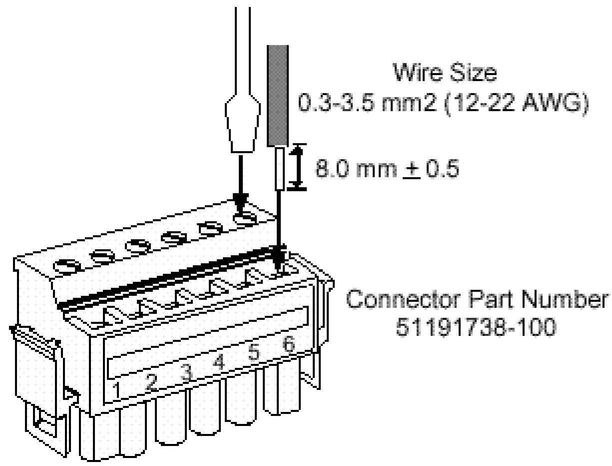


Compression Mating Connector for Standard Type FTA

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

To connect to a FTA with compression-type terminal connectors, the wire insulation is striped for 75 millimeters (3/8 inch), plus or minus 3 millimeters (1/8 inch), inserted into the connector terminal, and then held by tightening the individual terminal screw.

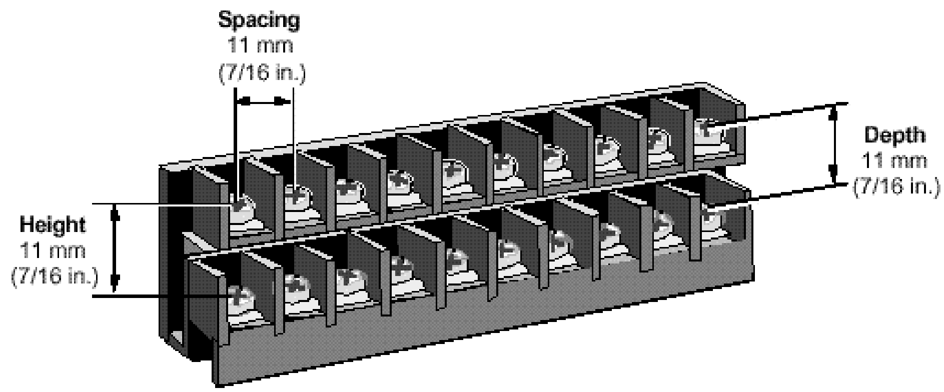
The following figure shows compression-type terminal connectors for mating with the six terminals on the Galvanically Isolated type FTAs. The acceptable wiring sizes are as stated above for connectors used with Standard type FTAs.



Compression Mating Connector for Galvanically Isolated Type FTA

FTA fixed-screw terminal connector

The following figure shows a fixed-screw terminal connector as it would appear on a Standard type FTA.



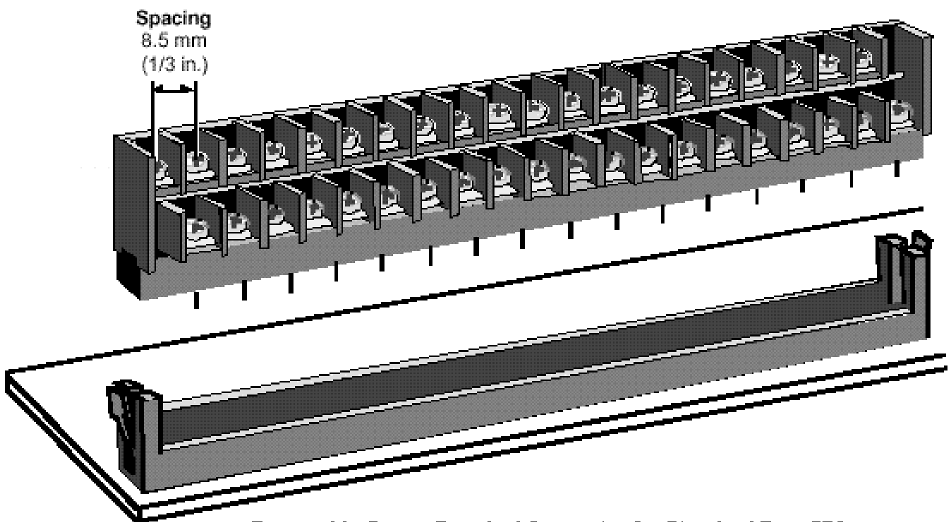
Fixed-Screw Terminal Connector for Standard Type FTA

Screw Terminal Strip Sizes

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

FTA removable-screw terminal connector

The following figure shows a removable-screw terminal connector as it would appear on a Standard type FTA.



Removable-Screw Terminal Connector for Standard Type FTA

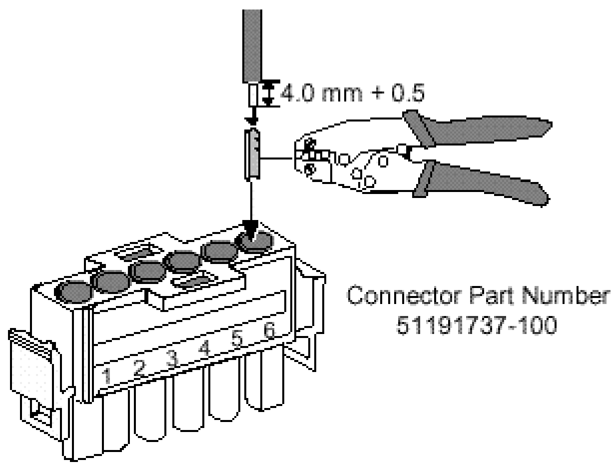
Screw Terminal Connector Size

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

FTA crimp-pin terminal connector

The following figure shows a crimp-pin terminal connector as it would appear on a Galvanically Isolated type FTA.

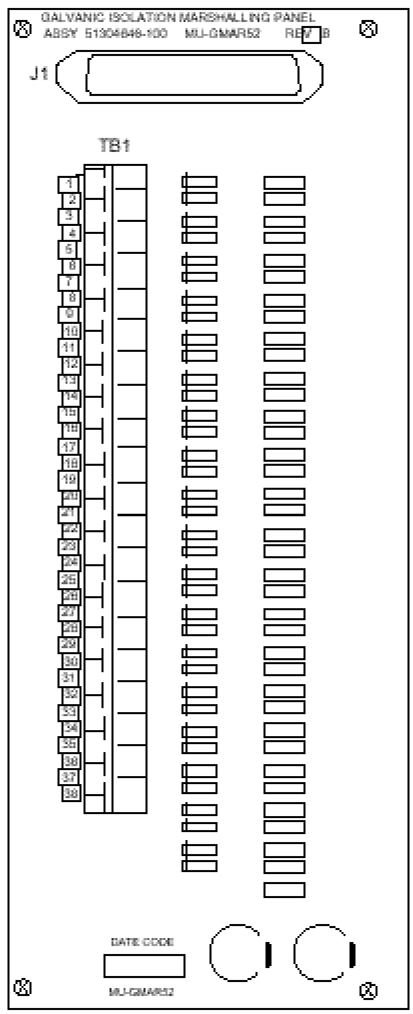
Wire Size	Crimp Pin Part Number	Crimp Tool Part Number
0.5-2.5 mm2 (14-20 AWG)	51191737-201	51191787-100



Crimp-Pin Terminal Connector for Galvanically Isolated Type FTA

FTA Marshalling Panel

The Marshalling Panel provides 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 Input/Output Processor subsystem. The following figure shows an assembly layout of the panel. The model MU-GMAR52 or MC-GMAR52 Marshalling Panel is similar in shape and appearance to a “B” size FTA. The Panel provides surge and ESD protection for the field wiring terminals. It has a 50-pin connector to accept an IOP to FTA cable.



IOP to FTA cable models

The shielded model MU-KFTSxx IOP to FTA cables are for use in CE Compliant applications. They feature metal connector cases. The unshielded model MU-KFTAxx IOP to FTA cables are for use in non-CE Compliant applications. They feature plastic connector cases. The following table list the available cables by model numbers for a given length.

Cable Length (Meters/Feet)	Non-CE Compliant Model Number	CE Compliant Model Number
1.0/3.	Part Number 51201420-001	3 Part Number 51204033-001
1.5/5	Part Number 51201420-915	Part Number 51204033-915
2.0/6	MU-KFTA02	MU-KFTS02
3.0/9	MU-KFTA03	MU-KFTS03
4.0/13	MU-KFTA04	MU-KFTS04
5.0/16	MU-KFTA05	MU-KFTS05
6.0/19	MU-KFTA06	MU-KFTS06
8.0/26	MU-KFTA08	MU-KFTS08
10.0/32	MU-KFTA10	MU-KFTS10
15.0/49	MU-KFTA15	MU-KFTS15
20.0/65	MU-KFTA20	MU-KFTS20
25.0/82	MU-KFTA25	MU-KFTS25
30.0/98	MU-KFTA30	MU-KFTS30
35.0/114	MU-KFTA35	MU-KFTS35
40.0/131	MU-KFTA40	MU-KFTS40
45.0/147	MU-KFTA45	MU-KFTS45
50.0/164	MU-KFTA50	MU-KFTS50

ATTENTION

CE Compliance is provided only when the mating connector on the card file backpanel is a filtered connector with a metal case and the mating connector on the FTA is a connector with a metal case. The metal connector case grounds the cable shield at both ends of the cable.

FTA models

The following table lists the available FTAs by type, model, and component part number. It also lists terminal type, number of channels, and mounting size for reference. The codes used for terminal type are as follows.

- C = Compression-Type Terminal Connector
- CP = Crimp-Pin Terminal Connector
- RS = Removable-Screw Type Terminal Connector
- S = Fixed-Screw Type Terminal Connector

ATTENTION

If you order a FTA by model number only, the CE-Compliant version will be supplied by default.

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
Standard Without Conformal Coating						
120 Vac DI	MU-TDIA12	51304439-100	51304439-125	C	32	C
120 Vac DI	MU-TDIA52	51304439-200	51304439-225	S	32	C
120 Vac DI	MU-TDIA72	51303930-100	N/A	RS	32	C
120 Vac/125 Vdc Relay DO	MU-TDOR12	51304443-100	51309148-125	C	16	B
120 Vac/125 Vdc Relay DO	MU-TDOR52	51304443-200	51309148-225	S	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
120/240 Vac SS DO	MU-TDOA12	51304408-100	N/A	C	16	B
120/240 Vac SS DO	MU-TDOA13	51304648-100	51304648-125	C	16	B
120/240 Vac SS DO	MU-TDOA52	51304408-200	N/A	S	16	B
120/240 Vac SS DO	MU-TDOA53	51304648-200	51304648-225	S	16	B
24 Vdc DI	MU-TDID12	51304441-100	51304441-125	C	32	C
24 Vdc DI	MU-TDID52	51304441-200	51304441-225	S	32	C
24 Vdc DI	MU-TDID72	51303928-100	N/A	RS	32	C
24 Vdc DI	MU-TDIY22	80366180-100	80366180-125	C	32	B
24 Vdc DI	MU-TDIY62	80364010-100	80364010-125	S	32	B
24 Vdc Isolated DO	MU-TDOY22	80366183-100	51204162-125	C	32	B
24 Vdc Isolated DO	MU-TDOY62	80364013-100	80364013-125	S	32	B
24 Vdc Nonisolated DO	MU-TDON12	51304446-100	N/A	C	16	B
24 Vdc Nonisolated DO	MU-TDON52	51304446-200	N/A	S	16	B
240 Vac DI	MU-TDIA22	51304431-100	51304431-125	C	32	C
240 Vac DI	MU-TDIA62	51304431-200	51304431-225	S	32	C
240 Vac/125 Vdc Relay DO	MU-TDOR22	51304427-100	51309150-125	C	16	B
240 Vac/125 Vdc Relay DO	MU-TDOR62	51304427-200	51309150-225	S	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
240 Vac/125 Vdc Relay DO	MU-TDOY23	80366189-100	80366189-125	C	16	B
240 Vac/125 Vdc Relay DO	MU-TDOY63	80366185-100	80366185-125	S	16	B
31-200 Vac SS DO	MU-TDOD22	51304428-100	N/A	C	16	B
31-200 Vac SS DO	MU-TDOD23	N/A	51309154-125	C	16	B
31-200 Vac SS DO	MU-TDOD62	51304428-200	N/A	S	16	B
31-200 Vac SS DO	MU-TDOD63	N/A	51309154-225	S	16	B
3-30 Vdc SS DO	MU-TDOD12	51304423-100	N/A	C	16	B
3-30 Vdc SS DO	MU-TDOD13	51304650-100	N/A	C	16	B
3-30 Vdc SS DO	MU-TDOD14	N/A	51309153-125	C	16	B
3-30 Vdc SS DO	MU-TDOD52	51304423-200	N/A	S	16	B
3-30 Vdc SS DO	MU-TDOD53	51304650-200	N/A	S	16	B
3-30 Vdc SS DO	MU-TDOD54	N/A	51309153-225	S	16	B
AO	MU-TAOX02	51304476-100	51304476-125	C	8	A
AO	MU-TAOX12	51304335-100	51304335-125	C	8	B
AO	MU-TAOX52	51304335-200	51304335-225	S	8	B
AO	MU-TAOY22	80366177-100	80366481-125	C	16	B
AO	MU-TAOY23	80366177-200	N/A	C	16	B
AO16HART	MU-TAOY24	N/A	51305865-125	C	16	B
AO16HART	MU-TAOY25			C	16	B
AO	MU-TAOY52	80364007-100	80366484-125	S	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
AO	MU-TAOY53	80364007-200	N/A	S	16	B
AO16HART	MU-TAOY54	N/A	51305867-125	S	16	B
AO16HART	MU-TAOY55			S	16	B
AO	MU-THAO11	N/A	51309542-125	c	16	B
HLAI	MU-TAIH03	N/A	51309136-125	C	16	A
HLAIHART	MU-TAIH04	N/A	51305900-125	C	16	A
HLAI	MU-TAIH13	N/A	51309138-125	C	16	B
HLAIHART	MU-TAIH14			C	16	B
HLAIHART	MU-TAIH15	N/A	51305863-125	C	16	B
HLAI	MU-TAIH23	N/A	80369165-125	C	16	B
HLAI	MU-TAIH53	N/A	51309138-225	S	16	B
HLAIHART	MU-TAIH54	N/A	51305863-225	S	16	B
HLAI/STI	MU-TAIH02	51304453-100	N/A	C	16	A
HLAI/STI	MU-TAIH12	51304337-100	N/A	C	16	B
HLAIHART	MU-TAIH14	-	N/A	C	16	B
HLAI/STI	MU-TAIH22	80366195-100	N/A	C	16	B
HLAI/STI	MU-TAIH52	51304337-200	N/A	S	16	B
HLAI/STI	MU-TAIH62	80366192-100	N/A	S	16	B
LLAI	MU-TAIL02	51304437-100	N/A	C	8	B
LLAI	MU-TAIL03	N/A	51309202-125	C	8	B
LLMux RTD	MU-TAMR02	51304477-100	N/A	C	16	B
LLMux RTD	MU-TAMR03	N/A	51309218-125	C	16	B
LLMux TC	MU-TAMT02	51401491-100	N/A	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
LLMux TC	MU-TAMT03	N/A	51309223-125	C	16	B
LLMux TC Remote	MU-TAMT12	51401573-100	N/A	C	16	B
LLMux TC Remote	MU-TAMT13	N/A	51309213-125	C	16	B
RHMUX GI/IS Power Adapter	MU-GRPA01	N/A	51304724-125	C	2	A
RHMUX GI/NI Power Adapter	MU-TRPA01	N/A	51304722-125	C	2	B
STI	MU-TSTX03	N/A	51309136-125	C	16	A
STI	MU-TSTX13	N/A	51309138-125	C	16	B
STI	MU-TSTX53	N/A	51309138-225	S	16	B
Power Adapter	MU-TLPA02	51304467-100	51309204-125	- -	- -	- -
DI Power Distribution Assembly	MU-TDPR02	51304425-100	51304425-125	- -	- -	- -
Standard With Conformal Coating						
120 Vac DI	MC-TDIA12	51304439-150	51304439-175	C	32	C
120 Vac DI	MC-TDIA52	51304439-250	51304439-275	S	32	C
120 Vac DI	MC-TDIA72	51303930-150	N/A	RS	32	C
120 Vac/125 Vdc Relay DO	MC-TDOR12	51304443-150	51309148-175	C	16	B
120 Vac/125 Vdc Relay DO	MC-TDOR52	51304443-250	51309148-275	S	16	B
120/240 Vac SS DO	MC-TDOA12	51304408-150	N/A	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
120/240 Vac SS DO	MC-TDOA13	51304648-150	51304648-175	C	16	B
120/240 Vac SS DO	MC-TDOA52	51304408-250	N/A	S	16	B
120/240 Vac SS DO	MC-TDOA53	51304648-250	51304648-275	S	16	B
24 Vdc DI	MC-TDID12	51304441-150	51304441-175	C	32	C
24 Vdc DI	MC-TDID52	51304441-250	51304441-275	S	32	C
24 Vdc DI	MC-TDID72	51303928-150	N/A	RS	32	C
24 Vdc DI	MC-TDIY22	80366180-150	80366180-175	C	32	B
24 Vdc DI	MC-TDIY62	80364010-150	80364010-175	S	32	B
24 Vdc Isolated DO	MC-TDOY22	80366183-150	80366183-175	C	32	B
24 Vdc Isolated DO	MC-TDOY62	80364013-150	80364013-175	S	32	B
24 Vdc Nonisolated DO	MC-TDON12	51304446-150	N/A	C	16	B
24 Vdc Nonisolated DO	MC-TDON52	51304446-250	N/A	S	16	B
240 Vac DI	MC-TDIA22	51304431-150	51304431-175	C	32	C
240 Vac DI	MC-TDIA62	51304431-250	51304431-275	S	32	C
240 Vac/125 Vdc Relay DO	MC-TDOR22	51304427-150	51309150-175	C	16	B
240 Vac/125 Vdc Relay DO	MC-TDOR62	51304427-250	51309150-275	S	16	B
240 Vac/125 Vdc Relay DO	MC-TDOY23	80366189-150	80366189-175	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
240 Vac/125 Vdc Relay DO	MC-TDOY63	80366185-150	80366185-175	S	16	B
31-200 Vac SS DO	MC-TDOD22	51304428-150	N/A	C	16	B
31-200 Vac SS DO	MC-TDOD23	N/A	51309154-175	C	16	B
31-200 Vac SS DO	MC-TDOD62	51304428-250	N/A	S	16	B
31-200 Vac SS DO	MC-TDOD63	N/A	51309154-275	S	16	B
3-30 Vdc SS DO	MC-TDOD12	51304423-150	N/A	C	16	B
3-30 Vdc SS DO	MC-TDOD13	51304650-150	N/A	C	16	B
3-30 Vdc SS DO	MC-TDOD14	N/A	51309153-175	C	16	B
3-30 Vdc SS DO	MC-TDOD52	51304423-250	N/A	S	16	B
3-30 Vdc SS DO	MC-TDOD53	51304650-250	N/A	S	16	B
3-30 Vdc SS DO	MC-TDOD54	N/A	51309153-275	S	16	B
AO	MC-TAOX02	51304476-150	51304476-175	C	8	A
AO	MC-TAOX12	51304335-150	51304335-175	C	8	B
AO	MC-TAOX52	51304335-250	51304335-275	S	8	B
AO	MC-TAOY22	80366177-150	80366481-175	C	16	B
AO	MC-TAOY23	80366177-250	N/A	C	16	B
AO16HART	MC-TAOY24	N/A	51305865-175	C	16	B
AO16HART	MC-TAOY25			C	16	B
AO	MC-TAOY52	80364007-150	80366484-175	S	16	B
AO	MC-TAOY53	80364007-250	N/A	S	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
AO16HART	MC-TAOY54	N/A	51305867-175	S	16	B
AO16HART	MC-TAOY55			S	16	B
AO	MC-THAO11	N/A	51309542-175	C	16	B
HLAI	MC-TAIH03	N/A	51309136-175	C	16	A
HLAIHART	MC-TAIH04	N/A	51305900-175	C	16	A
HLAI	MC-TAIH13	N/A	51309138-175	C	16	B
HLAIHART	MC-TAIH14			C	16	B
HLAIHART	MC-TAIH15	N/A	51305863-175	C	16	B
HLAI	MC-TAIH23	N/A	80369165-175	C	16	B
HLAI	MC-TAIH53	N/A	51309138-225	S	16	B
HLAIHART	MC-TAIH54	N/A	51305863-275	S	16	B
HLAI/STI	MC-TAIH02	51304453-150	N/A	C	16	A
HLAI/STI HHLAI	MC-TAIH12	51304337-150	N/A	C	16	B
HLAI/STI	MC-TAIH22	80366195-150	N/A	C	16	B
HLAI/STI	MC-TAIH52	51304337-250	N/A	S	16	B
HLAI/STI	MC-TAIH62	80366192-150	N/A	S	16	B
LLAI	MC-TAIL02	51304437-150	N/A	C	8	B
LLAI	MC-TAIL03	N/A	51309202-175	C	8	B
LLMux RTD	MC-TAMR02	51304477-150	N/A	C	16	B
LLMux RTD	MC-TAMR03	N/A	51309218-175	C	16	B
LLMux RTD	MC-TAMR04	N/A	51305907-175	C	16	B
LLMux TC	MC-TAMT02	51401491-150	N/A	C	16	B
LLMux TC	MC-TAMT03	N/A	51309223-175	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
LLMux TC	MC-TAMT04	N/A	51305890-175	C	16	B
LLMux TC Remote	MC-TAMT12	51401573-150	N/A	C	16	B
LLMux TC Remote	MC-TAMT13	N/A	51309213-175	C	16	B
RHMUX GI/IS Power Adapter	MC-GRPA01	N/A	51304724-175	C	2	A
RHMUX GI/NI Power Adapter	MC-TRPA01	N/A	51304722-175	C	2	B
RHMUX TC Local CJR	MC-GRMT01	N/A	51404106-175	S	16	Non Stand-ard
STI	MC-TSTX03	N/A	51309136-175	C	16	A
STI	MC-TSTX13	N/A	51309138-175	C	16	B
STI	MC-TSTX53	N/A	51309138-275	S	16	B
Power Adapter	MC-TLPA02	51304467-150	51309204-175	- -	- -	- -
DI Power Distribution Assembly	MC-TDPR02	51304425-150	51304425-175	- -	- -	- -
Galvanically Isolated Without Conformal Coating						
24 Vdc DI	MU-GDID12	51304640-100	51304640-125	C	32	B
24 Vdc DI	MU-GDID13	51304728-100	51304728-125	C	32	B
24 Vdc DI	MU-GDID82	51304640-300	51304640-325	CP	32	B
24 Vdc DI	MU-GDID83	51304728-300	51304728-325	C	32	B
24 Vdc DO	MU-GDOD12	51304642-100	51304642-125	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
AO	MU-GAOX02	51304638-100	51304638-125	C	8	B
AO	MU-GAOX12	51304638-500	51304638-525	C	8	B
AO	MU-GAOX72	51304638-300	51304638-325	CP	8	B
AO	MU-GAOX82	51304638-700	51304638-725	CP	16	B
AO	MU-GHAO11	N/A	51309540-125	C	16	B
AO16HART	MU-GHAO21	N/A	51305869-125	C	16	B
DO with LFD	MU-GDOL12	51304736-100	51304736-125	C	16	B
DO with LFD	MU-GDOL82	51304736-300	51304736-325	CP	16	B
GI 24 Vdc DO	MU-GDOD82	51304642-300	51304642-325	CP	16	B
GI HLAI/STI	MU-GAIH83	51304718-300	51304718-325	CP	16	B
HLAI	MU-GAIH12	51304636-100	N/A	C	16	B
HLAI, HLAIHART	MU-GAIH22	51304748-100	51304748-125	C	16	B
HLAI	MU-GAIH82	51304636-300	N/A	CP	16	B
HLAI	MU-GAIH92	51304748-300	51304748-325	CP	16	B
HLAI/STI, HLAIHART	MU-GAIH13	51304718-100	51304718-125	C	16	B
HLAI/STI, HLAIHART	MU-GAIH14	51304730-100	51304730-125	C	16	B
HLAI/STI	MU-GAIH84	51304730-300	51304730-325	CP	16	B
Combiner Panel	MU-GLFD02	51304732-100	51304732-125	- -	- -	- -
Marshalling Panel	MU-GMAR52	51304646-100	51309156-125	- -	- -	- -

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
Power Distribution Assembly	MU-GPRD02	51304644-100	51304644-125	- -	- -	- -
Galvanically Isolated With Conformal Coating						
24 Vdc DI	MC-GDID12	51304640-150	51304640-175	C	32	B
24 Vdc DI	MC-GDID13	51304728-150	51304728-175	C	32	B
24 Vdc DI	MC-GDID82	51304640-350	51304640-375	CP	32	B
24 Vdc DI	MC-GDID83	51304728-350	51304728-375	C	32	B
24 Vdc DO	MC-GDOD12	51304642-150	51304642-175	C	16	B
AO	MC-GAOX02	51304638-150	51304638-175	C	8	B
AO	MC-GAOX12	51304638-550	51304638-575	C	8	B
AO	MC-GAOX72	51304638-350	51304638-375	CP	8	B
AO	MC-GAOX82	51304638-750	51304638-775	CP	16	B
AO	MC-GHAO11	N/A	51309540-175	C	16	B
AO16HART	MC-GHAO21	N/A	51305869-175	C	16	B
DO with LFD	MC-GDOL12	51304736-150	51304736-175	C	16	B
DO with LFD	MC-GDOL82	51304736-350	51304736-375	CP	16	B
GI 24 Vdc DO	MC-GDOD82	51304642-350	51304642-375	CP	16	B
GI HLAI/STI	MC-GAIH83	51304718-350	51304718-375	CP	16	B
HLAI	MC-GAIH12	51304636-150	N/A	C	16	B
HLAI, HLAIHART	MC-GAIH22	51304748-150	51304748-175	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
HLAI	MC-GAIH82	51304636-350	N/A	CP	16	B
HLAI	MC-GAIH92	51304748-350	51304748-375	CP	16	B
HLAI/STI, HLAIHART	MC-GAIH13	51304718-150	51304718-175	C	16	B
HLAI/STI, HLAIHART	MC-GAIH14	51304730-150	51304730-175	C	16	B
HLAI/STI	MC-GAIH84	51304730-350	51304730-375	CP	16	B
Combiner Panel	MC-GLFD02	51304732-150	51304732-175	- -	- -	- -
Marshalling Panel	MC-GMAR52	51304646-150	51309156-175	- -	- -	- -
Power Distribution Assembly	MC-GPRD02	51304644-150	51304644-175	- -	- -	- -

Planning Your C200 Control System Installation

Background

There are two basic manners in which your Experion system may be ordered and delivered. You may elect to:

- have Honeywell or a third-party Control System Integrator (CSI) interconnect, test, and deliver your Experion system in an enclosure(s)
- order and receive your Experion system components, and thereby assume the responsibility for suitable mounting, interconnections, and testing

ATTENTION

The information found in *Planning Your Control System Installation* is specific to the standard options and configurations provided by Honeywell. However, this information can be used by you or your third-party CSI when installing your system to the specifications and requirements.

Enclosures

Single- or dual-access enclosures may be specified, depending on your requirements and the amount of hardware to be mounted.

ATTENTION

Be sure you provide proper thermal management inside all enclosure configurations to meet the ambient temperature requirement for your application. The Control hardware is rated for use in a 60°C (140°F) ambient unless otherwise marked on a module. Please see the *Control hardware temperature classification guidelines* in the *Control Hardware Installation Guide* for more information. Thermal management considerations include:

- Adhering to minimum enclosure size recommendations.
- Observing minimum spacing requirements for all hardware.
- Routing cables and wire trays so they are outside the unobstructed space around the hardware and not laying cables on top of any hardware.
- Using cooling equipment, such as fans and heat exchangers, as required to keep the temperature of the air exiting from within one inch (25mm) above the chassis from exceeding 70°C (158°F).

Mounting panels

A vertical mounting panel inside the enclosure provides for the attachment of infrastructure and control hardware such as:

- chassis
- DIN-rails
- power supplies
- tap-mounting brackets

For dual-access enclosures, there are normally two back-to-back mounting panels.

Chassis mounting and spacing

Starting at the top of the mounting space in an enclosure (in the first or only enclosure, as applicable), the controller chassis are first installed, followed by the installation of the I/O chassis follows.

To provide sufficient convection cooling for chassis and their resident power supplies and modules there must be:

- at least six inches of unobstructed space above and below each chassis, for convection cooling of modules and power supply in the chassis.
- at least eight inches of unobstructed space in height between vertically-adjacent chassis.
- four inches horizontal unobstructed space past the end of a chassis (on the right) or its attached power supply (on the left).

Remote Termination Panels

Remote Termination Panels (RTPs) may or may not be used with most IOMs. It depends on whether or not you desire the field wiring to be connected first to RTPs rather than going directly to the IOM front panel connectors. Remote Termination Panels must be ordered directly through Allen-Bradley distributors but using Honeywell part numbers to ensure receipt of IOM-compatible connector covers.

If RTPs are installed, the default location for RTPs in an enclosure is the bottom portion of the mounting space (below the lowest chassis). This way, field wiring enters the enclosure near the bottom, then is routed to the RTPs without entering the upper area where chassis are located. If field wiring enters the enclosure near the top, it can be routed to the RTPs near the bottom so long as this does not violate the requirements defined in *Wiring and Cabling*.

CAUTION

Making field connections near the bottom portion of the enclosure is recommended; otherwise, loose wires, cables and other hardware could fall into or onto the chassis and their associated modules and power supplies.

Wiring and Cabling

Wiring and cabling are typically placed inside wire-way hardware that confines the wiring/cabling to acceptable pathways inside the enclosure. This isolates different type wiring and cabling from each other, according to the National Electrical Code (NEC) and Canadian Electrical Code (CEC).

Wiring and cabling in a typical enclosure generally consists of:

- power and ground distribution,
- FTE network and/or ControlNet cables,
- redundancy cable(s) (connecting Redundancy Modules in partner chassis),
- RTP-to-IOM cables, and
- field-wiring entering the enclosure and connecting to RTPs or IOMs.

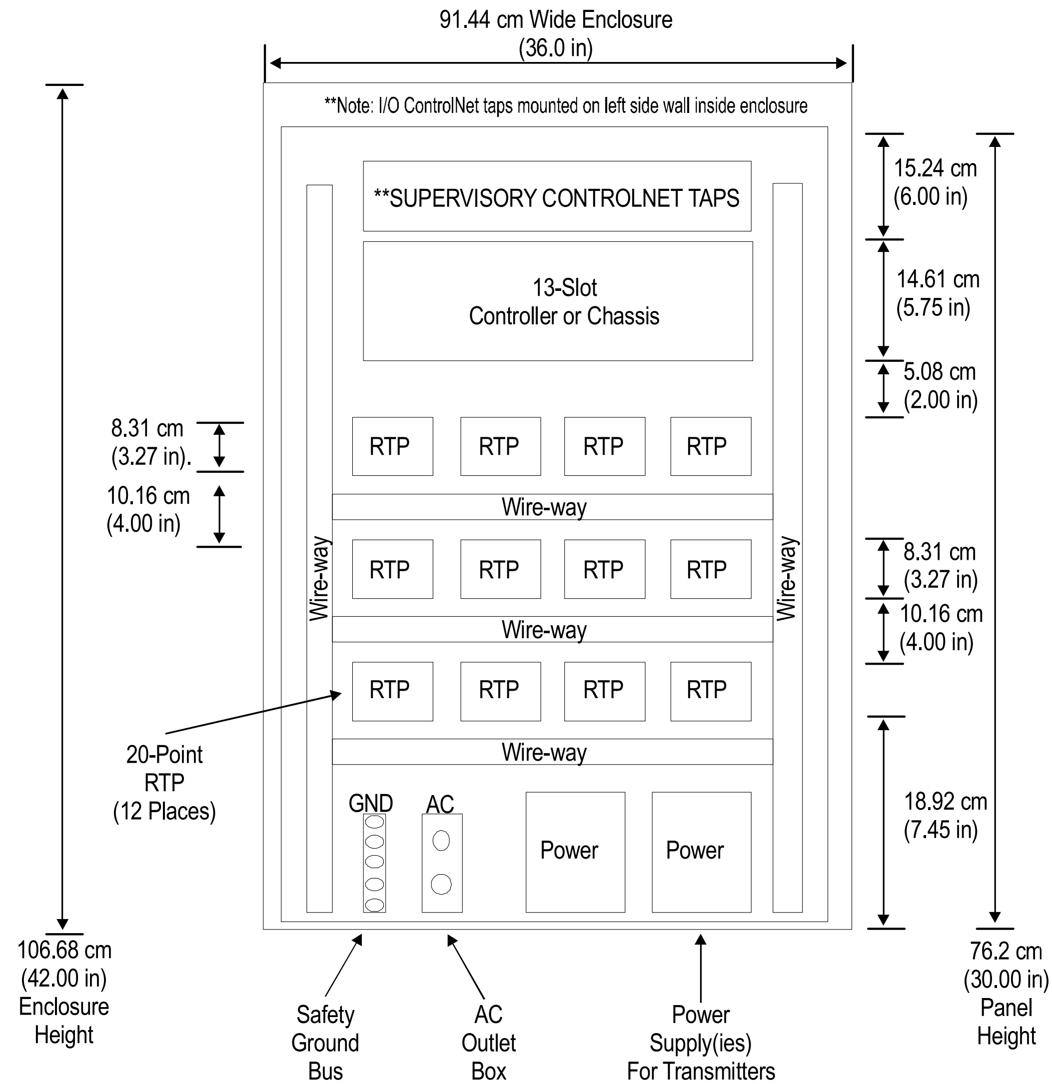
ControlNet network taps

It is recommended that Supervisory ControlNet taps be mounted above the top controller chassis. I/O ControlNet taps should be mounted on the left-side panel area, next to each chassis. Since taps have one-meter drop-cables, they must be mounted close enough to the associated CNI module inside the chassis.

Small-scale system enclosure configuration example

The following figure illustrates an example small-scale system enclosure configuration. This example configuration shows a single-access enclosure with:

- a single 13-slot non-redundant controller chassis and power supply
- two Supervisory ControlNet taps for redundant network cabling
- optional RTPs corresponding to the IOMs in the controller or I/O chassis
- optional power supplies for smart transmitters
- line power and ground distribution hardware
- wire-ways containing all internal wiring and cabling

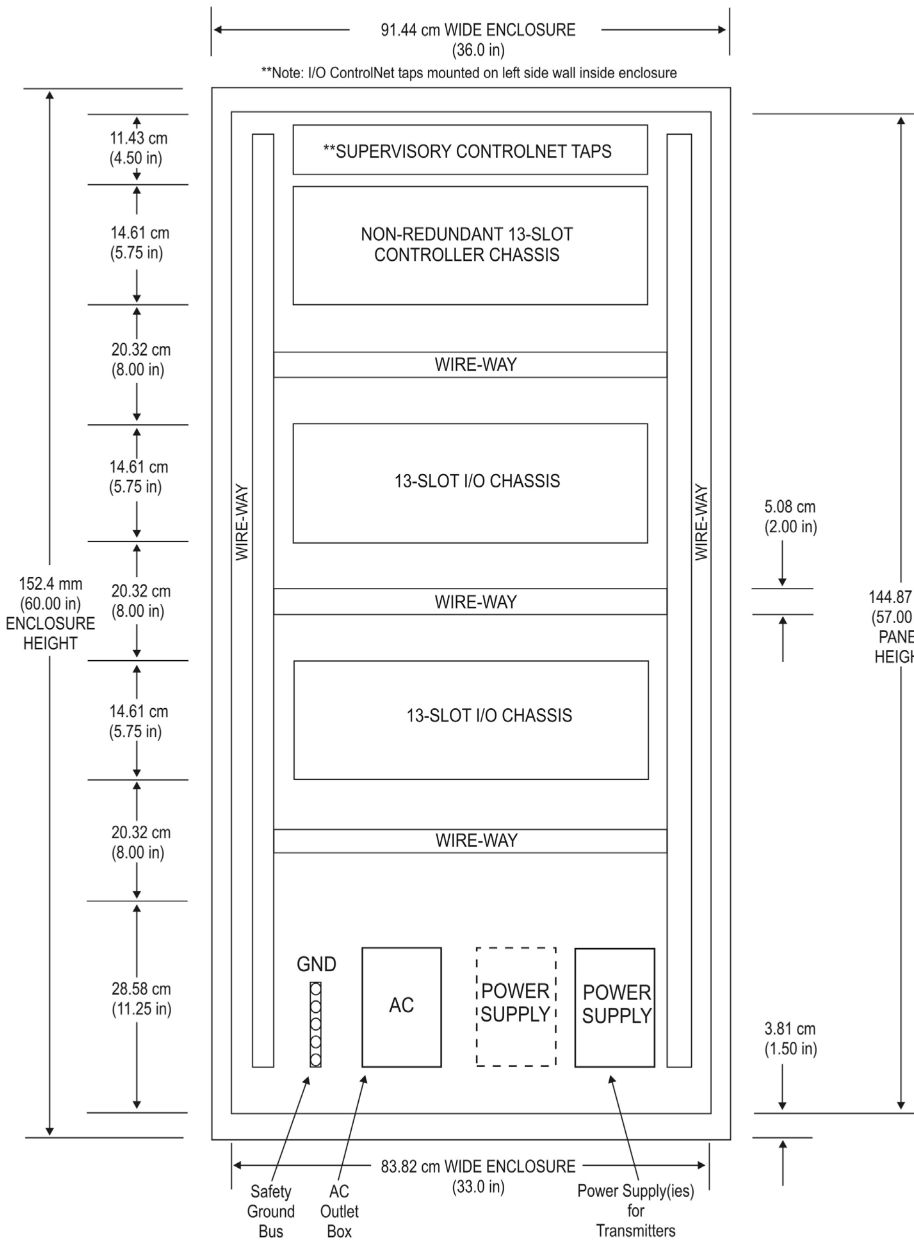


Small-scale system enclosure configuration example

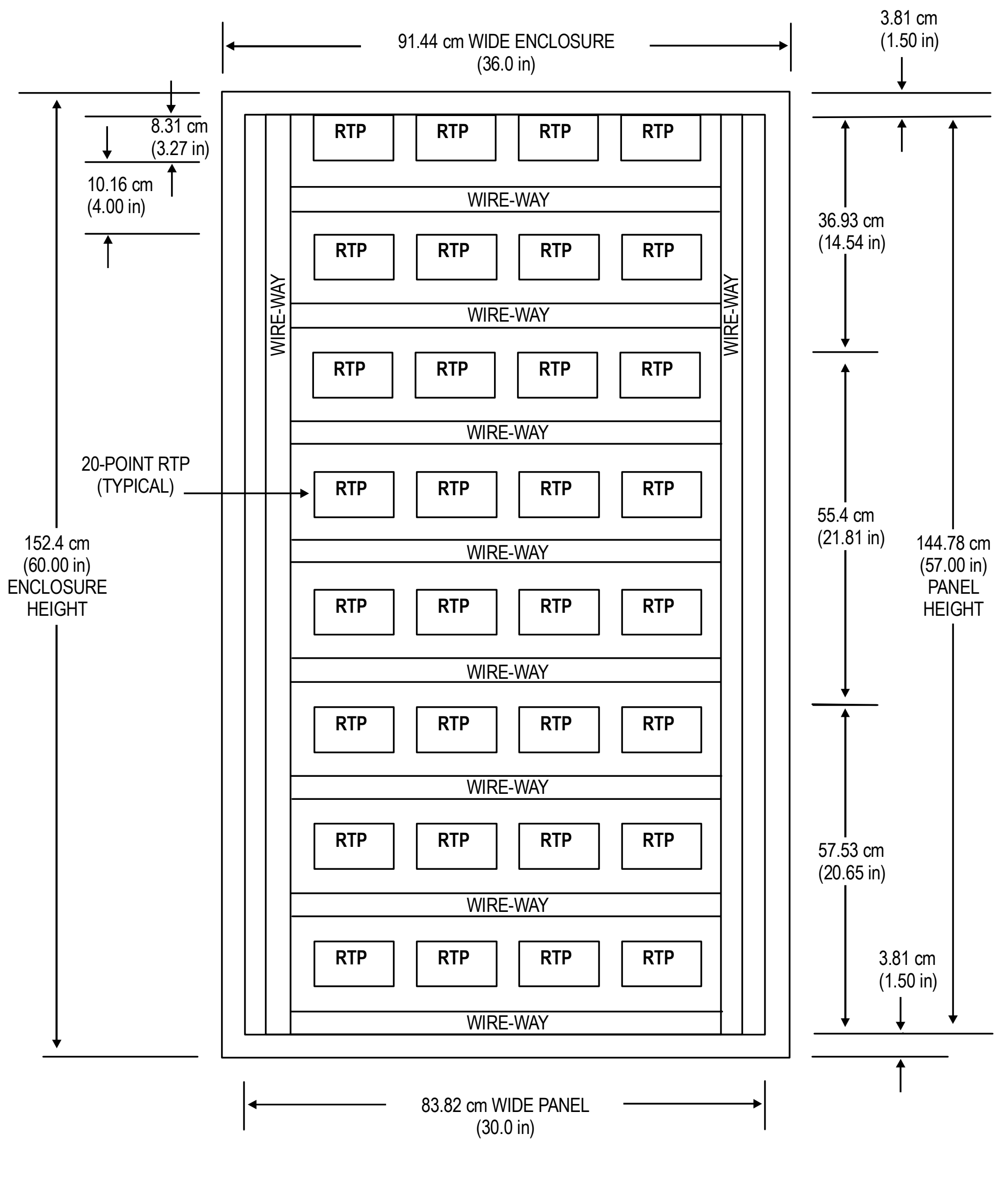
Medium-scale system enclosure configuration example

The following two figures combined, illustrate an example medium-scale, two-enclosure system with:

- a single 13-slot non-redundant controller or chassis, and power supply
- two 13-slot I/O chassis and power supplies
- two Supervisory ControlNet taps for redundant network cabling
- optional RTPs corresponding to the IOMs in the controller or I/O chassis
- optional power supplies for smart transmitters
- line power and ground distribution hardware
- wire-ways containing all internal wiring and cabling



Medium-scale system enclosure configuration example, 1-of-2

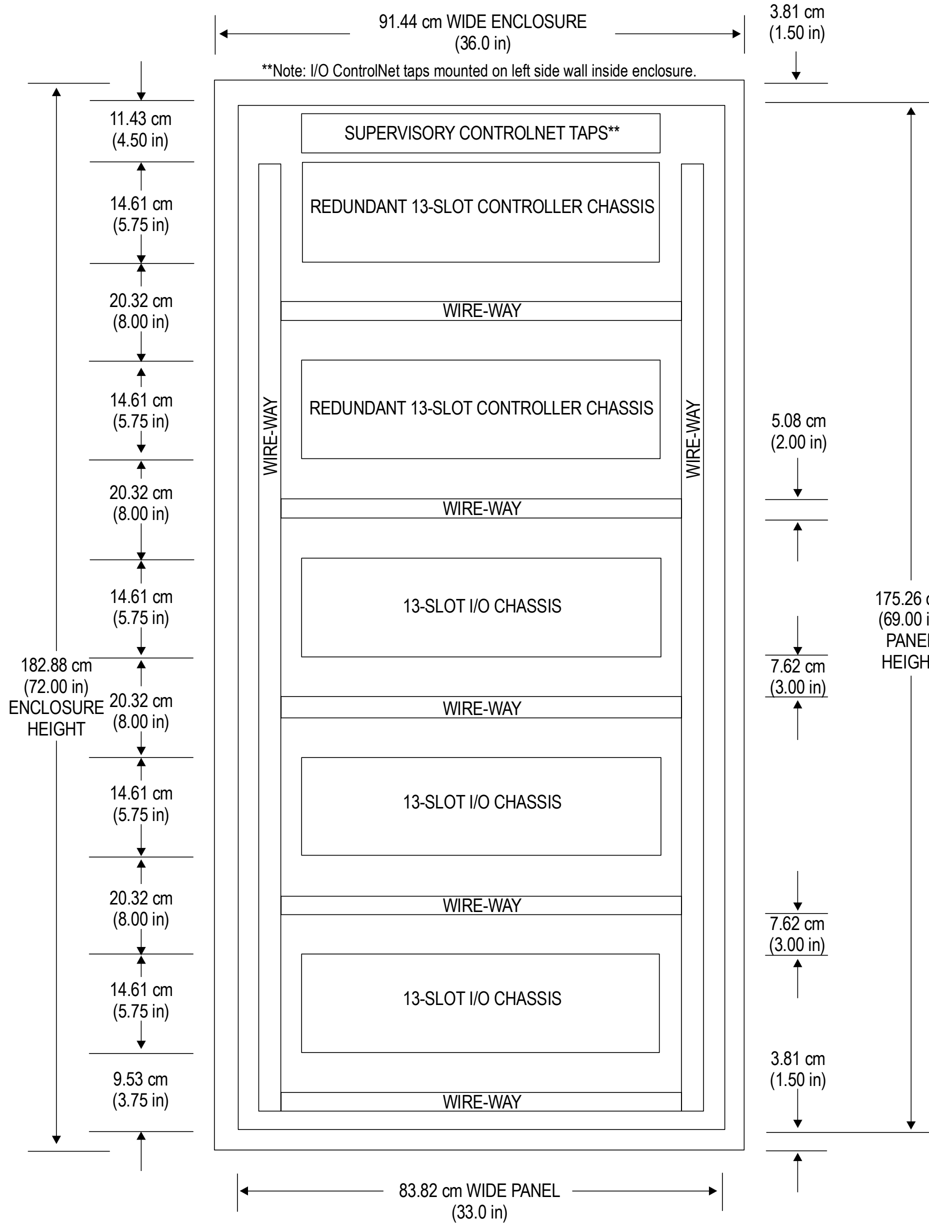


Medium-scale system enclosure configuration example, 2-of-2

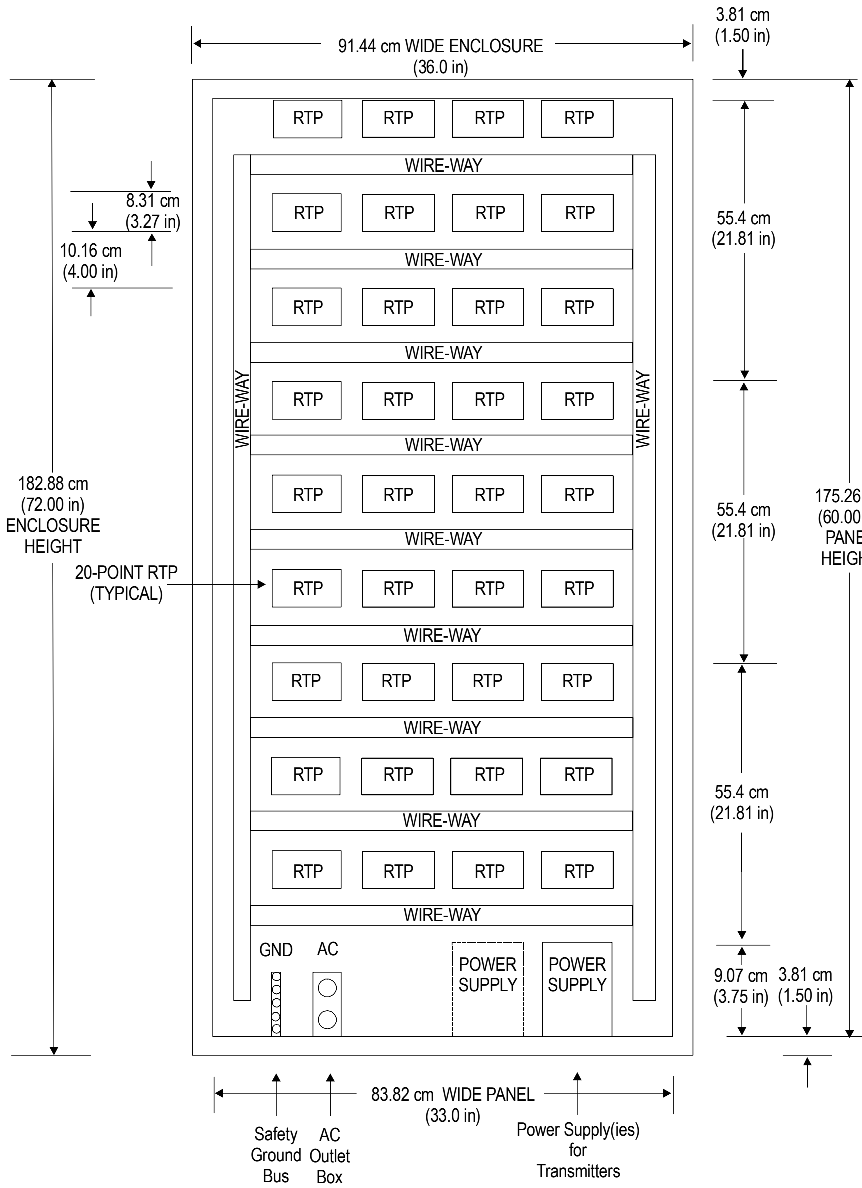
Large-scale system enclosure configuration example

The following two figures combined, illustrate an example large-scale system enclosure configuration. This example configuration shows a two enclosures with:

- a pair of 13-slot redundant controller chassis and power supplies.
- three 13-slot I/O chassis and power supplies.
- four Supervisory ControlNet taps for redundant controller, redundant media cabling.
- optional RTPs corresponding to the IOMs in the controller or I/O chassis.
- optional power supplies for smart transmitters.
- line power and ground distribution hardware.
- wire-ways containing all internal wiring and cabling



Large-scale system enclosure configuration example, 1-of-2

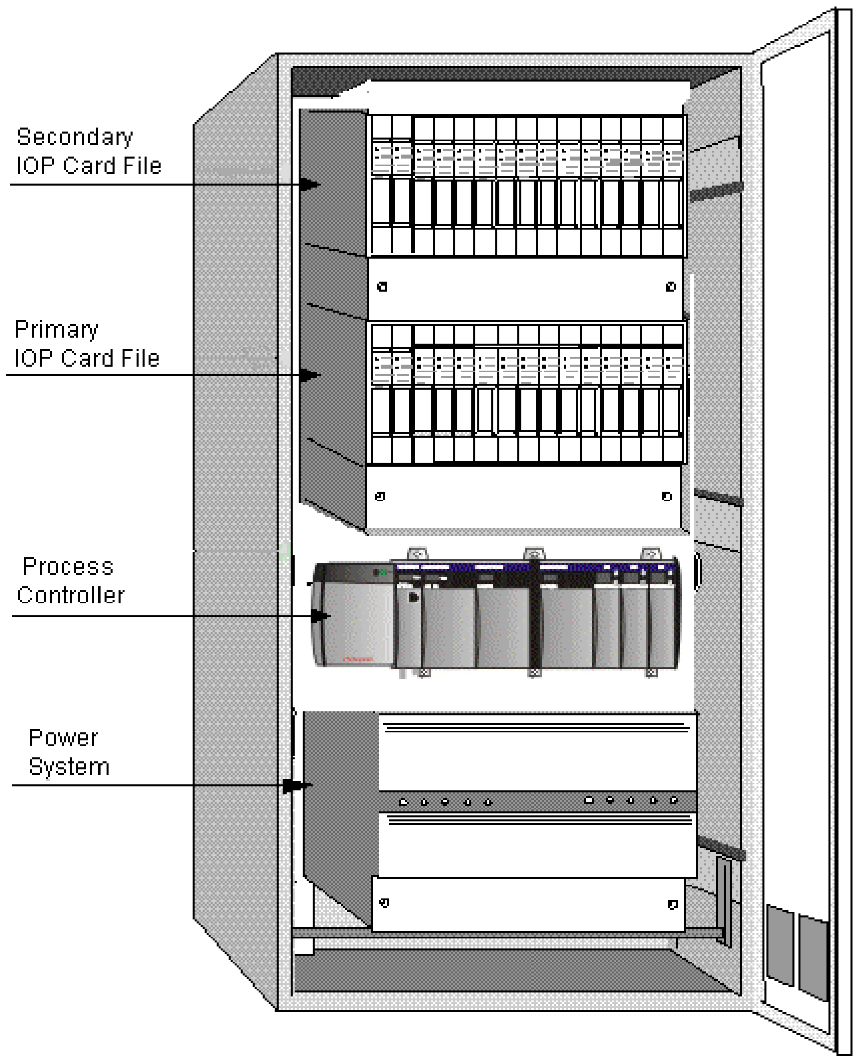


Large-scale system enclosure configuration example, 2-of-2

Single IOP cabinet configuration

The IOP subsystem can have various cabinet configurations. Cabinets can be complexed together or remotely separated. The Process Controller and IOP card files have independent Power Systems.

The following figure is an illustration of a single IOP cabinet containing two IOP card files in a redundant IOP configuration and one non-redundant Process Controller.

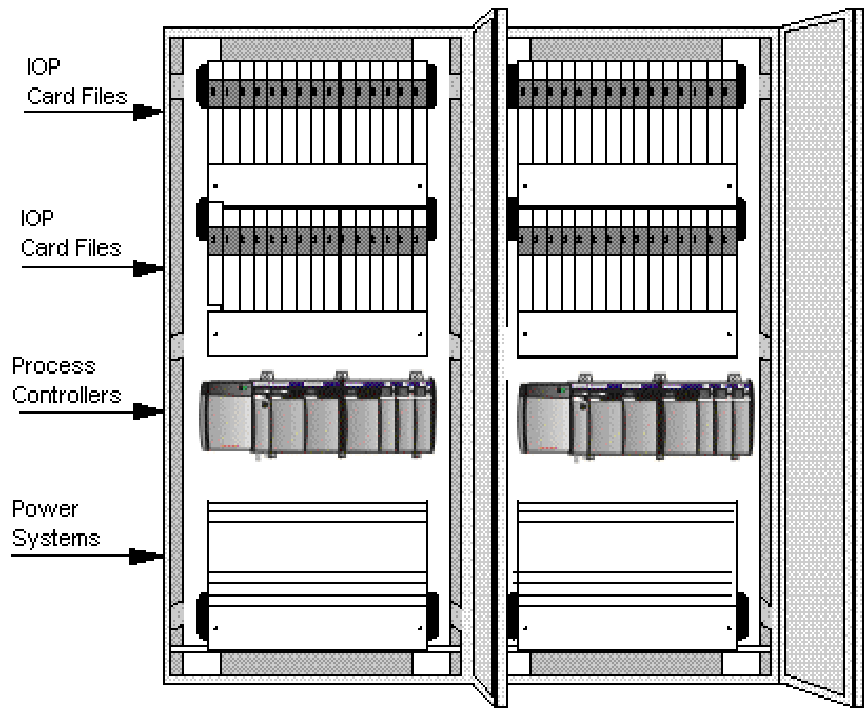


ATTENTION

- A 10-slot Process Controller chassis can fit inside the IOP cabinet without modification. If you remove the trim panels from inside the cabinet, you can fit a 13-slot chassis inside the IOP cabinet. You can mount larger 17-slot chassis external to the IOP cabinet as long as the 10 meter (33 feet) “in-cabinet” I/O Link electrical length requirement is not exceeded.
- Do **not** mount more than two (2) Process Controller chassis in an IOP cabinet.
- Mount the Process Controller immediately above the power system in the cabinet.
- As an aid to subsystem maintenance, the IOP card pairs should also be installed in the same slot number in both card files.
- A remote redundant IOP card installation is functionally possible provided an I/O Link Extender is not installed between the redundant IOP cards.
- Both IOP cards of a redundant pair must be located within the distance permitted for the 50-meter (164 feet) FTA to IOP cables.

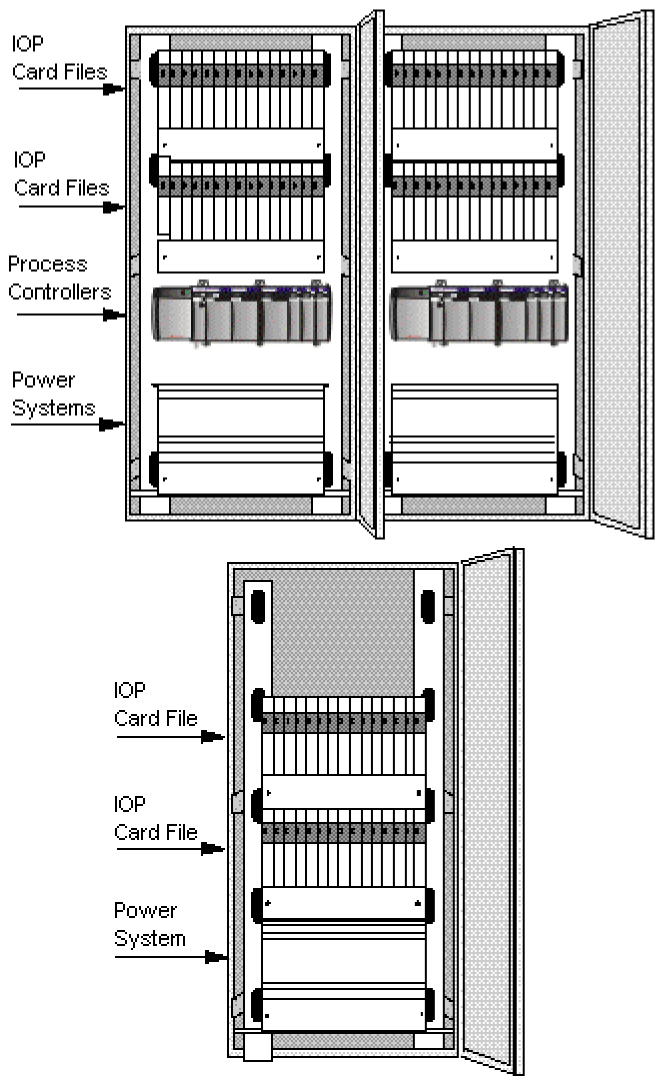
IOP in complexed cabinets with redundant Process Controllers

Two cabinets that are complexed together is shown in the following figure. The redundant chassis pair of Process Controllers are installed in separate cabinets. The purpose is to provide independent power for the Process Controllers and their associated IOP card files.



IOP in Complexed and remote cabinets

The following figure shows a 2-cabinet complex with redundant Process Controllers and a remote cabinet that contains IOP card files. Communication with the remote cabinet is provided by fiber optic I/O Link Extenders.



REFERENCE - INTERNAL

Refer to the appropriate Appendix listed below for the given cabinet model number for more information on cabinet construction and layout.

- Appendix C for cabinet models MU-CBSM01 and MU-CBDM01.
- Appendix D for cabinet models MU-C8SFR1 and MU-C8DFR1.

Series C Hardware Configuration

Planning Your Series C Control System

Possible Series C system configurations

The following table summarizes the hardware that can be included in a standard or hybrid Series C control system.

Standard Series C System Hardware	Hybrid Series C System Hardware
Series C Cabinet or Cabinet Complex	Standard Series C System
Series C Power System	Process Manager I/O including Field Termination Assemblies (FTAs)
Series C Control Firewall including I/O Termination Assembly (IOTA)	Series A Chassis I/O See Note 3
C300 Controller including IOTA	Series A Rail I/O See Note 3
Series C I/O including IOTA See Note 1	Series H Rail I/O See Note 3
Series C Fieldbus Interface Module (FIM4) including IOTA See Note 2	A combination of the above components See Note 3

Notes:

1 The Series C I/O can optionally include PM I/O LLMUX FTAs as part of the standard Series C LLMUX subsystem.

2 As a special case, a standard Series C system can have FIM4s and no C300 or Series C I/O.

3 Only the following hybrid Series C system configuration, consisting of standard Series C hardware and PM I/O, will be available with Experion R300 systems:

- A complexed cabinet consisting of Series C cabinet(s) and PM I/O cabinet(s):
  - With Series C hardware only in the Series C cabinet portion of the complexed cabinet;
  - With PM I/O hardware, including power system, IOPs, and FTAs, only in the PM I/O cabinet portion of the complexed cabinet; and
  - With I/O Link cables from the PM IOP files to the C300 IOTA entirely within the complexed cabinet, since the I/O Link cables are not allowed to leave the complexed cabinet.

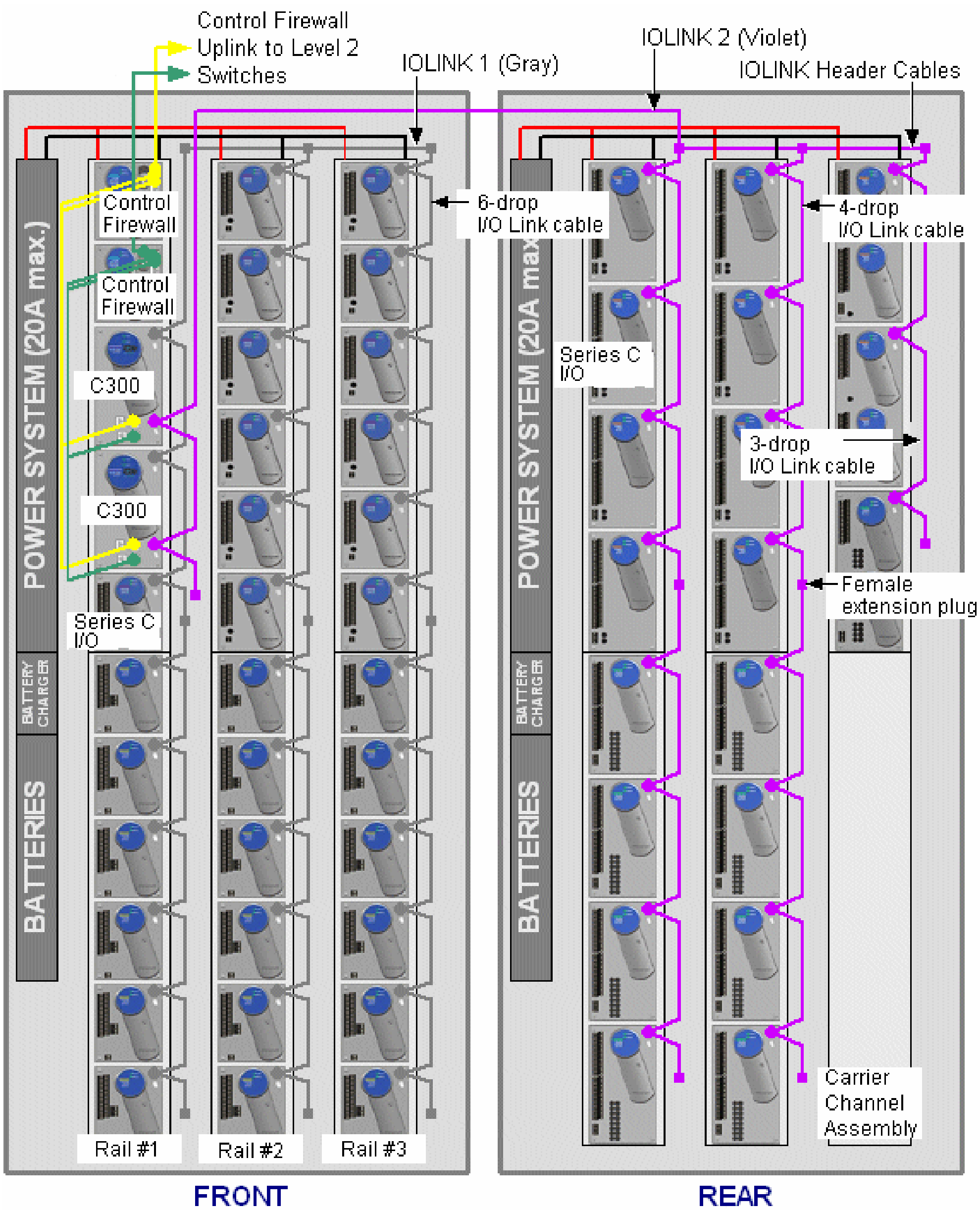
Configuration rules (*SCS*)

Reference	Description
CR_SCS.0	Each C300 controller can support two I/O Links.
CR_SCS.1	Each I/O Link can support either PM I/O or Series C I/O but not both.
CR_SCS.2	Each I/O Link can support up to 40 redundant or non-redundant IOPs/IOMs.
CR_SCS.3	The C300 Controller can support Series A Chassis I/O, Series A Rail I/O, or Series H Rail I/O through the FTE Bridge module.
CR_SCS.4	If PM I/O is present, you must use PM I/O cabinets to mount the PM files containing PM IOPs to provide the extra depth needed for PM I/O files.
CR_SCS.5	The I/O Link cables must not leave the physical confines of the cabinet complex. They are not permitted to exit the front, rear, left side, right side, top, or bottom of the cabinet or cabinet complex.
CR_SCS.6	All of the cabinets connected together in a complex must be the same type - Either single or dual access.
CR_SCS.7	A fan assembly must be used in every side of every cabinet and cabinet complex.
CR_SCS.8	A Series C dual-access cabinet is allowed to have a Series C power system in both cabinet sides.
CR_SCS.9	The PM FTA mounting channels are necessary in the Series C cabinet to support LLMUX FTAs connected to Series C LLMUX IOTAs.

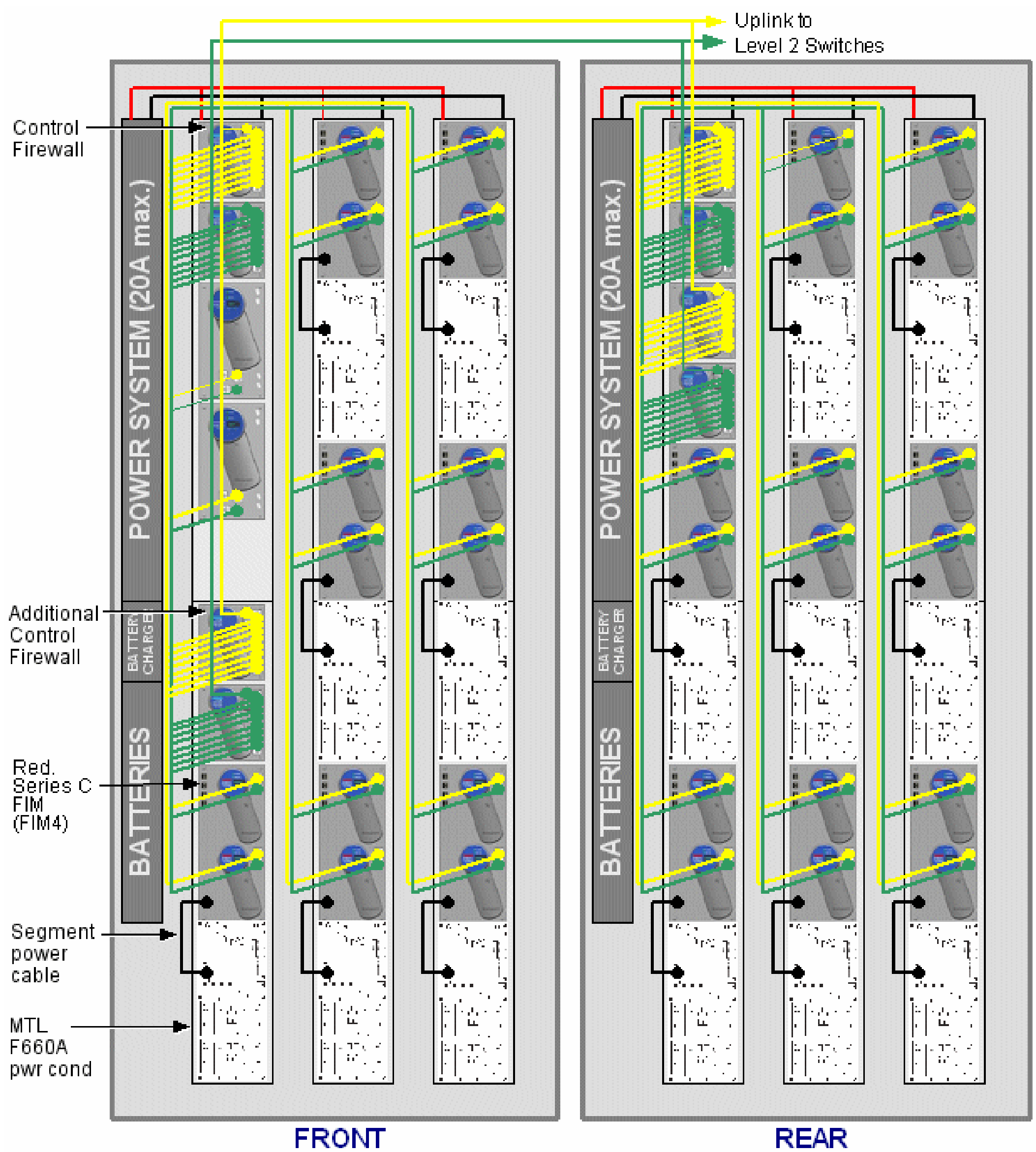
Series C cabinet layout examples

The following illustrations are examples of Series C cabinet layouts for given standard and hybrid Series C control system configurations.

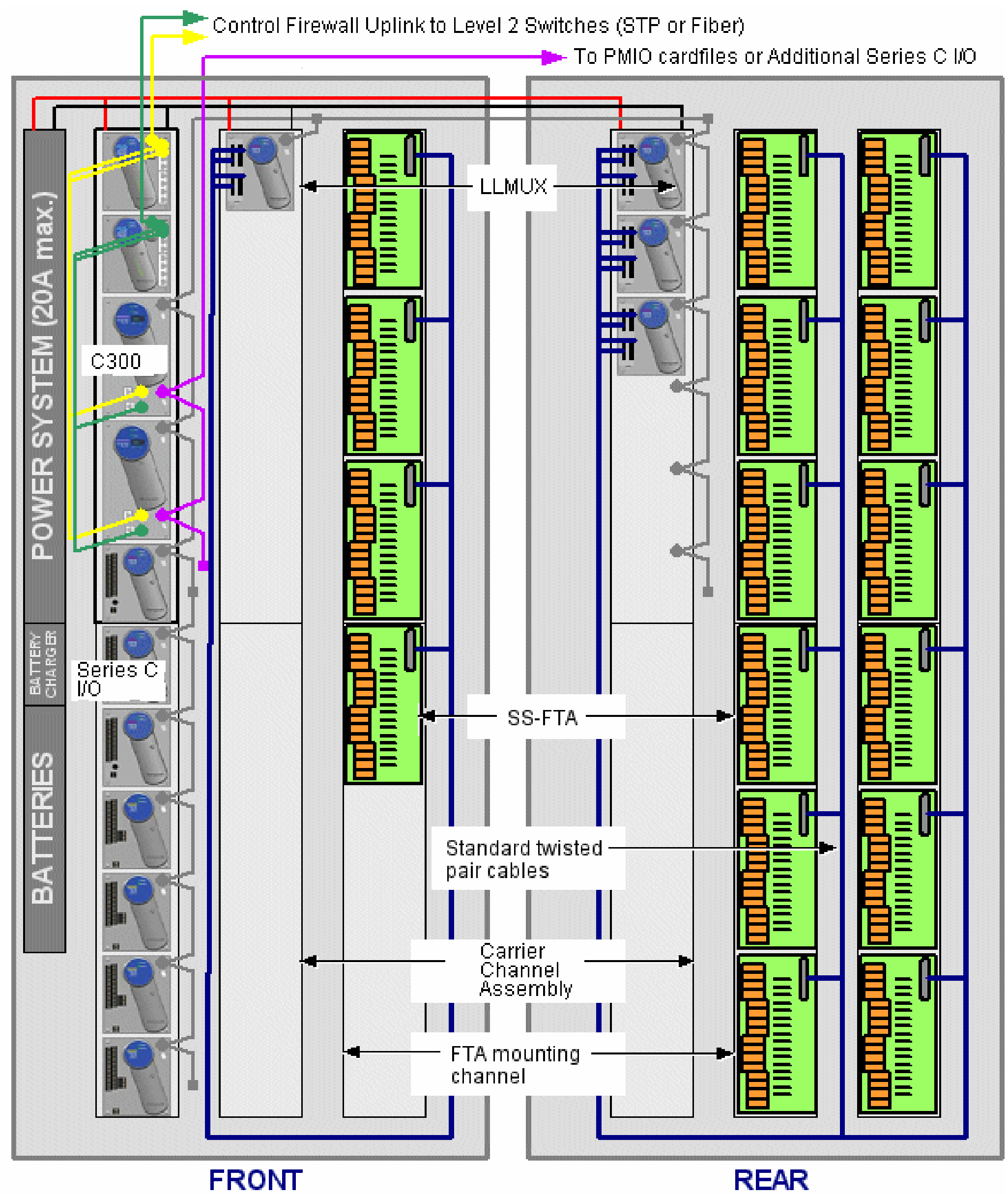
Standard Series C system with C300 and Series C I/O



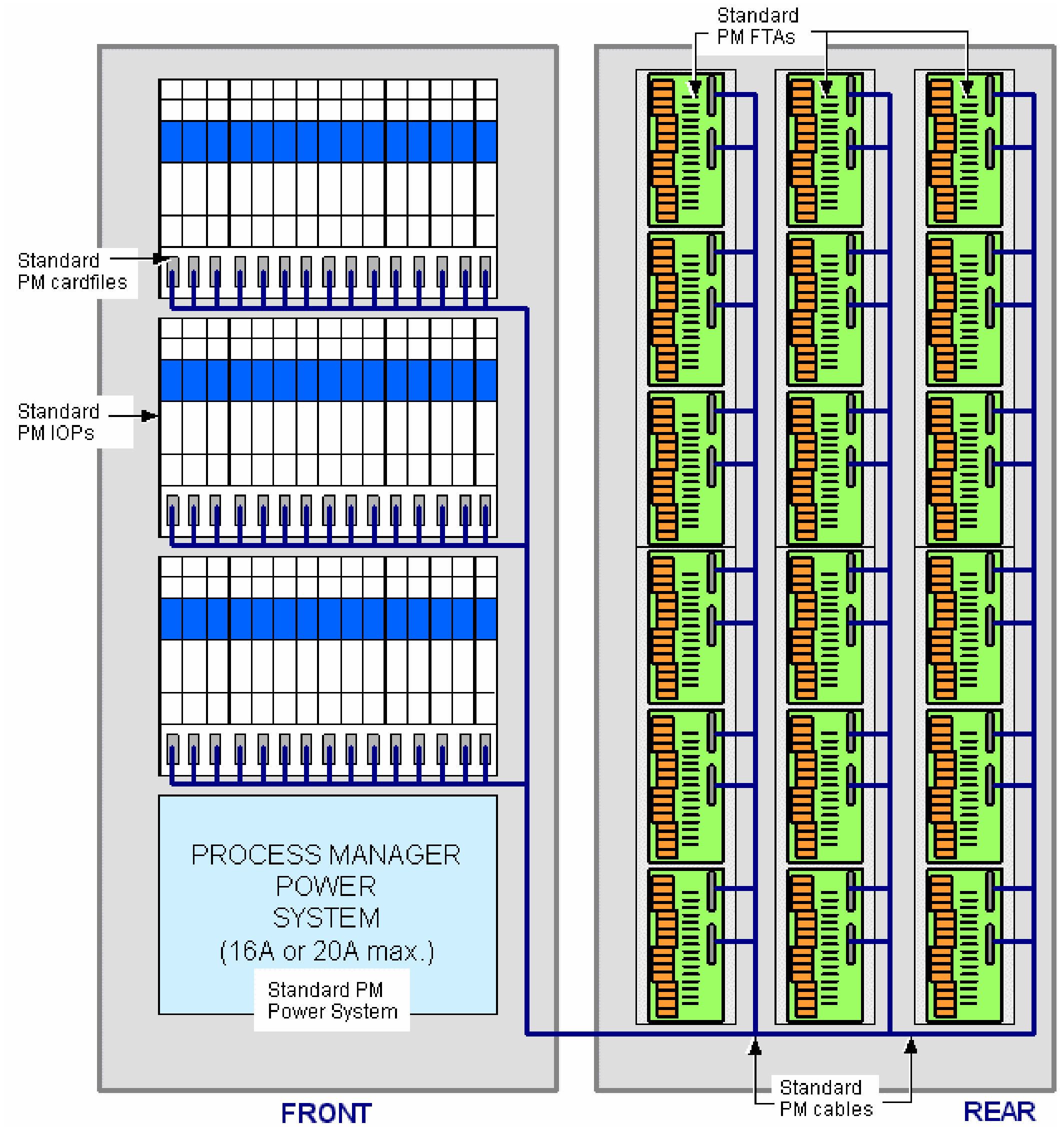
Standard Series C system with Series C FIMs and power conditioners



Standard Series C system with Series C I/O and LLMUX subsystem



Hybrid Series C system with PM I/O



Configuration rules (*IOL*)

Reference	Description
CR_IOL.0	The I/O Link is a redundant serial communications subsystem that is the interface between the C300 Controller and its Series C I/O or PM I/O. It is a multi-drop network operating at 750 Kilobits per second (Kbps) for Series C I/O and 375 Kbps for PM I/O. The C300 Controller has two I/O Link ports identified as I/O Link 1 (IOL1) and I/O Link 2 (IOL2). Each port is configurable to interface with either I/O Link speed. You **cannot** mix I/O of different speeds on the same link. The Series C I/O IOMs plug into different size IOTAs and use a simple hierarchy of interconnected cables for I/O Link distribution between assemblies.
CR_IOL.1	By default, I/O Link 1 (IOL1) is distributed first. The IOTAs that are to be connected to IOL1 are positioned in the carrier channel assemblies (CCAs) first; followed by the IOTAs that will be connected to I/O Link 2 (IOL2). IOL2 may or may not be used depending on the number of IOTAs on IOL1 and the communications load on IOL1. By default, IOL1 and IOL2 will not be mixed in a vertical set of two CCAs (although they could be). I/O Links should not be mixed in a single CCA. The IOL1 and IOL2 cables can be co-mingled in any physical (wireway) location.
CR_IOL.2	In a mixed system with both Series C I/O and PM I/O, the default I/O Link assignments are Series C I/O on IOL1 and PM I/O on IOL2.
CR_IOL.3	IOTAs in a Series C system are physically positioned in much the same way as FTAs in a PM system. Since the I/O Link cables connect to multiple IOTAs, there are some additional rules to follow. In a given system consisting of a C300 controller (and normally its redundant partner) and all the attached I/O, you should physically position IOTAs starting at the top of the upper CCA in the L (left) vertical channel (the default case) and filling from L to R. The layout is per cabinet side and proceeds from cabinet side to cabinet side regardless of where the next side is located (in the rear of the same cabinet or in the next adjacent cabinet). A vertical channel is a pair of CCAs (one mounted above the other); there are three vertical channels per cabinet side: L (left), M (middle), R (right). IOTAs should be mounted in the following order: Redundant Control Firewalls (CF9s) C300, Primary C300, Secondary C300 Memory Backup Assembly - FIM4, redundant (See Note 1) FIM4 Non-Redundant (See Note 1) (See Note 5) HLAI, Redundant AO, Redundant - HLAI, Non-Redundant AO, Non-Redundant LLAI (See Note 6)

Reference	Description
	24V DI, Redundant (See Note 2) 24V Bussed DO, Redundant (See Note 2) DO Relay Redundant (See Note 3) DO Relay Extension (Associated with DO Relay above) (See Note 3) 24V DI, Non-Redundant (See Note 2) 24V Bussed DO, Non-Redundant (See Note 2) DO Relay, Non-Redundant (See Note 3) DO Relay Extension (Associated with DO Relay above) (See Note 3) At this point, go to the top of a new CCA. 120 VAC DI, Redundant 240 VAC DI, Redundant DO Relay Redundant (See Note 4) DO Relay Extension (Associated with DO Relay above) (See Note 4) 120 VAC DI, Non-Redundant 240 VAC DI, Non-Redundant DO Relay, Non-Redundant (See Note 4) DO Relay Extension (Associated with DO Relay above) (See Note 4)
CR_IOL.4	You should use I/O Link 2 as the default to connect PM I/O to the C300 Controller. This means all the cables should have a violet jacket. If you should use I/O Link 1 for PM I/O, the cable tab numbers for gray cables should be used. This description also assumes that the C300s are mounted in the default position in the Series C cabinet, although the description is similar for other locations.
CR_IOL.5	You must use redundant pairs of three cables (in series) to connect either a non redundant C300 or redundant pair of C300s to one or more files of PM IOPs. Two of the three cables are Series C cables (part 51202329) and one is a PM Adapter cable (part 51202341).
CR_IOL.6	The first cable pair connects to the IOL2 connectors of the C300 IOTA(s) and goes from there to the top of the IOTA channel. This cable pair is a Series C **Drop** cable pair (part 51202329-312).
CR_IOL.7	From the top of the controller mounting channel, a Series C extension cable pair (of the appropriate length) should be used to go to the cabinet where the PM I/O is located. This cable pair should be tab 7YX where Y is an odd number, indicating a violet jacketed cable.
CR_IOL.8	Once in the cabinet where the PM I/O is located, the extension cable should be connected to a PM **Adapter** cable pair (part 51202341-112) which adapts (changes) the Series C connection system to the PM system. In the PM cabinet, one of the following two scenarios is possible. • There **is** an unused connector (male plug) on the PM I/O Link cable in the target system. Plug that into the female connector on the PM side of the

Reference	Description
	Adapter cable; or • There is **no** unused connector on the PM I/O Link cable in the target system. Remove one of the male plugs on the PM I/O Link cable from a PM file I/O Link connector and plug it into the female connector on an Adapter cable. Plug the male connector on the adapter cable into the PM file connector where the PM I/O Link male plug was.
CR_IOL.9	IOTAs associated with field wiring **over** 30 volts, such as 120 and 240 Vac DI and DO, must be physically separated from IOTAs associated with field wiring **under** 30 volts. This allows the field wiring associated with one group of IOTAs to be routed away from the field wiring associated with the other group of IOTAs to minimize electrical interference between the two groups. This makes it easier to meet any electrical codes requiring separation of such wiring. This can be done by keeping each group of IOTAs on their own separate CCAs or by grouping them at each end of the same CCA, as long as this does not create a similar conflict with IOTAs on the CCA above or below.

Notes:

1 If all the FIM4s consume less than one CCA, use the order shown in CR_IOL..3 with the FIM4s below the CF9s and C300s. If they consume more than one CCA but less than two CCAs, start at the top of the next channel and fill the remaining space in the CCA below the C300s with I/O. If they consume three or more CCAs, use the order shown In CR_IOL.3. It is best to keep FIM4s in their own CCAs as it simplifies both FTE and I/O Link cabling.

2 If the hardware configuration does not permit analog I/O and digital I/O in the same CCA (with co-mingled field wiring), the 24V digital I/O should start at the top of the next CCA.

3 . This order only applies if the relays are switching up to 30 Vdc. If they are switching 120 or 240 Vac, the DO Relay and associated Extension IOTAs should be placed with the higher voltage I/O.

4 This order applies if the relays are switching 120 or 240 Vac (or any voltage above 30 Vdc).

5 Note that the transition to IOL2 can occur anywhere in the following list depending on the number of IOTAs and the communication load on IOL1.

6 PM LLMUX FTAs are the multiplexing front end of the Series C LLMUX subsystem and are mounted in 3-feet (1 m) long PM FTA channels (not Series C IOTA CCAs). The PM FTA channels must be mounted in pairs (one channel above the other) starting on the right side of the cabinet side (They must not be to the left of any IOTA CCAs in the same cabinet side). They do not have to be on the same cabinet side as the LLMUX IOTA to which they are connected. Each LLMUX IOTA can support and connect to up to four PM LLMUX FTAs.

Selecting Series C Cabinet Hardware

The Series C cabinets are available in single-access and dual-access models with kits available for complexing up to four cabinets together. The cabinets include materials from the manufacturer Rittal as well as from Honeywell.

Single-Access, 0.5 meter (20 inches)-deep cabinet parts

The following table lists the model or part numbers for the hardware that can be used to construct a single-access Series C cabinet.

Description	Model or Part Number
Series C, Single-Access, Cabinet Frame (Rittal), NEMA 1 [0.8 m (32 in) W x 0.5 m (20 in) D x 2 m (79 in) H]	CU-CBDS01
Standard Cabinet Paint Color is RAL 7035 - Only select one of the following if another color is required.	
Non-standard cabinet paint color RAL 7032	51197174-200
Non-standard cabinet paint color other than RAL 7032 or 7035	51197174-100
Door Options (select one)	
Standard Door	MU-C8DRS1
Double Door	MU-C8DRD1
Door Hinging Options for Standard Door Only (select one)	
Standard Right-Hand (RH)-Front and RH-Rear Hinging	51197150-100
Left-Hand (LH)-Front and RH-Rear Hinging	51197150-400
RH-Front and LH-Rear Hinging	51197150-300
LH-Front and LH-Rear Hinging	51197150-200
Door Hinge Options for Standard Door Only (select one)	
130-degree Door Hinges	51197168-100
180-degree Door Hinges	51197168-200
Key Lock (select one)	
Standard Key Lock	51197165-100

Description	**Model or Part Number**
Pushbutton Key Lock	51197165-200
Skin (two are required, for both sides of a single cabinet or for both ends of a cabinet complex)	
Single-Access Cabinet Side Skin (0.5 m (20 in) deep cabinet)	MU-C8SSS1
Base (select one)	
100 mm (4 in) Base/Plinth for Single-Access 0.5 m (20 in) Deep Cabinet	MU-C8SBA1
200mm (8 in) Base/Plinth for Single-Access 0.5 m (20 in) Deep Cabinet	MU-C8SBA2
Cabinet Complexing Kit (select one)	
Complexing Kit for Single-Access 0.5 m (20 in) Deep Cabinets	51109524-500
Complexing Kit for Single-Access 0.5 m (20 in) Deep Cabinets (for use in the field)	51109524-700
Fan Cover Assembly (One is required for each Top Cover Plate cutout not receiving a Fan Assembly)	
Fan Cover Assembly (used when Cabinet Fan Assembly is absent)	51199948-100
Optional Equipment	
Cabinet Light with Motion Sensor	MU-CULF01
Cabinet Thermostat	MU-C8TRM1

Dual-Access, 0.8 meter (32 inches)-deep cabinet parts

The following table lists the model or part numbers for the hardware that can be used to construct a dual-access Series C cabinet.

Description	Model or Part Number
Series C, Dual-Access, Cabinet Frame (Rittal), NEMA 1 [0.8 m (32 in) W x 0.8 m (32 in) D x 2 m (79 in) H]	CU-CBDD01
Standard Cabinet Paint Color is RAL 7035 - Only select one of the following if another color is required.	
Non-standard cabinet paint color RAL 7032	51197174-200
Non-standard cabinet paint color other than RAL 7032 or 7035	51197174-100
Door Options (select one)	
Standard Door	MU-C8DRS1
Double Door	MU-C8DRD1
Door Hinging Options for Standard Door Only (select one)	
Standard Right-Hand (RH)-Front and RH-Rear Hinging	51197150-100
Left-Hand (LH)-Front and RH-Rear Hinging	51197150-400
RH-Front and LH-Rear Hinging	51197150-300
LH-Front and LH-Rear Hinging	51197150-200
Door Hinge Options for Standard Door Only (select one)	
130-degree Door Hinges	51197168-100
180-degree Door Hinges	51197168-200
Key Lock (select one)	
Standard Key Lock	51197165-100
Pushbutton Key Lock	51197165-200
Skin (two are required, for both sides of a single cabinet or for both ends of a cabinet complex)	
Dual-Access Cabinet Side Skin (0.8 m (32 in) deep cabinet)	MU-C8DSS1

Description	Model or Part Number
Base (select one)	
100 mm (4 in) Base/Plinth for Dual-Access 0.8 m (32 in) Deep Cabinet	MU-C8DBA1
200mm (8 in) Base/Plinth for Dual-Access 0.8 m (32 in) Deep Cabinet	MU-C8DBA2
Cabinet Complexing Kit (select one)	
Complexing Kit for Dual-Access 0.8 m (32 in) Deep Cabinets	51109524-200
Complexing Kit for Dual-Access 0.8 m (32 in) Deep Cabinets (for use in the field)	51109524-600
Fan Cover Assembly (One is required for each Top Cover Plate cutout not receiving a Fan Assembly)	
Fan Cover Assembly (used when Cabinet Fan Assembly is absent)	51199948-100
Optional Equipment	
Cabinet Light with Motion Sensor	MU-CULF01
Cabinet Thermostat	MU-C8TRM1

Selecting Power Entry Accessories

You can supply ac line power wiring through standard terminal blocks or optional circuit breaker box to the Series C cabinet power supplies and fan assemblies.

Standard power entry parts

The following table lists the model or part numbers for terminal block and mounting plate used for standard power entry into a Series C cabinet.

Description	Model or Part Number
AC Terminal Block	51506481-100
Mounting Plate for AC Terminal Block (one required for each block)	51202334-100

Standard power entry guidelines

With the standard power entry, you use the power switch on the Series C power system to turn the power supply **On** or **Off**.

If You Have . . .	Then, . . .
One Series C Power System in the cabinet.	Connect the user-supplied ac line power cord (L1, L2, Ground) through a cabinet side to the input side of Port 1 on the AC terminal block. Connect the power cable of a Series C power system to the output side of Port 1 on the AC terminal block. For more details about power and ground connections, see the following *Series C Hardware Grounding Considerations* section.
Two Series C Power Systems in the cabinet.	Connect one user-supplied ac line power cord (L1, L2, and Ground) through a cabinet side to the input side of Port 1 on the AC terminal block. Connect the power cable of one Series C power system to the output side of Port 1 on the AC terminal block. Connect the second user-supplied ac line power cord (L1, L2, and Ground) through a cabinet side to the input side of Port 2 on the

If You Have . . .	Then, . . .
	AC terminal block. Connect the power cable from the other Series C power system to the output side of Port 2 on the AC terminal Block.

Optional power entry parts

You can install an optional Series C breaker box listed in the following table instead of the standard AC terminal block to provide four two-pole circuit breakers to provide ac line power for individual power supplies and fan assemblies in the cabinet.

Description	Model or Part Number
Breaker Box	51403897-100

Optional power entry guidelines

If You Have . . .	Then, . . .
A single-access Series C cabinet with one or two power supplies and a fan assembly; or a dual-access Series C cabinet with one or two power supplies and two fan assemblies (one in each cabinet side).	Only one breaker box is required.
A dual-access Series C cabinet with a second power system and the total number of power supplies and fan assemblies exceeds four.	Two breaker boxes are required. Locate a breaker box in each cabinet side and wire one power system to one breaker box and wire the other power system to the second breaker box.

Selecting Fan Assembly Kits

Depending on the rating of the ac line power voltage, you must install one of the fan assemblies listed in the following table in each Series C cabinet side containing Series C hardware.

Each fan assembly kit contains two fans and mounts in the single, rectangular cutout in the top cover of each side of the Series C cabinet. A single-access cabinet has one cutout and a dual-access cabinet has two cutouts. Cables are provided in the kit to connect the fan assembly directly to the ac power entry hardware as described in the previous section.

Description	Model or Part Number
Fan Assembly Kit, 2 Fans and Cables (115 VAC, 50-60 Hz)	51199947-175
Fan Assembly Kit, 2 Fans and Cables (240 VAC, 50-60 Hz)	51199947-275

Carrier Channel Assembly Parts

You must install the carrier channel assembly (CCA) listed in the following table vertically inside the Series C cabinet to mount Series C hardware. The CCA installation is similar to that for an FTA mounting channel.

Description	Model or Part Number
Carrier Channel Assembly (CCA), 3 feet (1 meter) long	CC-MCAR01

Each CCA includes a 24 Vdc bus bar, a 24 Vdc common (ground) bus bar, and a field wiring shield landing bus bar to connect and ground shields of field wiring that connects to IOTAs, as shown in the following figure. A CCA mounted vertically under another CCA in the same cabinet side receives its dc power from the CCA above it. When two vertically adjacent CCAs are connected to each other, the two buses in one CCA physically interconnect with the two buses in the other CCA without the need for connecting cables.

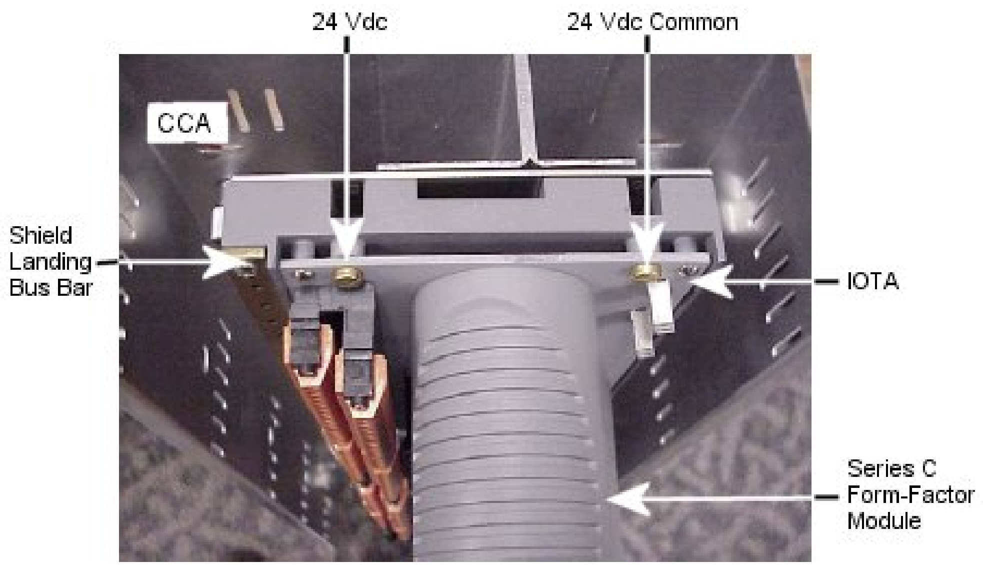


Figure 47 Top View of Carrier Channel Assembly with IOTA and resident Series C form-factor module installed

Carrier Channel Assembly Reference Dimensions

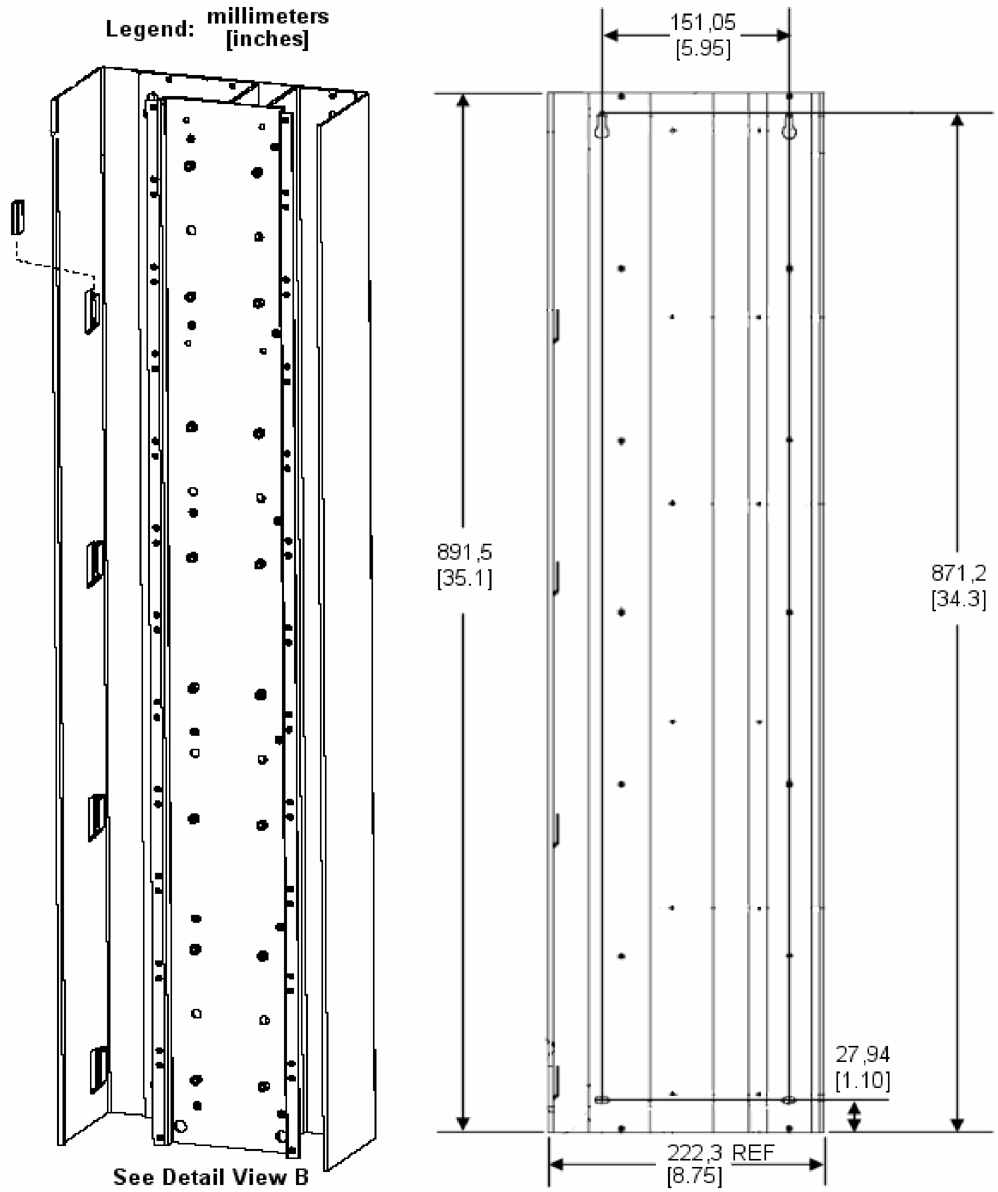


Figure 48 View A - CCA Overall Mounting Dimensions

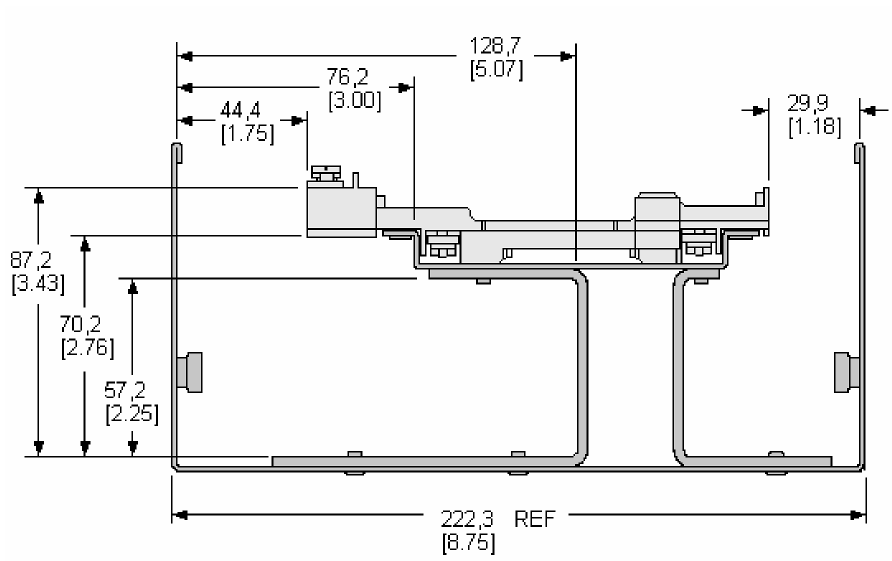


Figure 49 View B - CCA Cross Section Detail

Selecting Series C Power System

The Series C Power System provides +24 Vdc power to compatible assemblies in one or more cabinet sides.

Series C power system parts

The power systems listed in the following table provide 24Vdc power to compatible assemblies in one or more cabinet sides. Each power system includes the following at a minimum:

- The metal enclosure that holds up to two power supplies and a 24 V backup assembly, if provided.
- An eight-connector interface at the top of the metal enclosure for six 24 Vdc power distribution connectors, one connector interface to C300 Controller memory battery backup assemblies, and one connector interface for power system alarm contacts.

Description	Model or Part Number
Standard Power Systems	
Power System (20A), redundant (2 power supplies), 120/240 VAC, with 24V Backup Battery Assembly	CC-PWRB01 (51199940-100)
Power System (20A), redundant (2 power supplies), 120/240 VAC	CC-PWRR01 (51199939-100)
Power Subsystem (20A), non-redundant (one power supply), 120/240 VAC	CC-PWRN01 (51199937-100)
Spare/Loose Items	
24V Backup Battery Rack (no batteries)	51199945-100
24V Backup Battery Kit (3 batteries and interconnecting cables)	51199946-100
20A Power Supply	51199299-100

Model CC-PWRB01 power system

The model CC-PWRB01 power system has two 24 Vdc (20 amperes) output power supplies for redundancy as well as a 24V backup assembly. The battery backup assembly has rechargeable batteries and battery charger to sustain the 24 Vdc (20 amperes) output for up to 30 minutes in the event of an ac power input failure. Each 24 Vdc power supply can be powered by a separate ac power source (ac line or uninterrupted power supply), if desired. The output is 25 to 26 Vdc (20 amperes) while the ac input is present and 24 to 25 (20 amperes) while the battery backup is available.

Model CC-PWRR01 Power System

The model CC-PWRR01 power system only has two 24 Vdc (20 amperes) output power supplies for redundancy and no 24V backup assembly to sustain the 24 Vdc output in the event of an ac power input failure. Each 24 Vdc power supply can be powered by a separate ac power source (ac line or uninterrupted power supply), if desired. The output is 25 to 26 Vdc (20 amperes) while the ac input is present.

Model CC-PWRN01 power system

The model PWRN01 power system only has a single (non-redundant) 24 Vdc (20 amperes) output power supply and no 24V backup battery assembly to sustain the 24 Vdc output of the power system in the event of ac power input failure. The output is 25 to 26 Vdc (20 amperes) while the ac input is present.

24V Backup Assembly

The 24 V backup assembly consists for one battery rack and one 24 V backup battery kit as described in the previous Series C power system parts section. When a 24V backup assembly is included in a power system installed in a cabinet, the battery rack is installed in the cabinet but the battery kit is shipped separately in a box for field installation.

Power Distribution Subsystem

The power distribution subsystem consists of the hardware listed in the following table to distribute 24 Vdc from a Series C power system to one or more CCAs in one or both sides of a cabinet containing the power system.

Description	Model or Part Number
Power Distribution Subsystem (includes the following parts)	51199406-100
Spare/Loose Parts	
DC Power Cable (connects one of the six 24 Vdc power distribution connectors in the 8-connector interface on the subsystem to the Horizontal DC Power Bus Bar (HDPB)), 9-inches (229 mm) long	51202324-100
Horizontal DC Power Bus Bar (HDPB) (includes mounting hardware)	51403896-100
Pair of Red and Black Conductors (Wires) (provide +24 Vdc and 24 Vdc common from the HDPB to one CCA in a cabinet side. Additional pairs are needed to connect to additional CCAs in the same or opposite cabinet side.)	51202335-300

Horizontal dc power bus bar (HDPB)

The HDPB provides dc power to the tops of up to three (vertical) CCAs (mounted on IOTA Channels) at the top of the cabinet in one cabinet side. the +24 Vdc and 24 Vdc common are provided to IOTAs and their IOMs through two buses (conductors) in each CCA. Each CCA also contains a third bus that serves as a connection point for field wiring shield wires.

If a Series C Power System and HDPB must also power additional CCAs in the other cabinet side of a dual-access cabinet, additional red/black wire pairs (51202335-300) must be added for each vertically-adjacent pair of CCAs in the other cabinet side. The HDPB has three additional terminals for connection of a total of six pairs of red and black wires, so it can support CCAs in both the front and rear sides of a dual-access cabinet, as long as the Power System can provide enough current for both cabinet sides. Otherwise, another Power System and another Power Distribution Subsystem must be used to power the CCAs in the other cabinet side.

C300 Controller Memory Backup

The controller memory backup assembly consists of the following parts and provides up to 50 hours of memory backup to one or two connected C300 Controllers.

Description	Model or Part Number
C300 Memory Backup Assembly (MBA) - For 1 to 2 C300s	CC-SCMB01
C300 Memory Backup Assembly (MBA) - For 2 or more C300s	CC-SCMB02
Spare/Loose Parts	
RAM Charger Assembly	51199932-100
RAM Charger Mounting Assembly (3 inches, 76 mm)	51202340-100
Cable, MBA to one C300 Controller, 30 inches (0.7 m) long	51202330-100
Power cable, MBA to Power System, 55 inches (1.4 m)long	51202331-100
Cable, MBA to one C300 Controller, 84 inches (2 m) long	51202330-200

Memory backup assembly cabling guidelines

- You can use the 30-inch (0.7 meter) long cable to connect the MBA to C300, when the RAM charger mounting assembly is mounted adjacent to its associated C300 IOTA on the same CCA. Use the 84-inch (2 m) long cable when the RAM charger mounting assembly is **not** adjacent to its associated C300 IOTA on the same CCA.
- You can connect up to two C300s to the RAM charger mounting assembly using either the 30-inch (0.7 m) or 84-inch (2 m) long cables, as required.
- The 55-inch (1.4 m) long power cable restricts the mounting location of the MBA to the upper CCA on the left side of a cabinet side adjacent to the Series C power system.

Memory backup hold-up times

The following table lists the hold-up time for a fully charged RAM battery charger depending on the number of C300 Controllers that are connected.

Number of C300s	Hold-Up Time in Hours	Hold-Up Time in Days
1	110	4.58

Number of C300s	Hold-Up Time in Hours	Hold-Up Time in Days
2	55	2.23
3	36.6	1.52
4	27.5	1.14

Series C DC Power Connections

The following figure illustrates the typical dc power and battery backup connections made in Series C cabinets. For more information about the components shown in the figure, refer to the previous power system and memory backup sections.

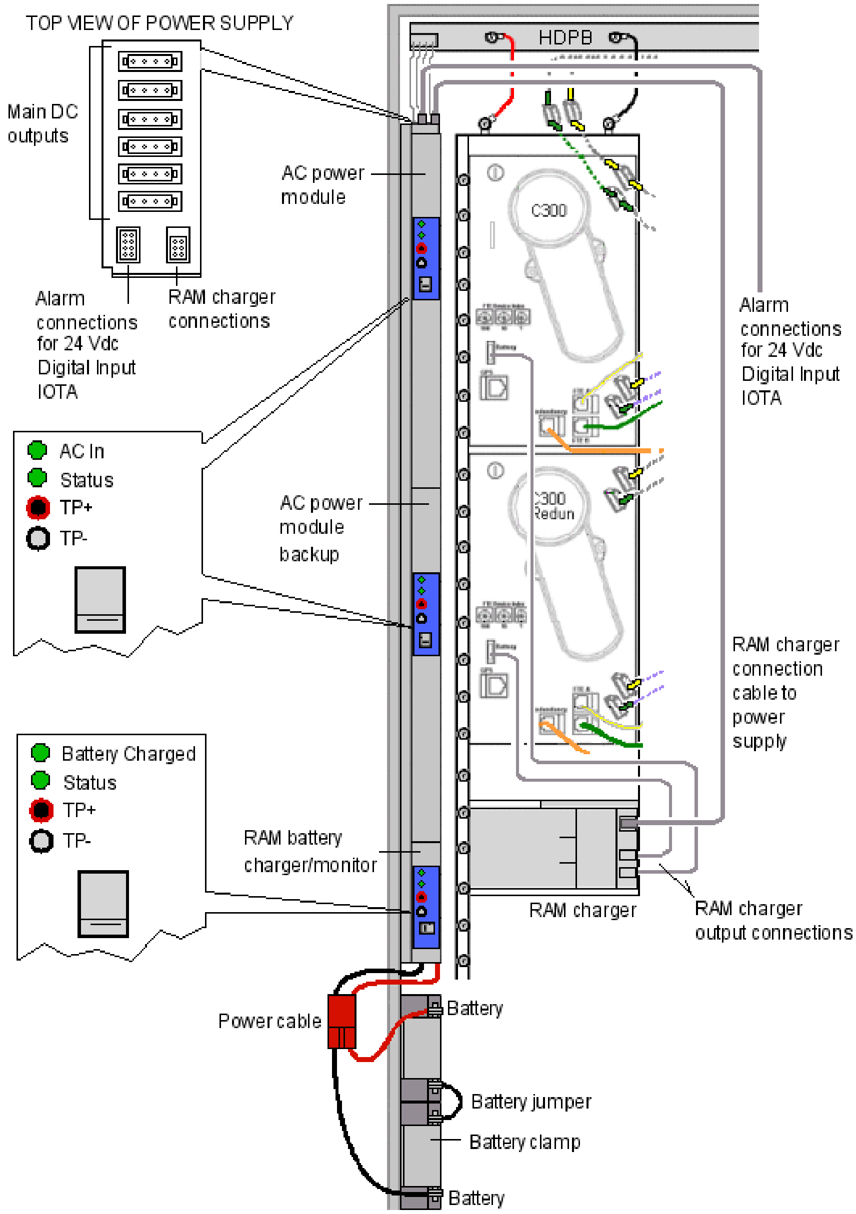


Figure 50 Typical dc power and battery backup connections in Series C cabinet

Series C Power System Indicators

The following table summarizes the Light Emitting Diode (LED) indications provided by the various Series C power system components.

LED Name -Color	LED State		
	OFF	***ON***	***Blinking***
AC Power Module Indicators (per supply)			
AC IN - Green	AC input is lost	AC input is within specified range	N/A
Status - Green	• DC output voltage is out of specifications, • A greater current than specified is being pulled from the power supply, and/or • Power supply has reached temperatures above specified limits.	Power supply output is within specified voltage, temperature, and current limits.	Fan has failed. (This indicator must also be off even if a failed fan in one supply is being *windmilled* by the airflow from the fan in an adjacent supply.)
Main Battery Backup Charger/Regulator/Monitor Indicators			
Status - Green	• DC input is lost, • Battery charger senses an over-voltage on the batteries, • Battery charger senses over-current while charging batteries, • Battery charger senses an over-temperature condition, • Batteries are not	Power supply output is within the specified voltage, temperature, and current limits.	Fan has failed. (This indicator must also be off even if a failed fan in one supply is being *windmilled* by the airflow from the fan in an adjacent supply.)

LED Name -Color	LED State		
	present, or • Temperature sensor is missing or not connected.		
Battery Charged - Green	• Main battery is missing or discharged, or • Battery is not at the top-off voltage.	Battery output is capable of supplying the specified output voltage and current for the specified time.	N/A
Ram Battery Backup Charger/Monitor Indicators			
Status - Green	• Main battery is missing, or • Battery is not charged yet	Battery output is capable of supplying the specified output voltage and current for the specified time.	N/A
Note: Alarm opens if : • Battery voltage is less than 3.5 volts, • Input voltage to the charger is less than 14 volts, • Battery pack has been removed, or • Battery is still being charged (not in the top-off state).			

Series C Power System Alarms

Each power supply and the main battery backup regulator/charger, and the RAM battery backup charger provide an alarm contact. The alarm contact opens if any of the LED indicators listed in the previous section are **not** in the normal (ON) state. The alarm contact is electrically isolated from all other circuitry so that it can be series connected by the user with alarms in other devices.

Use a hermetically sealed electromechanical relay. The alarm contacts are rated for 24 volts ac or dc at 0 to 65 mA non-inductive load. An alarm condition is signaled by an open contact (1000 ohms or more); and a no alarm condition is signaled by a closed contact (10 ohms or less).

LLMUX FTAs Mounting Considerations

The LLMUX FTAs are considered as part of a standard Series C system because they work with the LLMUX IOM as shown in the following figure. The LLMUX FTAs receive power from the LLMUX IOTA and can be mounted in one of the following locations.

- In the same cabinet or cabinet complex.
- In a suitable enclosure up to 1,000 feet remote from the LLMUX IOTA with the restriction that the interconnecting cabling between the IOTA and the FTAs must be routed in a manner consistent with national and local electrical code requirements for the environment (Division 2/Zone 2 hazardous location or nonhazardous location) in which it is routed.

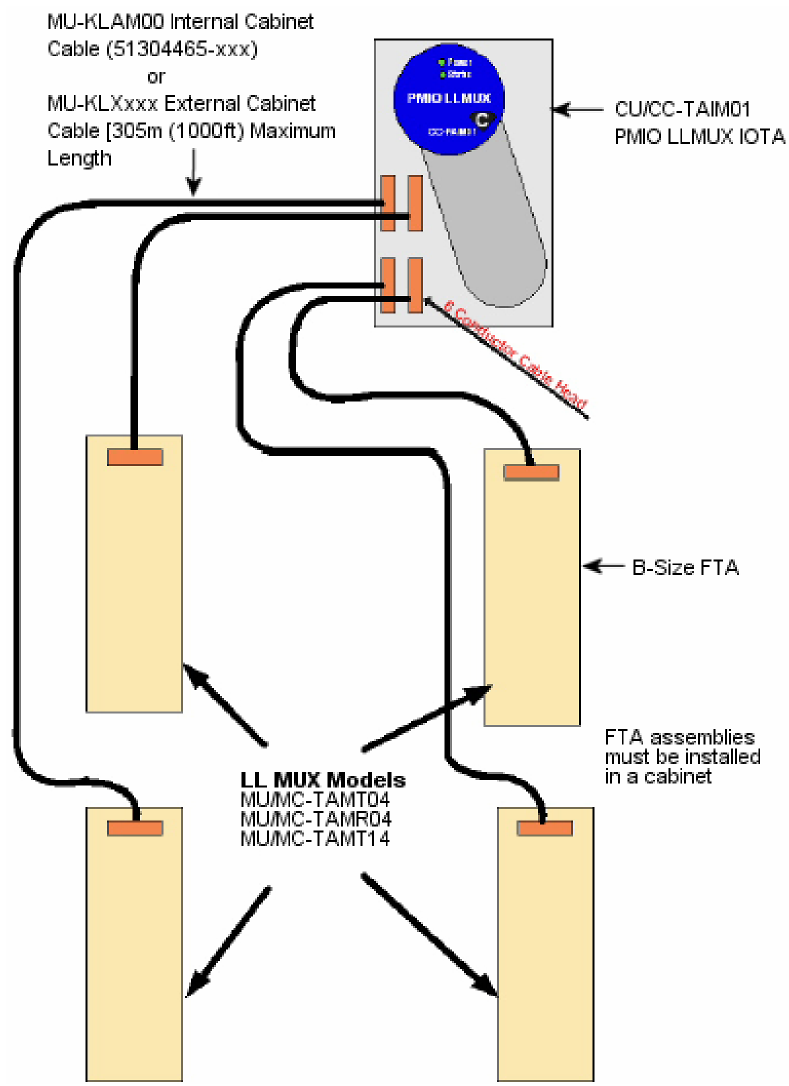


Figure 51 LLMUX FTA used with Series C LLMUX IOTA

Remote CJR installation considerations

The following figure shows the remote CJR installation requirements. You must use the model MU-KRCJ00 cable to connect the remote CJR sensor to the model MC-TAMT14 FTA. Its length is restricted to 50 meters (164 feet). The cable shield must be connected to Safety Ground at both ends of the cable.

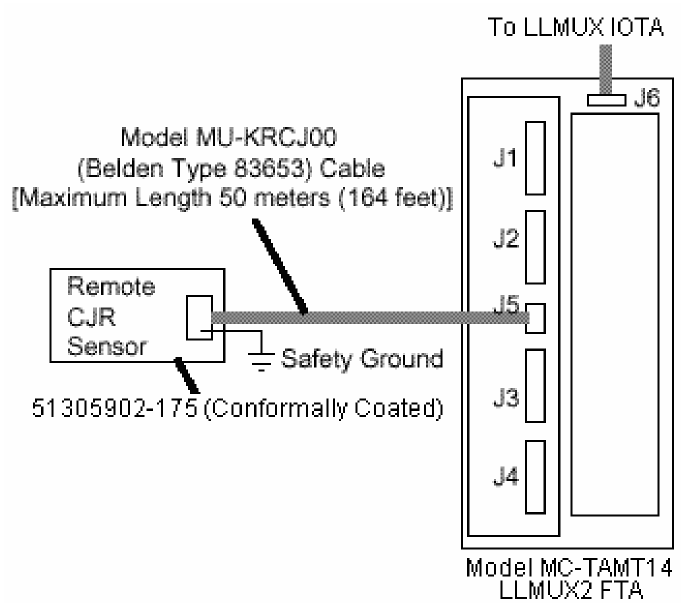


Figure 52 Remote CJR sensor connected to LLMUX2 FTA MC-TAMT14

Series C System Cabling

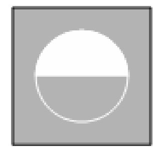
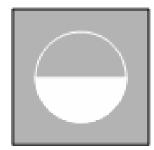
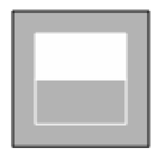
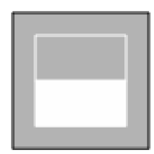
Cable color coding schemes

The following topics show the color and symbols used for the various cables and connectors used in the Series C system

Ethernet connections

Function	Cable Color	Connector Boot Color	Text	Symbol on IOTA
FTE Link A	White	**Yellow**	FTEA	
FTE Link B	White	**Green**	FTEB	
C300 Redundancy	White	**Orange**	REDUNDANCY	
GPS	White	**Black**	GPS	

I/O Link Connections

Function	Cable Color	Connector Label Color	Text	Symbol on IOTA
IOLINK1 Link A	**Gray**	**Yellow**	IOL1A	
IOLINK Link B	**Gray**	**Green**	IOL1B	
IOLINK2 Link A	**Violet**	**Yellow**	IOL2A	
IOLINK2 Link B	**Violet**	**Green**	IOL2B	
IOLINK 1 Jumper		**Gray**	(Jumper Number 1 to 40)	
IOLINK 2 Jumper		**Violet**	(Jumper Number 1 to 40)	

I/O Link Cables

You can connect the following types of I/O Link cables to the redundant I/O Link cable connector ports (IOL1A/B and IOL2A/B) on the C300 Controller IOTA:

- Series C I/O Link (750 KBaud), to support Series C IOMs in their IOTAs
- PM I/O Link (375 KBaud), to support PM IOPs in PM files

Both types always require a pair of cables (Cable A and Cable B). See the previous section about cable color coding schemes.

Series C I/O Link cable types

The following table provides a summary of the types of I/O Link cables that are used in the Series C system.

Cable Name and Type	Description
Header, 3 Drop	The **Header** cable is a multi-drop cable that distributes the I/O Link horizontally to multiple CCAs in a cabinet side or sides. Header cables can be extended to other header cables. Normally, a header cable runs across the top of the cabinet. This cable can be connected to additional cables of the same type to span cabinet sides with or without extension cables.
Header, 6 Drop	This cable can span two cabinet sides in the front and back of the same cabinet or the same side of adjacent cabinets
Drop, Special	The **Drop** cable is a multi-drop cable that runs vertically in a CCA. Two drop cables can be plugged together to distribute the I/O Link in a pair of vertical CCAs. The top connector of the topmost drop cable plugs into a connector on the header cable. There are several configurations of drop cables to handle the three different Series C IOTA dimensions [6-inches (152 mm), 9-inches (229 mm) and 12-inches (305 mm)]. There are many situations where a connector on a drop cable is not used. This occurs primarily when there is a mixture of different size IOTAs in a CCA, or the hardware configuration does not fill the CCA. This cable connects C300s to header and bypasses redundant Control Firewalls above.
Drop, 6 Connections on 6-inch Pitch	Use this cable to connect to non redundant HLAI and AO IOTAs, as well as LLAI IOTAs. Since every other connector is on a 12-inch (305 mm) pitch it can also be used with a mix of 6-inch (152 mm) and 12-inch (305 mm) IOTAs.

Cable Name and Type	Description
Drop, 4 Connections on 9-inch Pitch	Use this cable to connect to non redundant DI and DO IOTAs.
Drop, 3 Connections on 12-inch pitch	Use this cable to connect to all redundant IOTAs.
Extension, 36 inches	An **extension** cable is used to extend the I/O Link through an area where there are no IOTA connections or to another cabinet side. Extension cables come in a variety of lengths. They can plug into taps on a header cable, the end of a header cable, or the bottom of a drop cable (although this is not a normal use). Extension cables are normally used for three purposes: • To extend a header cable to another cabinet side in a complex; • To by pass the top CCA in a vertical pair (when there are no I/O Link connections in the top CCA); or • To connect to PM I/O in another cabinet side or cabinet. Obviously, there are situations where the length of an extension cable will be non standard (custom). There are no inherent limitations on the length of an extension cable; but there are stringent grounding rules for the I/O Link that restrict where an extension cable can go. As a result, the maximum extension cable length should be 30 feet (9 m) or less. Use this extension to bypass an upper CCA where there are no I/O Link connections. It can also extend a header cable past an adjacent cabinet side where there are no connections needed.
Adapter, to PM	An **adapter** cable is used to connect a Series C extension cable to a PM file. This short cable plugs into Series C extension cable and has the mating connector to plug into a PM file I/O Link connector.
Tap Expander, 1:2	A **tap expander** cable is used to expand a tap (connector) on a drop cable to multiple taps. The most common use is to expand one tap to two. For example, if a 12 inch (305 mm) space is available on CCA and the user wants to install two 6-inch (152 mm) IOTAs and the drop cable has only one connector left, a 1:2 tap expander is used instead of removing the existing drop cable and replacing it with one with more connectors. Expands any connector on a drop cable to 2 connectors that can plug into IOTAs.

Series C I/O Link cable parts

Each I/O Link cable is available in an A version (marked yellow) and a B version (marked green). They are normally sold as a pair, since both are needed. The I/O Link 2 (IOL2) cable part numbers have similar tab numbers as the I/O Link 1 (IOL1) cables but with the second digit equal to 1 instead of zero.

Description	Model or Part Number
Series C I/O Link 1 (IOL1) Cable Assemblies	
Gray Header Cable, 3 drops, yellow label (cable A)	51202329-600
Gray Header Cable, 3 drops, green label (cable B)	51202329-601
Cable pair consisting of one each of the preceding two cables	*51202329-602*
Gray Header Cable, 3 drops, daisy-chain, yellow label (cable A)	51202329-604
Gray Header Cable, 3 drops, daisy-chain, green label (cable B)	51202329-605
Cable pair consisting of one each of the preceding two cables	*51202329-606*
Gray Header Cable, 6 drops, yellow label (cable A)	51202329-500
Gray Header Cable, 6 drops, green label (cable B)	51202329-501
Cable pair consisting of one each of the preceding two cables	*51202329-502*
Gray Drop Cable, 3 drops, for channel containing two Control Firewalls (CF9s) plus two C300s plus one 6-inch (152 mm) IOTA, yellow label (cable A)	51202329-300
Gray Drop Cable, 3 drops, for channel containing two CF9s plus two C300s plus one 6-inch (152 mm) IOTA, green label (cable B)	51202329-301
Cable pair consisting of one each of the preceding two cables	*51202329-302*
Gray Drop Cable, 3 drops, 12-inch (305 mm) pitch, yellow label (cable A)	51202329-400
Gray Drop Cable, 3 drops, 12-inch (305 mm) pitch, green label (cable B)	51202329-401
Cable pair consisting of one each of the preceding two cables	*51202329-402*
Gray Drop Cable, 4 drops, 9-inch (229 mm) pitch, yellow label (cable A)	51202329-200
Gray Drop Cable, 4 drops, 9-inch (229 mm) pitch, green label (cable B)	51202329-201
Cable pair consisting of one each of the preceding two cables	*51202329-202*

Description	Model or Part Number
Gray Drop Cable, 6 drops, 6-inch (152 mm) pitch, yellow label (cable A)	51202329-100
Gray Drop Cable, 6 drops, 6-inch (152 mm) pitch, green label (cable B)	51202329-101
Cable pair consisting of one each of the preceding two cables	*51202329-102*
Gray Extension Cable, 9-inches (229 mm) long, yellow label (cable A)	51202329-700
Gray Extension Cable, 9-inches (229 mm) long, green label (cable B)	51202329-701
Cable pair consisting of one each of the preceding two cables	*51202329-702*
Gray Extension Cable, 25-inches (635 mm) long, yellow label (cable A)	51202329-704
Gray Extension Cable, 25-inches (635 mm) long, green label (cable B)	51202329-705
Cable pair consisting of one each of the preceding two cables	*51202329-706*
Gray Extension Cable, 36-inches (1 m) long, yellow label (cable A)	51202329-720
Gray Extension Cable, 36-inches (1 m) long, green label (cable B)	51202329-721
Cable pair consisting of one each of the preceding two cables	*51202329-722*
Gray Extension Cable, 48-inches (1.2 m) long, yellow label (cable A)	51202329-724
Gray Extension Cable, 48-inches (1.2 m) long, green label (cable B)	51202329-725
Cable pair consisting of one each of the preceding two cables	*51202329-726*
Gray Tap Expander 1:2, yellow label (cable A)	51202329-800
Gray Tap Expander 1:2, green label (cable B)	51202329-801
Cable pair consisting of one each of the preceding two cables	*51202329-802*
Series C I/O Link 2 (IOL2) Cable Assemblies	
Violet Header Cable, 3 drops, yellow label (cable A)	51202329-610
Violet Header Cable, 3 drops, green label (cable B)	51202329-611
Cable pair consisting of one each of the preceding two cables	*51202329-612*
Violet Header Cable, 3 drops, daisy-chain, yellow label (cable A)	51202329-614
Violet Header Cable, 3 drops, daisy-chain, green label (cable B)	51202329-615

Description	Model or Part Number
Cable pair consisting of one each of the preceding two cables	*51202329-616*
Violet Header Cable, 6 drops, yellow label (cable A)	51202329-510
Violet Header Cable, 6 drops, green label (cable B)	51202329-511
Cable pair consisting of one each of the preceding two cables	*51202329-512*
Violet Drop Cable, 3 drops, for channel containing two CF9s plus two C300s plus one 6-inch (152 mm) IOTA, yellow label (cable A)	51202329-310
Violet Drop Cable, 3 drops, for channel containing two CF9s plus two C300s plus one 6-inch (152 mm) IOTA, green label (cable B)	51202329-311
Cable pair consisting of one each of the preceding two cables	*51202329-312*
Violet Drop Cable, 3 drops, 12-inch (305 mm) pitch, yellow label (cable A)	51202329-410
Violet Drop Cable, 3 drops, 12-inch (305 mm) pitch, green label (cable B)	51202329-411
Cable pair consisting of one each of the preceding two cables	*51202329-412*
Violet Drop Cable, 4 drops, 9-inch (229 mm) pitch, yellow label (cable A)	51202329-210
Violet Drop Cable, 4 drops, 9-inch (229 mm) pitch, green label (cable B)	51202329-211
Cable pair consisting of one each of the preceding two cables	*51202329-212*
Violet Drop Cable, 6 drops, 6-inch (152 mm) pitch, yellow label (cable A)	51202329-110
Violet Drop Cable, 6 drops, 6-inch (152 mm) pitch, green label (cable B)	51202329-111
Cable pair consisting of one each of the preceding two cables	*51202329-112*
Violet Extension Cable, 9-inches (229 mm) long, yellow label (cable A)	51202329-710
Violet Extension Cable, 9-inches (229 mm) long, green label (cable B)	51202329-711
Cable pair consisting of one each of the preceding two cables	*51202329-712*
Violet Extension Cable, 25-inches (635 mm) long, yellow label (cable A)	51202329-714
Violet Extension Cable, 25-inches (635 mm) long, green label (cable B)	51202329-715
Cable pair consisting of one each of the preceding two cables	*51202329-716*

Description	Model or Part Number
Violet Extension Cable, 36-inches (1 m) long, yellow label (cable A)	51202329-730
Violet Extension Cable, 36-inches (1 m) long, green label (cable B)	51202329-731
Cable pair consisting of one each of the preceding two cables	*51202329-732*
Violet Extension Cable, 48-inches (1.2 m) long, yellow label (cable A)	51202329-734
Violet Extension Cable, 48-inches (1.2 m) long, green label (cable B)	51202329-735
Cable pair consisting of one each of the preceding two cables	*51202329-736*
Violet Tap Expander 1:2, yellow label (cable A)	51202329-810
Violet Tap Expander 1:2, green label (cable B)	51202329-811
Cable pair consisting of one each of the preceding two cables	*51202329-812*

PM I/O Link cables

The PM I/O Link (375 KBaud) cable connects C300 Controller IOTA to PM files containing IOPs. A PM I/O Link **Adapter** cable set connects a standard PM I/O Link cable to an I/O Link port of a C300 Controller IOTA. Then, the other end of the PM I/O Link cable connects to the PM file containing PM IOPs associated with that C300 Controller. See the following section for a list of standard PM I/O Link cable part numbers.

PM I/O Link cable parts

Description	Model or Part Number
PM I/O Link Adapter Cable Pair	51202341-112
I/O Link Cable Set, 2 drops	51195479-100
I/O Link Cable Set, 3 drops	51195479-200
I/O Link Cable Set, 4 drops	51195479-300
I/O Link Cable Set, 5 drops	51195479-400
I/O Link Cable Set, 6 drops	51195479-500
I/O Link Cable Set, 8 drops	51195479-600

I/O Link address jumpers

A push-on color-coded (gray or violet) jumper with a printed number (1-40) on it must be installed on each IOTA connected to a Series C I/O Link cable.

I/O Link address jumper kits

One or more of the jumper kits listed in the following table are needed based on whether a system uses I/O Link 1 (IOL1), I/O Link 2 (IOL2), or both cables and which associated range of printed numbers. For example, a Series C system using only IOL1 and addresses 1 to 8 would only need kit part number 51153818-201.

Description	Model or Part Number
I/O Link 1 Jumper Kits	
IOL1 Gray Jumpers 1-10 (contains 51506433-201 through 51506433-210 parts)	51153818-201
IOL1 Gray Jumpers 11-20 (contains 51506433-211 through 51506433-220 parts)	51153818-202
IOL1 Gray Jumpers 21-30 (contains 51506433-221 through 51506433-230 parts)	51153818-203
IOL1 Gray Jumpers 31-40 (contains 51506433-231 through 51506433-240 parts)	51153818-204
I/O Link 2 Jumper Kits	
IOL2 Violet Jumpers 1-10 (contains 51506433-101 through 51506433-110 parts)	51153818-101
IOL2 Violet Jumpers 11-20 (contains 51506433-111 through 51506433-120 parts)	51153818-102
IOL2 Violet Jumpers 21-30 (contains 51506433-121 through 51506433-130 parts)	51153818-103
IOL2 Violet Jumpers 31-40 (contains 51506433-131 through 51506433-140 parts)	51153818-104

Ethernet cables

Ethernet cables are used in Series C cabinets to interconnect Control Firewall IOTAs, C300 Controller IOTAs, and Series C FIM IOTAs. Only shielded twisted pair (STP) type cable is used. The use of unshielded twisted pair (UTP) cable is not allowed.

C300 Controller redundancy cable parts

One of the following Ethernet cables with orange end-boots is used to connect one C300 Controller IOTA to its partner C300 Controller IOTA in a redundant pair of C300 Controllers. The 36-inch (1 m) length cable is the default length used to interconnect partner IOTAs that are located vertically adjacent to each other on the same CCA. Other lengths are used when the partner IOTAs are not mounted close together.

Description	Model or Part Number
Ethernet Redundancy Cable, STP CAT5, orange boots, 36 inches (1 m) long	51305980-836
Ethernet Redundancy Cable, STP CAT5, orange boots, 48 (1.2 m) inches long	51305980-848
Ethernet Redundancy Cable, STP CAT5, orange boots, 60 (1.5 m) inches long	51305980-860
Ethernet Redundancy Cable, STP CAT5, orange boots, 84 inches (2 m) long	51305980-884

Other in-cabinet Ethernet cable parts

One of the following yellow-colored (FTEA) cables and one of the following green-colored (FTEB) Ethernet cables are used to connect a Control Firewall IOTA to a C300 Controller IOTA or to a Series C FIM IOTA.

Description	Model or Part Number
FTE Link A Cables	
FTEA Ethernet Cable, STP CAT5, Yellow, 24 inches (610 mm) long	51305890-124
FTEA Ethernet Cable, STP CAT5, Yellow, 36 inches (1 m) long	51305890-136
FTEA Ethernet Cable, STP CAT5, Yellow, 48 inches (1.2 m) long	51305890-148

Description	Model or Part Number
FTEA Ethernet Cable, STP CAT5, Yellow, 60 inches (1.5 m) long	51305890-160
FTEA Ethernet Cable, STP CAT5, Yellow, 84 inches (2 m) long	51305890-184
FTE Link B Cables	
FTEB Ethernet Cable, STP CAT5, Green, 24 inches (610 mm) long	51305890-224
FTEB Ethernet Cable, STP CAT5, Green, 36 inches (1 m) long	51305890-236
FTEB Ethernet Cable, STP CAT5, Green, 48 inches (1.2 m) long	51305890-248
FTEB Ethernet Cable, STP CAT5, Green, 60 inches (1.5 m) long	51305890-260
FTEB Ethernet Cable, STP CAT5, Green, 84 inches (2 m) long	51305890-284

LLMUX FTA cables

As previously defined in the *LLMUX FTA Mounting Considerations* section, the LLMUX FTA is connected through a cable to the Series C LLMUX IOTA.

LLMUX FTA cable parts

Description	Model or Part Number
LLMUX FTA to LLMUX IOTA cable (in-cabinet)	51304465-XXX
LLMUX FTA to LLMUX IOTA cable (outside cabinet)	MU-KLXxxx
LLMUX FTA to LLMUX IOTA cable (outside Cabinet) - Optional	MU-KLO305
Remote CJR Sensor to Model MC-TAMT14 LLMUX FTA cable	MU-KRCJ00

Cable 51304465-XXX reference

Use this cable to connect the LLMUX FTA to the Series C LLMUX IOTA within the same cabinet or cabinet complex. The cable has two individually shielded, twisted-pair wires. Connect the shields to ground at both ends of the cable. The following table lists general cable specifications for reference.

Manufacturer Type	Belden 9406

Configuration	Shielded double pair
Flame Resistance Conformity	CSA FT 4
CSA Type	CMG
NEC Type	CMG
Available Lengths (xxx represents)	033, 066, 100, 200, or 300 centimeters (12, 25, 39, 78, or 118 inches)

Cable MU-KLXxxx reference

Use this cable to connect the LLMUX FTA to the Series C LLMUX IOTA located in a remote cabinet up to 305 meters (l,000 feet) away. It can be used for Intrinsically Safe, Nonincendive, and nonhazardous applications. The cable is a single-twist, four-conductor cable with a braided shield. Connect the shield to ground at both ends of the cable. The following table lists general cable specifications for reference.

Manufacturer Type	Belden 83654
Configuration	Shielded 18-gauge four-conductor single twist (TEFLON jacket)
Flame Resistance Conformity	CSA FT4/FT6 and UL910
CSA Type	CMP
NEC Type	CMP
Temperature Rating	-70 to +200 degrees C (-94 to +392 degrees F)
Available Lengths (xxx represents)	076, 152, or 300 meters (249, 499, or 985 feet))

Cable MU-KLO305 reference

Use this optional cable to connect the LLMUX FTA to the Series C LLMUX IOTA located in a remote cabinet up to 305 meters (l,000 feet) away. The cable tolerates moisture from normal precipitation, but must not be submerged and is not suitable for direct burial in this application. The cable is a single-twist, four-conductor cable with a braided shield and armored jacket. Connect the shield to ground at both ends of the cable. The following table lists general cable specifications for reference.

Manufacturer Type	Belden YC41926
Configuration	Shielded, 12-gauge, four-conductor, single twist (armored jacket) CE Compilant PLTC or ITC, 300 volts
Vertical Tray Flame Test	UL1581/IEEE383
Temperature Rating	-30 to +90 degrees C (-22 to +194 degrees F)
Available Length	305 meters (1,000 feet))

Cable MU-KRCJ00 reference

Use this cable to connect the model MC-TAMT14 LLMUX FTA to the remote CJR sensor up to 50 meters (164 feet) away. Connect the cable shield to Safety Ground at both ends of the cable. The following table lists general cable specifications for reference.

Manufacturer Type	Belden model 83653
Configuration	Three 1.0 mm 2 (18 AWG) conductors
Insulation and Jacket	Teflon conductor insulation and jacket
Shielding	Braid over foil
Flame Resistance Conformity	CSA PCC FT4/FT 6 and UL910
Temperature Rating	-30 to +90 degrees C (-22 to +194 degrees F)
Use	Air Plenum
NEC Type	CMP
Available Length	50 meters (164 feet)

DO relay extension cables

A DO relay extension cable connects between a DO Relay IOTA and its associated DO Relay Extension IOTA that contains relays.

DO relay extension cable parts

The DO relay extension cable is available in the lengths listed in the following table. The 3-feet (1 m) long cable is used when the DO Relay Extension IOTA is mounted in its default location immediately below its associated DO Relay IOTA. Longer cables are available for configurations where the DO Relay Extension IOTA is not mounted in its default location. The DO Relay Extension cables are allowed to leave the cabinet or cabinet complex.

Description	Model or Part Number
DO Relay Extension Cable – length is to be determined	CC-KREB00
DO Relay Extension Cable - 0.5M (1.6 ft)	CC-KREBR5
DO Relay Extension Cable - 1M (3 ft)	CC-KREB01
DO Relay Extension Cable - 2M (6.5 ft)	CC-KREB02
DO Relay Extension Cable - 5M (16 ft)	CC-KREB05
DO Relay Extension Cable - 10M (33 ft)	CC-KREB10
DO Relay Extension Cable - 20M (66 ft)	CC-KREB20
DO Relay Extension Cable - 30M (98 ft)	CC-KREB30
DO Relay Extension Cable - 40M (131 ft)	CC-KREB40
DO Relay Extension Cable - 50M (164 ft)	CC-KREB50

Fieldbus power conditioner cables

A Fieldbus power conditioner cable connects between a Series C FIM IOTA and its associated Fieldbus power conditioner.

Fieldbus power conditioner cable parts

The cables listed in the following table are used with the Fieldbus power conditioner and are available from the vendor MTL-Relcom.

Description	MTL-Relcom Model
Fieldbus Power Conditioner Cable - 30 cm (1 ft)	FCAB-05
Fieldbus Power Conditioner Cable - 1 m (3 ft)	FCAB-06
Fieldbus Power Conditioner Cable - 2 m (6.5 ft)	FCAB-07
Fieldbus Power Conditioner Cable - 4 m (13 ft)	FCAB-08

Other Fieldbus power conditioner parts

The following table lists other Fieldbus power conditioner parts that are available from the vendor MTL-Relcom.

Description	MTL-Relcom Model
F660A Power Conditioner Parts	
Alarm Module	F660A-ALM
Unpopulated IOTA	F660A-C
Fieldbus Power Module	FPS-IPM
Blanking Module (pack of 10)	FPS-BLK10
F860 Power Conditioner Parts	
Unpopulated IOTA	F860-C
Eight-Segment Power Module	F801

Agency Approvals for Series C Cabinets

Agency approval labels can be applied to the cabinet by the Honeywell factory prior to but not after system shipment.

Inclusion of third-party products or Honeywell models not previously identified voids all agency approvals. The cabinet may only be labeled with a generic, no agency approval, Honeywell label.

Series C Hardware Attributes

Power draw and heat dissipation ratings for Series C components

The following table lists the power draw in amperes and heat dissipation in watts for the given Series C component model. Please refer to the *Power Draw for IOP* section in *Appendix E* for information about PM I/O.

Model Number	Description	Current (Amps @ 24 Vdc)	Heat Dissipation (Watts)
CC-PWRN01	Power system (one supply, no 24 Vdc backup)	-	125
CC-PWRR01	Power system (2 supplies, no 24Vdc backup)	-	145
CC-PWRB01	Power system (2 supplies + 24Vdc backup)	-	145
CC-PCNT01	C300 Controller, non-redundant	0.319	7.975
CC-TCNT01	C300 Controller IOTA	0	0
CC-SCMB01	C300 Memory Backup Assembly	0.010	0.100
CC-PFB401	Series C Fieldbus Interface Module (FIM4)	0.212	5.300
CC-TFB401	FIM4 IOTA	0	0
CC-TFB411	FIM4 IOTA Redundant	0	0
CC-SFPR01	Fieldbus Power Conditioner IOTA Redundant (MTL)	0.600	5.00
CC-PCF901	Control Firewall	0.150	3.750
CC-TCF901	Control Firewall IOTA	0	0
CC-FSMx01	FTE Single Mode Fiber Module (Plugs into one port of Control Firewall IOTA.)	0.040	1.00
CC-FMMx01	FTE Multi-Mode Fiber Module (Plugs into one port of Control Firewall IOTA.)	0.040	1.00
Series C I/O Modules and IOTAs			

Model Number	Description	Current (Amps @ 24 Vdc)	Heat Dissipation (Watts)
CC-PAIH01	High-level AI HART IOM	0.195	3.972
CC-TAIX01	AI IOTA	0.320	2.464
CC-TAIX11	AI IOTA Redundant	0.320	2.464
CC-PAOH01	Analog Output HART IOM	0.461	8.492
CC-TAOX01	AO IOTA	0	0.606
CC-TAOX11	AO IOTA Redundant	0	0.606
CC-PDIL01	Digital Input 24V IOM	0.095	2.700
CC-TDIL01	DI 24V IOTA	0.190	4.220
CC-TDIL11	DI 24V IOTA Redundant	0.190	4.220
CC-PDIH01	Digital Input High Voltage IOM	0.050	1.180
CC-TDI110	DI 110 VAC IOTA	0	3.650
CC-TDI120	DI 110 VAC IOTA Redundant	0	3.650
CC-TDI220	DI 220 VAC IOTA	0	7.330
CC-TDI230	DI 220 VAC IOTA Redundant	0	7.330
CC-PDOB01	Digital Output 24V Bussed Out IOM	0.070	5.680
CC-TDOB01	DO 24V Bussed Out IOTA	0	3.900
CC-TDOB11	DO 24V Bussed Out IOTA Redundant	0	3.900
CC-TDOR01	DO Relay IOTA	0	0
CC-TDOR11	DO Relay IOTA Redundant	0	0
CC-SDOR01	DO Relay Extension Board	0.147	3.865
CC-PAIM01	PMIO LLMUX IOM	0.076	1.900
CC-TAIM01	PMIO LLMUX IOTA	0	0
CC-TAIM21	PMIO LLMUX IOTA with Power Adaptor	0	0

Series C Hardware Grounding Considerations

Grounding considerations in this section apply to Experion systems that include:

- C300 Controllers with Series C I/O,
- C300 Controllers with Series C I/O and Process Manager I/O,
- C300 Controllers that replaced C200 Controllers being used with Process Manager I/O, and
- C300 Controllers that replaced High Performance Process Manager (HPM) controllers with Process Manager I/O.

Grounding basics

Electrical systems must be connected to ground to:

- Protect personnel from electric shock,
- Protect equipment from damage,
- Protect site from lightning damage, and
- Insure the reliability and electrical integrity of the system.

To satisfy all of these requirements, a system may require multiple ground systems. A ground system is a series of rods driven into the earth or a grid system to connect to true earth. Building frames, equipment housings, instrument signals and lightning terminals are connected to these ground rods with appropriately sized wire.

Types of Grounding Systems

The following grounding systems are used for distributed control areas and are described in the following paragraphs.

- AC Safety Ground
- Supplementary Ground
- Master Reference Ground
- Lightning Ground

AC Safety Ground System (mains ground)

The safety ground protects the plant power system, electrical equipment, and personnel from electric shock. All metal equipment and enclosures are connected to this system through the ground wire. If insulated, the ground wire color is normally green. The ground wire and neutral wire are connected to the mains ground rods or grid located where the power enters the building or job area as shown in the following figure.

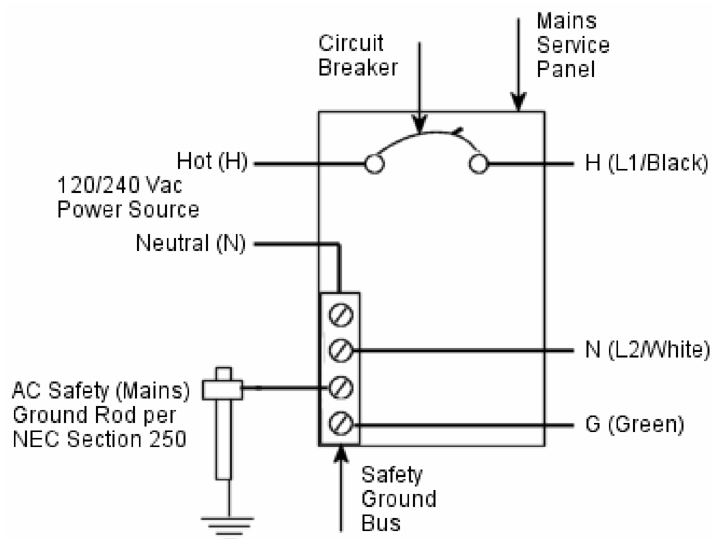


Figure 53 Typical AC power source through mains panel with safety ground bus and AC safety (mains) ground rod.

Supplementary Ground System

In accordance with NEC section 250.54, supplementary grounding electrodes can be used to connect to equipment grounding conductors. The supplementary ground can serve as the termination point for all common leads, as shown in the following illustration.

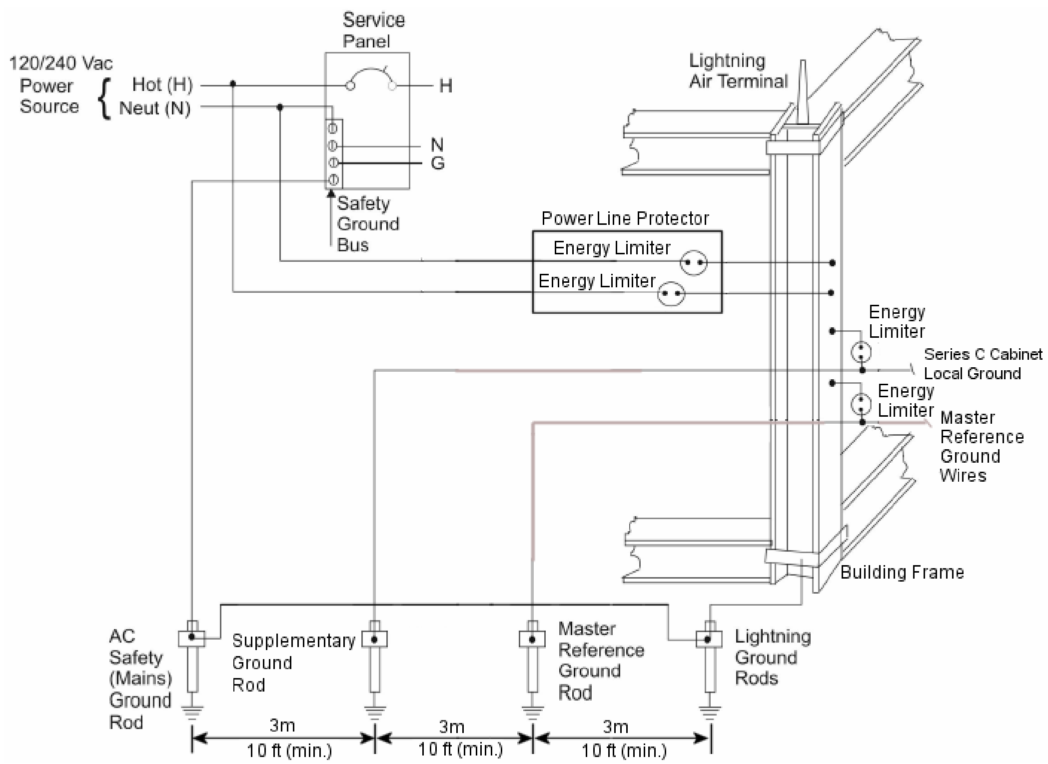


Figure 54 Typical AC power source through mains panel with safety ground bus, AC safety (mains) ground, supplementary ground, master reference ground, and lightning ground rods.

Master Reference (signal common) Ground System

The Master Reference Ground (MRG) is **not** used with Experion systems. It has been used in existing TPS installations including Process Manager I/O cabinets. There is no need to replace this ground, if it is present in an existing Process Manager I/O cabinet installation that is being adapted for use with an Experion Series C cabinet.

The MRG serves as the reference point for all signals. All common leads terminate at this point. Bus bars and wire shields are all connected to this ground. To maintain system reliability and electric integrity, the resistance to true earth should be less than five ohms for general purpose area installations. The master reference ground rods or grid are isolated from the safety and lightning ground rods to eliminate any noise at the signal reference point, as shown in the previous figure.

Lightning Ground System

The lightning ground system safely dissipates lightning energy to protect personnel and the structure. Lightning energy is intercepted by air terminals and/or the building frame and conducted through cable to the ground rods or grid. Lightning system ground rods are connected to mains ground rods (safety ground) to prevent arcing to the building, as shown in the previous figure.

Energy limiter for dissimilar grounds

Electrical codes do allow more than one grounding system, such as safety ground and master reference ground, in a building as long as there are devices which can automatically connect the two grounds together in case of a lightning strike or the presence of a differential voltage greater than 90 volts. We recommend the use of a commercially available energy limiter device called a *Spark Gap*.

Isolation

Power line noise saturates the entire area around the safety (mains) ground rods. To prevent this noise from affecting the supplementary or master reference ground, separate it from the mains ground. The preferred arrangement is to install the mains ground and instrument grounds on opposite sides of the control area. If this is not practical, separate all ground rod systems by at least 3 meters (10 feet).

Codes and references

Ground rod systems must conform to local and national standards. Specific recommendations for design and installation of ground systems are contained in such technical publications as:

- NFPA - 70
- IEE - 142
- Manual on installation of Refinery Instruments and Control Systems: API RP 550
- Lightning Protection Institute Installation Code LPI-175

Two AC power sourcing methods

You can use one of the following methods to provide separate AC power sources for an Experion subsystem.

Method 1

This method takes advantage of the redundant power supply option. The two power supplies can be wired to operate from two separate AC feeder sources. 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.

Method 2

This method uses an automatic transfer switch to provide two AC feeder sources. It does not require redundant power supplies or dual AC feeders 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 Experion controller will perform without compromise even if this cycle requires 10 milliseconds.

Series C cabinet safety ground connections

The following illustration and callout table identify typical safety ground connections in the Series C cabinet. For Honeywell assembled cabinets, all power and ground connections within the cabinet are made by Honeywell manufacturing. The drawing is not to scale nor are component positions representative of actual mounting locations within the cabinet.

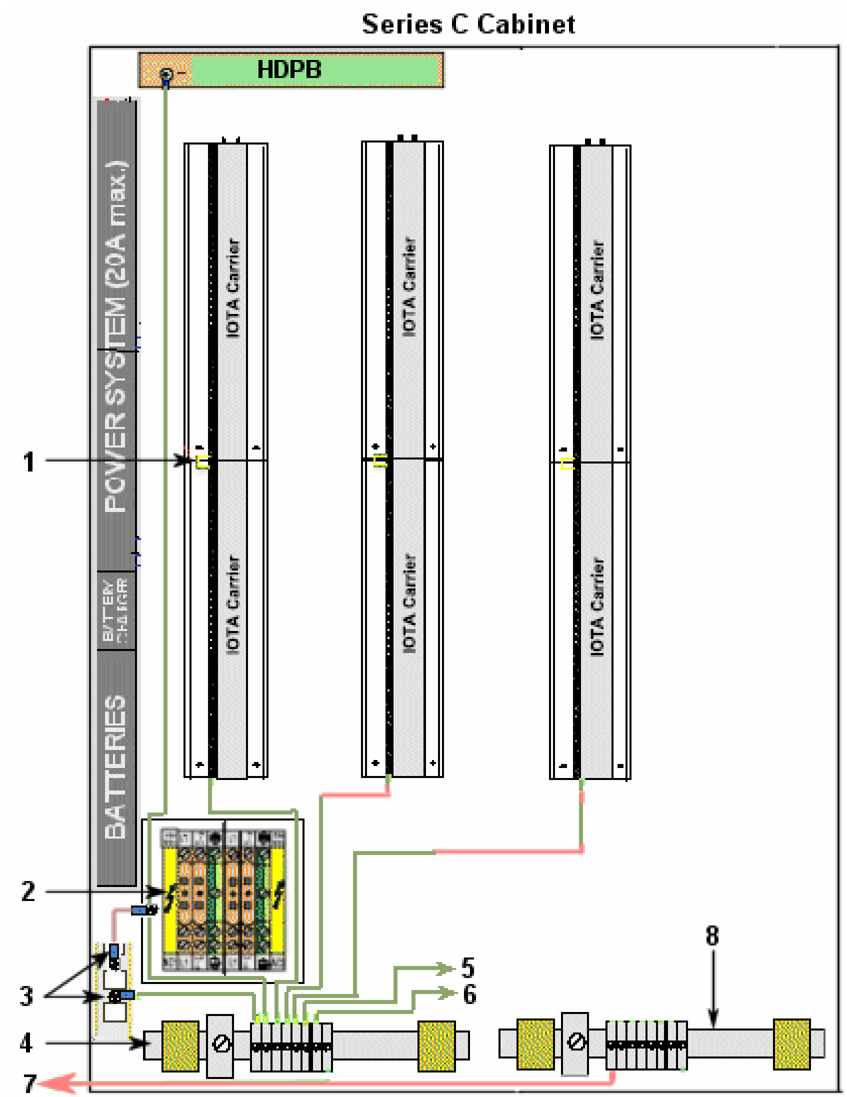


Figure 55 Typical safety ground connections in Series C cabinet

Table 4 Callout descriptions for previous figure

Callout	Description
1	The upper and lower carrier channel assembly shield landing bus bar grounds are jumpered together in the center and the lower shield landing bus bar ground is connected to the AC safety ground bar. Accepts user supplied single or dual AC line power input - Hot (L1), Neutral (L2), and Ground (AC Safety ground).
2	The AC terminal block and mounting plate for routing power and making safety ground connections within the cabinet is mounted on the cabinet floor. See the following figure for details about typical power and ground connections.
3	The AC safety ground bar and the AC terminal block mounting plate are connected to the cabinet frame.
4	The AC safety ground bar is mounted to the cabinet frame.
5	To cabinet front or rear AC safety ground bar if required.
6	To cabinet complex front or rear AC safety ground bar as required.
7	To supplementary ground connection, if required.
8	The Local ground bar is mounted to the cabinet frame, if required.

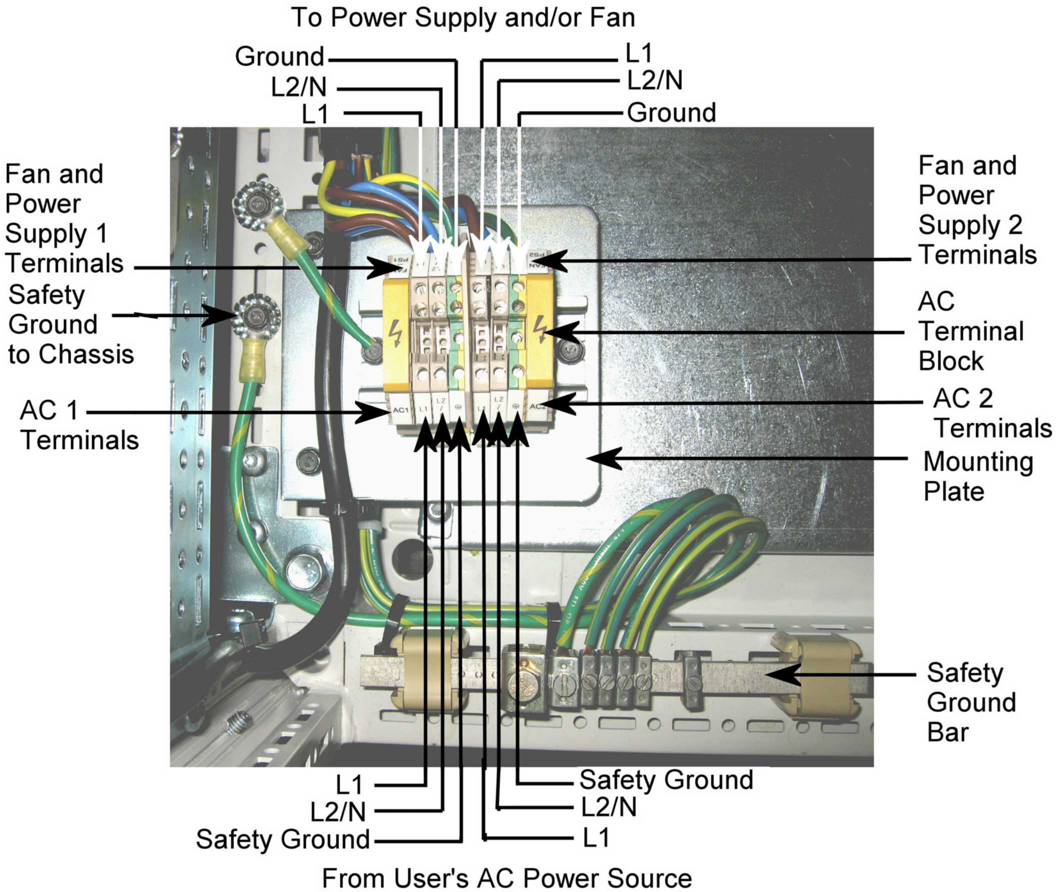


Figure 56 Typical power and ground connections to AC terminal block in Series C cabinet

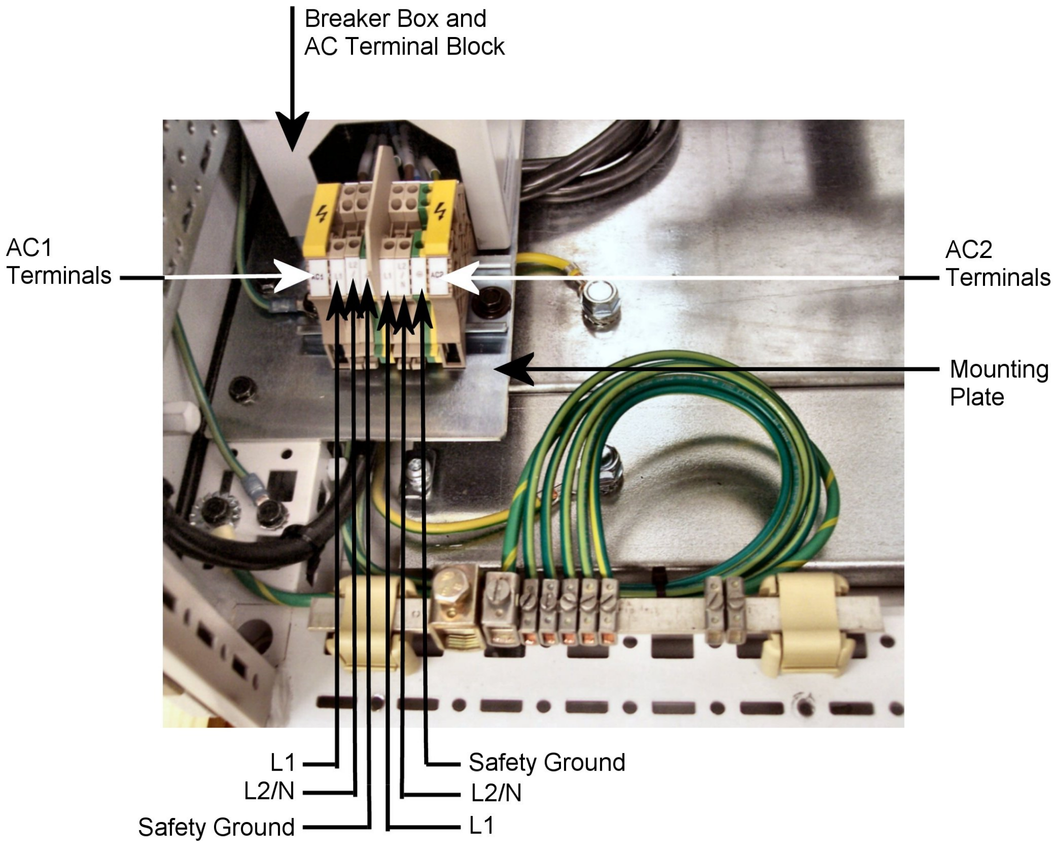


Figure 57 Typical power and ground connections to optional breaker box and AC terminal block in Series C cabinet

Grounding guidelines for C300 Controllers with Series C I/O

The following guidelines apply to installations that include C300 and Series C I/O components as shown in the following sample quad dual access Series C cabinet complex illustration.

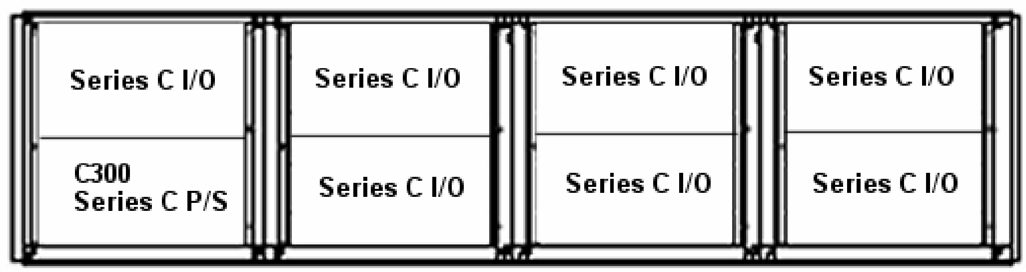


Figure 58 Quad dual access Series C cabinet complex example with C300, Series C Power Supply, and Series C I/O

- Connect the system to a single external (safety) ground, like you would install an EC compliant High Performance Process Manager (HPM) system. The Series C power system requires single-point grounding to AC safety ground, as previously described in the *Series C cabinet safety ground connections* section.
- Any customer wiring shields that must be grounded at the Series C IOTAs is connected to the safety ground shield landing bus bar that is part of the Series C Carrier Channel Assemblies as previously described.
- There are no grounding options for the Series C I/O Link connections to the C300 IOTA.

Series C cabinet typical power and ground connections

The following illustration shows the typical power and ground connections that are required for Series C hardware configuration.

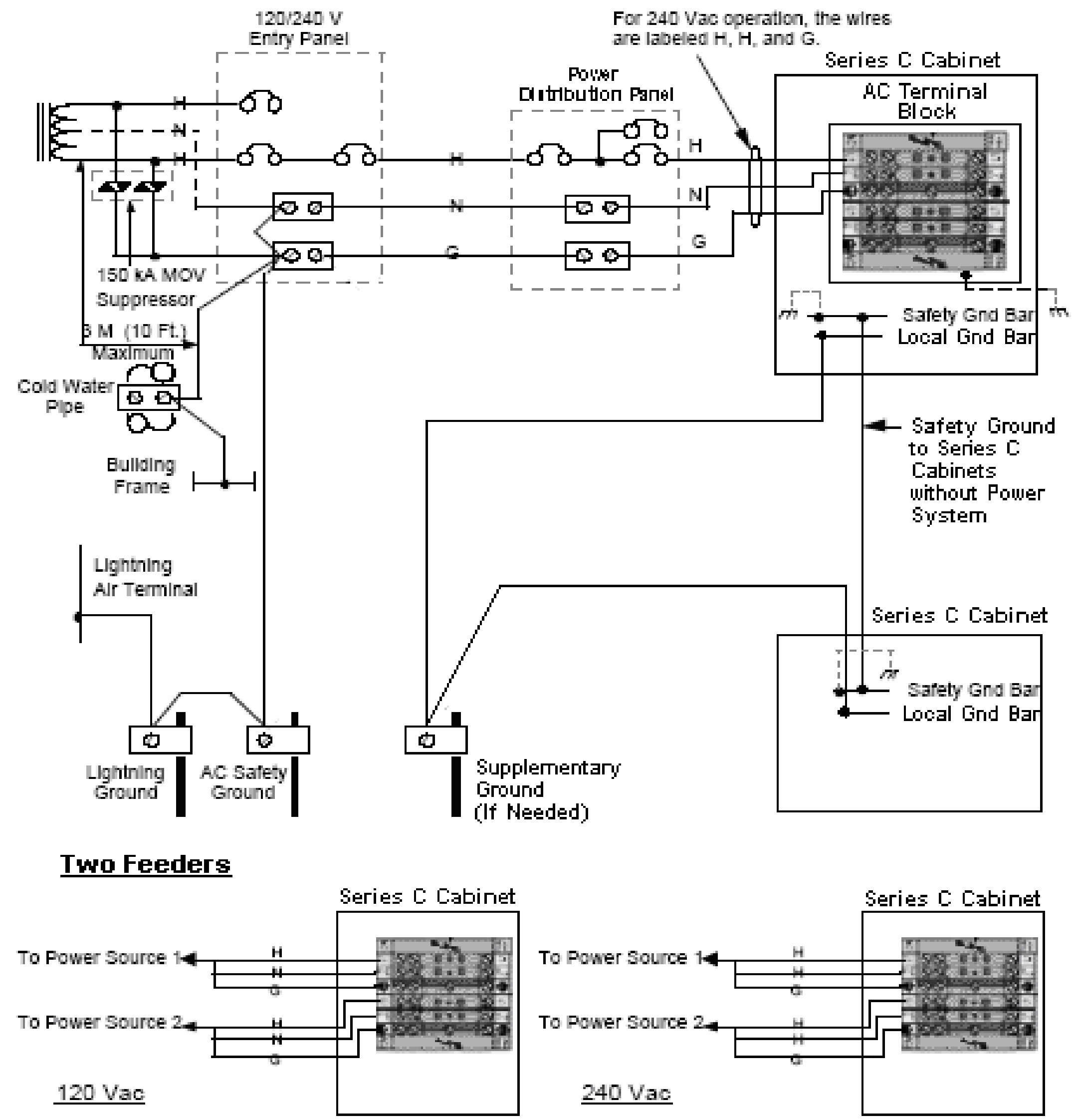


Figure 59 Typical power and ground connections for Series C cabinet.

Grounding guidelines for C300 Controllers with Series C I/O and PM I/O

The following guidelines apply to installations that include C300, Series C I/O, and PM I/O components as shown in the following sample quad dual access cabinet complex illustration. The Series C components are housed in Series C cabinets and the PM I/O components are housed in PM cabinets also known as IOP cabinets.

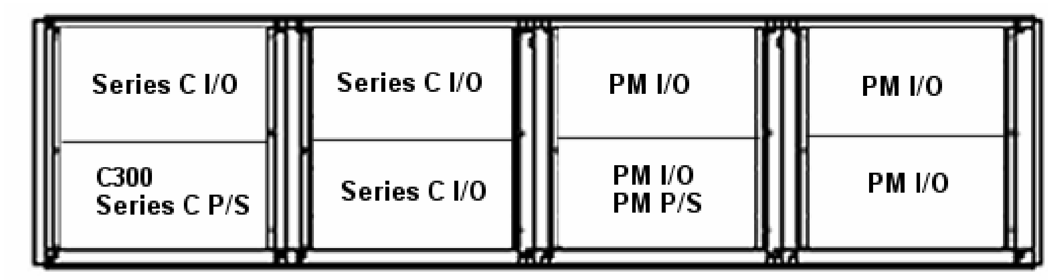


Figure 60 Quad dual access cabinet complex example with C300, Series C power supply, Series C I/O, PM power supply, and PM I/O in Series C and PM cabinets, respectively

- Connect the Series C power supply system to a single external (safety) ground, like you would install an EC compliant High Performance Process Manager (HPM) system. The Series C power system requires single-point grounding to AC safety ground, as previously described in the *Series C cabinet safety ground connections* section.
- Any customer wiring shields that must be grounded at the Series C IOTAs is connected to the safety ground shield landing bus bar that is part of the Series C Carrier Channel Assemblies as previously described.
- There are no grounding options for the Series C I/O Link connections to the C300 IOTA.
- If the PM I/O hardware is EC compliant, the PM power system requires single-point grounding to safety ground. See the following illustrations for more information about typical AC power and ground connections for PM I/O subsystems.
- If the PM I/O hardware is **Non-**EC compliant, the PM power system requires dual-point grounding to master reference ground (MRG) and safety ground. See the following illustrations for more information about typical AC power and ground connections for PM I/O subsystems.

- Remove all PM I/O Link cable shield grounding jumpers in all PM I/O files. Note that the PM I/O Link cable shields will be single-point grounded to safety ground through the C300 Controller.

TIP

When upgrading from C200/IOLIM or HPM to C300, aside from changes to PM I/O Link cable shield grounding per as previously noted, the upgraded system requires no other grounding changes to the existing part of the system. This means no changes are required in the powering and grounding of the Process Manager power system that continues to power the PM I/O.

PM cabinet typical power and ground connections

The following illustration shows the typical power and ground connections that should exist for a current PM I/O configuration. These connections can remain the same when used with C300 and Series C I/O.

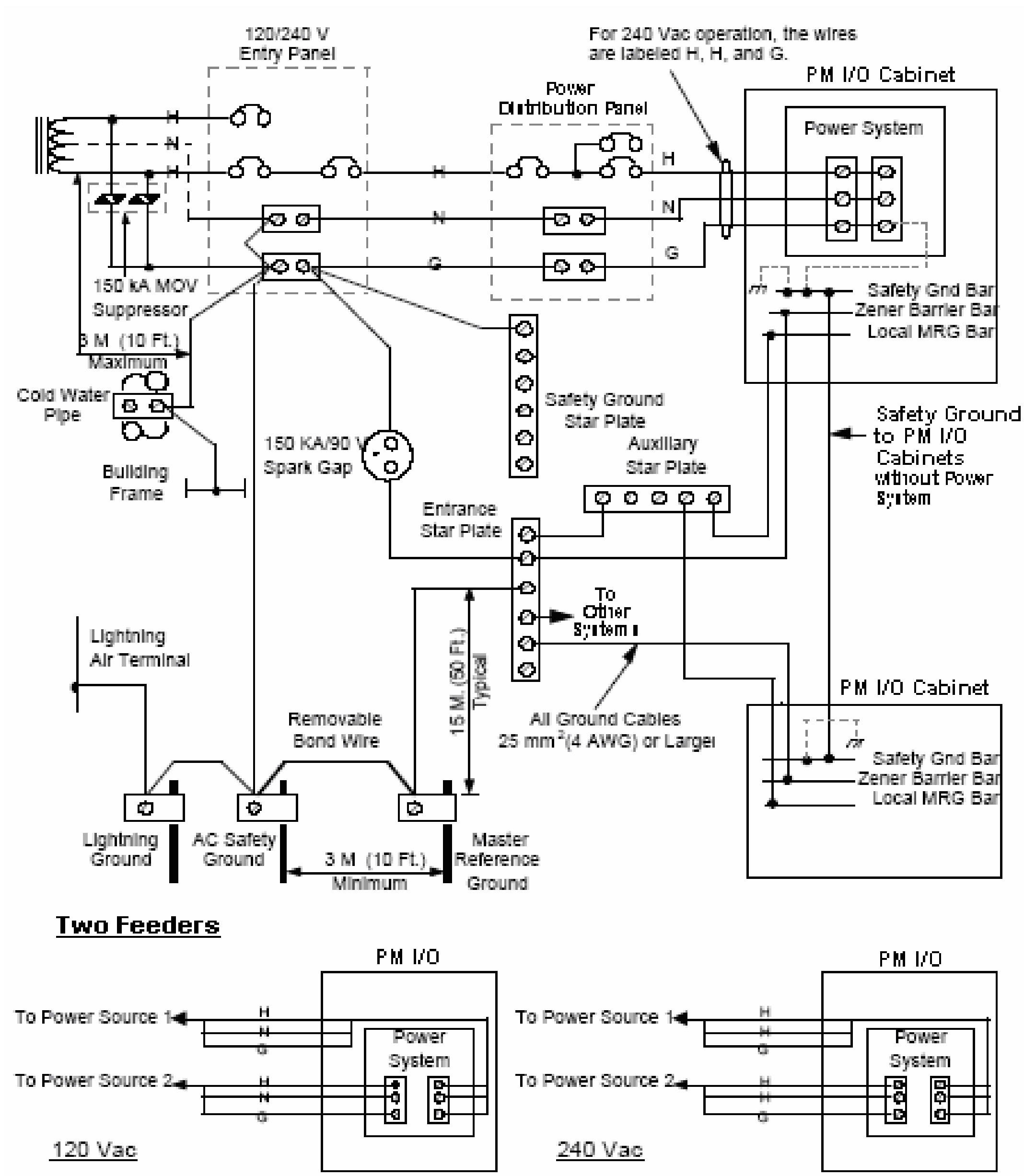


Figure 61 Typical power and ground connections for PM I/O cabinet that is non-EC compliant.

PM cabinet safety ground connections

The following illustration shows the typical ground connections that should be present in an existing PM I/O configuration.

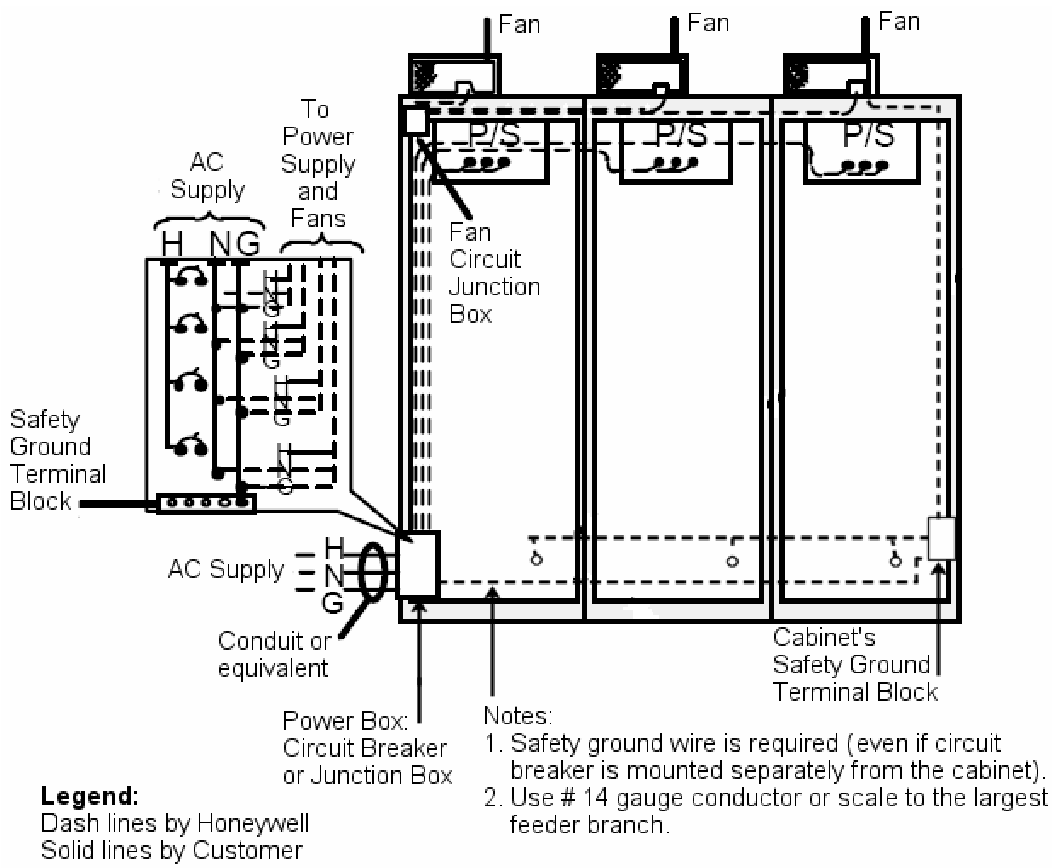


Figure 62 Typical PM cabinet safety ground connections.

Grounding considerations for C200/IOLIM to C300 upgrade

As shown in the following illustration, the C200 Controller and IOLIM chassis is replaced in the existing PM cabinets with a C300 Controller in added Series C cabinets.

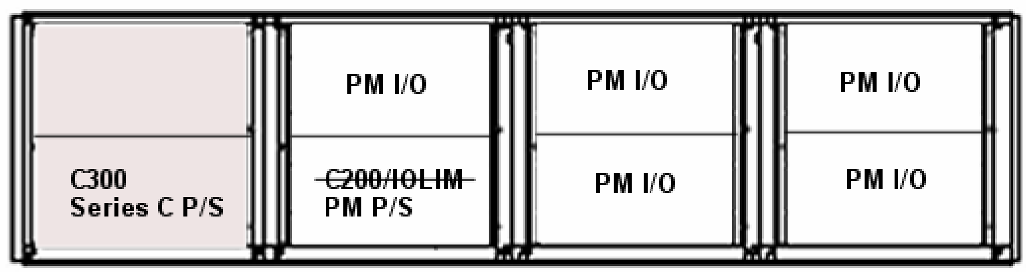


Figure 63 Quad dual access cabinet complex example with C300 and Series C power supply in Series C cabinets replacing C200/IOLIM in PM cabinets with PM power supply and PM I/O

- Connect the Series C power supply system to a single external (safety) ground, like you would install an EC compliant High Performance Process Manager (HPM) system. The Series C power system requires single-point grounding to AC safety ground, as previously described in the *Series C cabinet safety ground connections* section.
- Any customer wiring shields that must be grounded at the Series C IOTAs is connected to the safety ground shield landing bus bar that is part of the Series C Carrier Channel Assemblies as previously described.
- There are no grounding options for the Series C I/O Link connections to the C300 IOTA.
- If the PM I/O hardware is EC compliant, the PM power system requires single-point grounding to safety ground. See the following illustrations for more information about typical AC power and ground connections for PM I/O subsystems.
- If the PM I/O hardware is **Non-**EC compliant, the PM power system requires dual-point grounding to master reference ground (MRG) and safety ground. See the following illustrations for more information about typical AC power and ground connections for PM I/O subsystems.
- Remove all PM I/O Link cable shield grounding jumpers in all PM I/O files. Note that the PM I/O Link cable shields will be single-point grounded to safety ground through the C300 Controller.

- See the previous sections *PM cabinet typical power and ground* connections and *PM cabinet safety ground connections* for more information about typical power and ground connection requirements for existing PM I/O configurations.

TIP

When upgrading from C200/IOLIM or HPM to C300, aside from changes to PM I/O Link cable shield grounding per as previously noted, the upgraded system requires no other grounding changes to the existing part of the system. This means no changes are required in the powering and grounding of the Process Manager power system that continues to power the PM I/O.

Grounding considerations for HPM to C300 upgrade

As shown in the following illustration, the High Performance Process Manager (HPM) controller is replaced in the existing PM cabinets with a C300 Controller in added Series C cabinets.

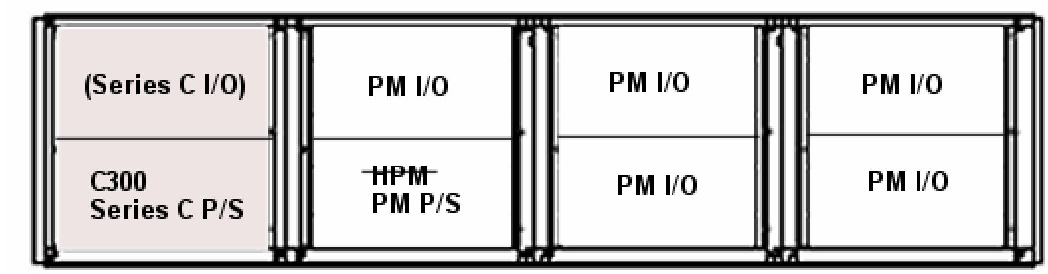


Figure 64 Quad dual access cabinet complex example with C300 and Series C power supply in Series C cabinets replacing HPM in PM cabinets with PM power supply and PM I/O

- Connect the Series C power supply system to a single external (safety) ground, like you would install an EC compliant High Performance Process Manager (HPM) system. The Series C power system requires single-point grounding to AC safety ground, as previously described in the *Series C cabinet safety ground connections* section.
- Any customer wiring shields that must be grounded at the Series C IOTAs is connected to the safety ground shield landing bus bar that is part of the Series C Carrier Channel Assemblies as previously described.

- There are no grounding options for the Series C I/O Link connections to the C300 IOTA.
- If the PM I/O hardware is EC compliant, the PM power system requires single-point grounding to safety ground. See the previous illustrations for more information about typical AC power and ground connections for PM I/O subsystems.
- If the PM I/O hardware is **Non-**EC compliant, the PM power system requires dual-point grounding to master reference ground (MRG) and safety ground. See the previous illustrations for more information about typical AC power and ground connections for PM I/O subsystems.
- Remove all PM I/O Link cable shield grounding jumpers in all PM I/O files. Note that the PM I/O Link cable shields will be single-point grounded to safety ground through the C300 Controller.
- See the previous sections *PM cabinet typical power and ground* connections and *PM cabinet safety ground connections* for more information about typical power and ground connection requirements for existing PM I/O configurations.

Grounding considerations for C200/IOLIM to C300 upgrade in PM cabinets

As shown in the following illustration, the C200 Controller and IOLIM chassis is replaced by a C300 Controller in the existing PM cabinets using the PM power supply.

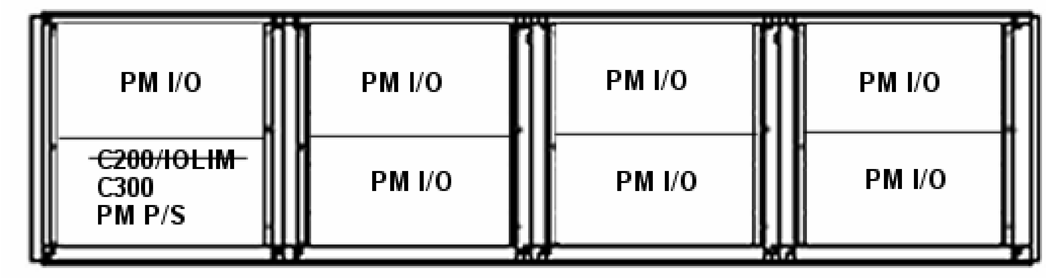


Figure 65 Quad dual access cabinet complex example with C300 replacing C200/IOLIM in PM cabinets with PM power supply and PM I/O

- If complex includes EC compliant PM I/O hardware, the PM power system requires single-point grounding to safety ground.
- If complex includes **Non**-EC compliant PM I/O hardware, the PM power system requires dual-point grounding to master reference ground and safety ground.
- Remove all PM I/O Link cable shield grounding jumpers in all PM I/O files. Note that the PM I/O Link cable shields will be single-point grounded to safety ground through the C300 Controller.
- See the previous sections *PM cabinet typical power and ground* connections and *PM cabinet safety ground connections* for more information about typical power and ground connection requirements for existing PM I/O configurations.

ControlNet Configuration

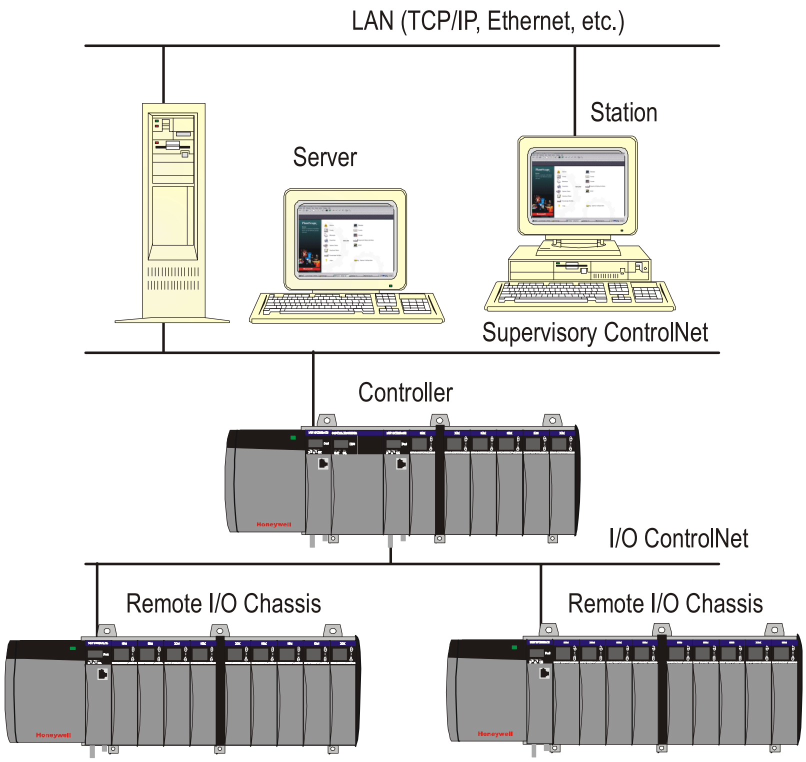
Planning Overview

Background

The ControlNet cable system gives you the flexibility to design a communication network for your particular application. To take full advantage of this flexibility, you should spend sufficient time planning the installation of your cable system, before assembling any of the hardware.

Types of ControlNet networks

ControlNet networks are described in terms of their location within the system topology. As illustrated in the following figure, an Experion system may include both Supervisory and I/O ControlNet networks. Note that ControlNet taps are not shown but are present in both networks.



ControlNet topology

ControlNet supervisory network

A single ControlNet supervisory network can support either one non-redundant server or one redundant server pair. See *Planning Your Control Hardware, C200 Controllers* in this Guide for how many controllers are supported.

ATTENTION

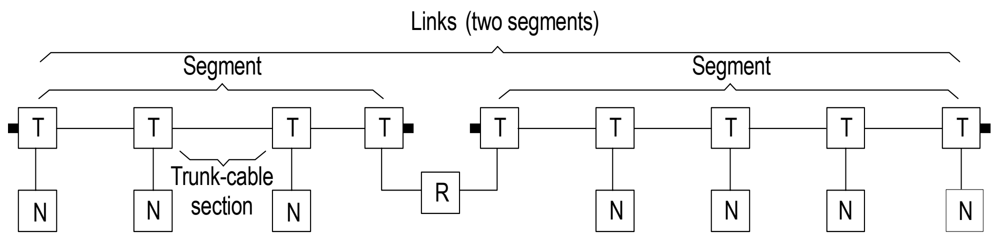
Experion clients (operator and engineering stations) connect to the Server over an independent Ethernet or Fault Tolerant Ethernet link and not the ControlNet supervisory network

I/O ControlNet network

The I/O ControlNet supports up to eight I/O chassis in addition to its controller chassis (single non-redundant controller or redundant controller pair).

High-level ControlNet network overview

A ControlNet network, as illustrated in the following figure, is the collection of nodes or nodes that may be segregated into segments and links (e.g.: Experion Servers and Controllers), as required by your application. Segments are connected using repeaters.



Network components

The ControlNet cable system is comprised of the following core components:

- Network
- Links
- Segments
- Repeaters
- Trunk Cable
- Cable Connectors
- Terminators
- Taps
- Nodes

The purpose, use, and planning considerations for these components (as they relate to a ControlNet network) are described in detail in this section.

Programming devices may be connected to the ControlNet cable system through the maintenance tap on a segment (for a temporary connection), a tap on a segment (for a permanent connection, or through the ControlNet network access cable.

Quick planning guide

Table 3 provides a quick guide for planning your ControlNet Cable network. For more detailed information, refer to the appropriate topic in this section.

Table 5 Quick planning guide

Component	Model #	Guidelines	Quantity
Taps			
• Straight T • Straight Y • Right Angle T • Right Angle Y	• 9904-TPS • 9904-TPYS • 9904-TPR • 9904-TPYR	You need a tap for each connection to the trunk (nodes and repeaters). Each tap kit contains: two BNC connector kits, 1 dust cap, 1 universal mounting bracket and 2 screws.	The number of taps required = the number of repeaters x 2 + number of nodes.
Coaxial Repeaters			
• 85 – 250 Vac 110 – 250 Vdc • 20 – 72 Vdc	• 9904-RPT • 9904-RPTD	You need to use a repeater to: • increase the number of nodes attached. • extend the allowable cable length.	Refer to *Connecting Your Links and* Segments.
Cable Connectors			
• Standard • Bullet • Barrel	• TC-MC1BNC • TC-MC2BNC • TC-MC3BNC		

Component	Model #	Guidelines	Quantity
• Isolated Bulkhead • Right-Angle	• TC-MC5BNC • TC-MC6BNC	Refer to Planning for Your ControlNet Cable Connectors	As required.
Terminators			
• Tap Dummy Load (TDL)	• 1786-TCAP (includes 5 TDLs)	Terminates a drop cable when the ControlNet node is not connected.	One per unterminated drop cable. (Do not use as Trunk Terminator)
• Trunk Terminator (BNC - 75 ohms)	• TC-TCXBNC (includes 2 terminators)	You need a terminator for each end of each segment.	The number of terminators = the number of segments x 2.
Trunk Cable (reconnectors installed and tested)			
• 1 meter cable • 3 meter cable • 10 meter cable • 30 meter cable • 50 meter cable • 100 meter cable • 200 meter cable • 500 meter cable	• TC-KCCX01 • TC-KCCX03 • TC-KCCX10 • TC-KCCX30 • TC-KCCX50 • TC-KCC100 • TC-KCC200 • TC-KCC500	Refer to *Planning Your Physical* Media.	
Tool Kit			
• Coax tool kit	• 9904-CTK	Use the tool kit to modify trunk cable to your specifications	One

Component	Model #	Guidelines	Quantity
Trunk Cable (cable without connectors installed)			
• 275 meter cable	• TC-KCC900	Refer to *Physical Media Planning* Note: TC-KCC900 is raw cable without connectors installed. Use with standard cable connectors TC-MC1BNC.	

ATTENTION

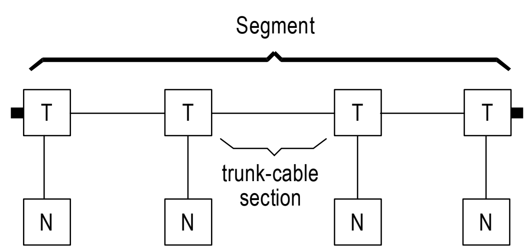
You will need to double your quantities when ordering components for a redundant cable system.

Planning Your Link and Segment Configurations

Background

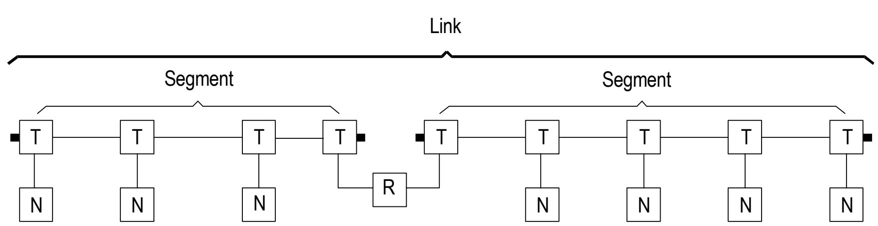
Links and segments are two high-level (yet basic) building blocks of a ControlNet network, each providing a mechanism for distributing your control. Your application and the specifications of each of these network forms will help determine how you will configure your system. When planning your ControlNet network, be aware that:

- segments, as illustrated in the following figure:
  - are a collection of trunk sections.
  - include taps for each node.
  - include trunk terminators at each end of the segment.



- a Link, as illustrated in following figure, is:
  - a collection of nodes.
  - one or more segments.

In many Experion systems, each ControlNet supervisory and/or I/O network is a single segment with only a few taps and no repeaters.



ATTENTION

Also keep in mind that:

- each node in a link must have a unique address in the range of 1-20, for ControlNet I/O network. For ControlNet supervisory network, the default system configuration is for 24 nodes (UMAX) but it can be updated to 32 only if actual number of nodes required exceeds 24.
- The total allowable length of a segment depends upon the number of taps in your segment.
- Repeaters are used to link multiple segments within a single link.

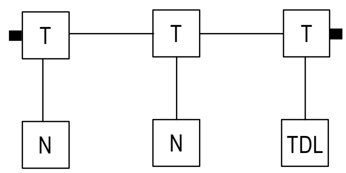
Segment planning considerations

1. The following are important segment-planning considerations.
2. All connections to the trunk require a tap.
3. Taps may be installed at any location on the trunk.
4. Tap drop-cable length must not be changed. The cables must always be 1 meter.
5. Use Tap Dummy Loads to allow for spare drop cables for network maintenance or future node implementation. See the following figure.
6. The maximum number of taps is 48, with 250 m (820 ft) of trunk.
7. If a bullet connector is used to reserve a future tap location, include it in the tap count to prevent possible network re-configuration later when the tap is actually installed.
8. The maximum trunk length is 1000 m (3280 ft), with two taps.
9. 75 ohms trunk terminators are required on both ends.
10. Unconnected drop-cables are not allowed. You may install one tap within each segment (maintenance, future expansion, etc.) provided you attach a Tap Dummy Load (1786-TCAP) to the node end of the drop-cable.
11. Use BNC bullet connectors at future tap locations.
12. Avoid high noise environments when routing cables.

WARNING

The Tap Dummy Load (1786-TCAP) and the ControlNet Terminator (trunk cable) should not be used interchangeably. The tap dummy load has an impedance of about 4K ohms; ControlNet terminator, 75 ohms.

Attaching a ControlNet Terminator to the node end of the drop-cable may effectively disable your ControlNet network.



T = Tap, N=Node, TDL = Tap Dummy Load

Link planning considerations

The following are important link planning considerations.

13. A maximum of five coaxial repeaters in series are allowed.
14. A node requires a network address unique to that link and in the range of 1-20 in order to function on the network. A supervisory link may contain a maximum of 32 nodes (excluding repeaters) but an I/O link is limited to 20.
15. Repeaters require a tap but are not counted as nodes. They are included in the number of devices allowed per segment.
16. Repeaters may be installed at any tap location along a segment.
17. There can only be one path between any two points on a link.
18. The configuration of both sides (A and B) of a redundant link must be the same. ControlNet redundant-cable-compatible hardware should be connected to the A and B networks in the same order and with similar cable lengths.
19. The signal delay along A or B path (including all coaxial and fiber-optic trunk cable and repeaters) between any two nodes in a network must not exceed 120 microseconds

20. The difference in signal delay times along A and B paths (including all coaxial and fiber-optic trunk cables and repeaters) between any two nodes in a redundant-cable ControlNet network must not be greater than 3.2 microseconds, which is about 800 meters of coax cable or about 640 meters of fiber-optic cable, or proportionally between those two values for networks containing both types of cable. [Use 4 microseconds/km for coax and 5 microseconds/km for fiber.]

See Using redundant media (optional) in the *Planning Guide* for redundant segment and link planning.

Connecting Your Links and Segments

Background

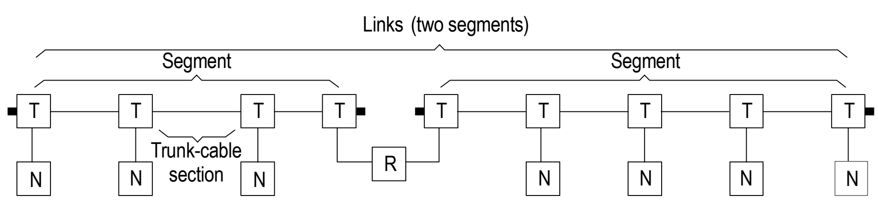
The total number of taps (resulting in additional nodes) and the total length of your ControlNet network can be increased by using repeaters. The entire pathway of contiguous segments and links, through repeaters and bridges, constitutes a single ControlNet network (as illustrated in the following figure).

- Repeaters:
  - when inserted into your network, create a new segment.
  - increase the allowable number of taps, or extend the total length of your segment.
  - do not change any tap restrictions applied to the segment on either side.
  - may be used to create a star configuration (go off in multiple directions from one point)
  - have a replaceable fuse for over-current protection.
  - have two indicators for status and troubleshooting

ATTENTION

The maximum number of addressable nodes per link (not counting repeaters) is 32 (24 default) for supervisory network and 20 for I/O network segment.

A repeater can be connected to a segment at any tap location. Since repeaters do not require an address, they do not count against the total of 32 or 20.



ControlNet network and the application of repeaters and bridges

Coaxial Repeater options

Table 4 lists your repeater options based on input power.

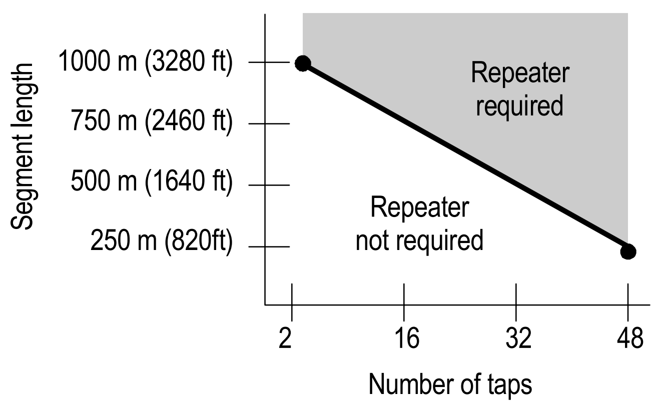
Table 6 Available repeaters

For an Input Power of...	Use this Repeater
85 to 250 Vac or 110 to 250 Vdc	9904-RPT
20 to 72 Vdc	9904-RPTD

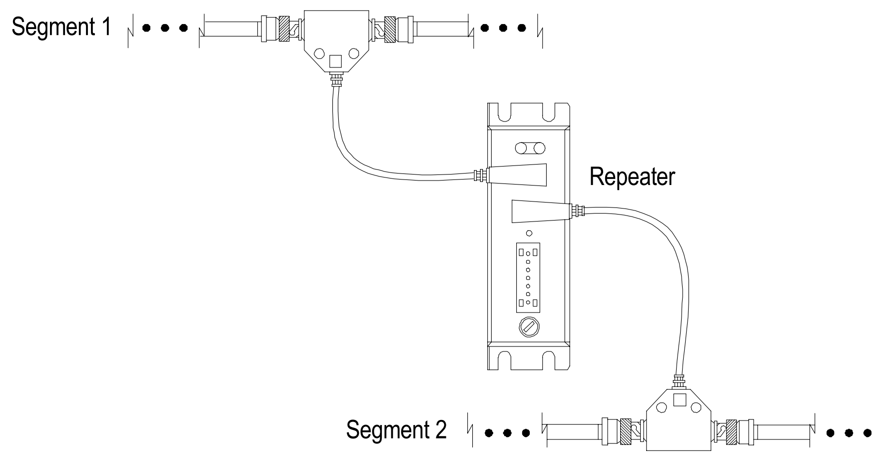
Determining if you need repeaters

You need to install repeaters if your system requires more taps per segment or more trunk cable than the specifications allow. The first of the following two figures provides a graph that can be used to determine the number of repeaters required whenever the segment length is known. The second figure that follows illustrates a repeater connecting two segments.

Honeywell offers two repeaters, as listed in Table 4, based on the type of input power.



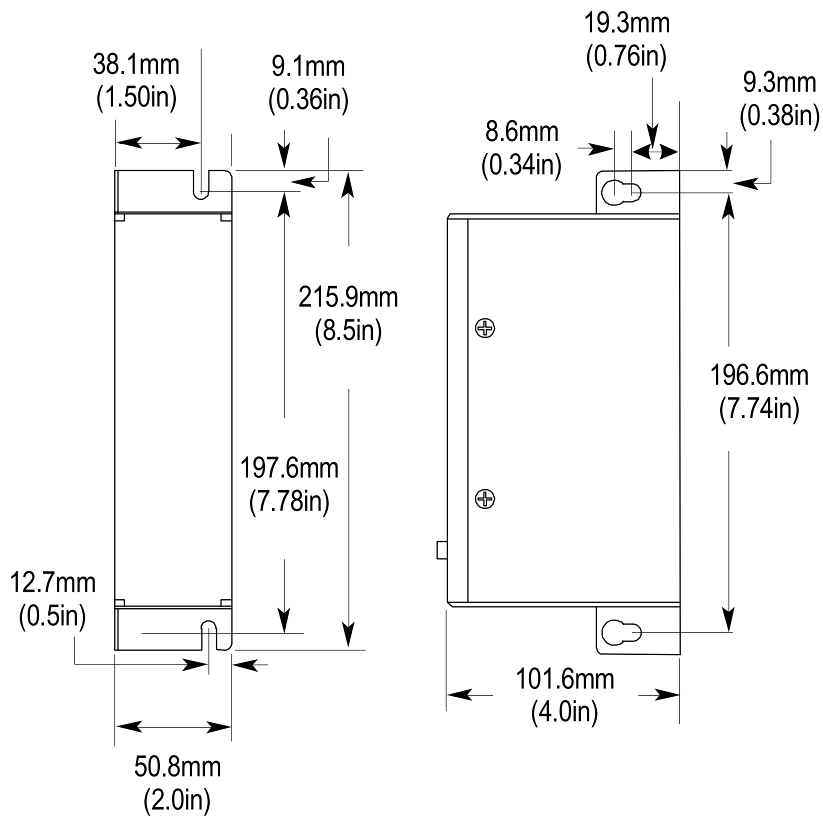
Determining the number of repeaters



Repeater connecting two segments

Mounting dimensions

The following figure illustrates a repeater and its mounting dimensions.



Configuring your link with repeaters

A repeater can be connected to a segment at any tap location. When you configure your link, using repeaters, you can install them in:

- Series,
- Parallel, or
- Series/Parallel combination..

The maximum system size is based on the distance between any two nodes. The total amount of cable used in the network is only limited by the distance between the furthest two nodes.

Table 5 lists the maximum allowable number of repeaters for each of the three configurations.

Table 7 Maximum number of repeaters per link

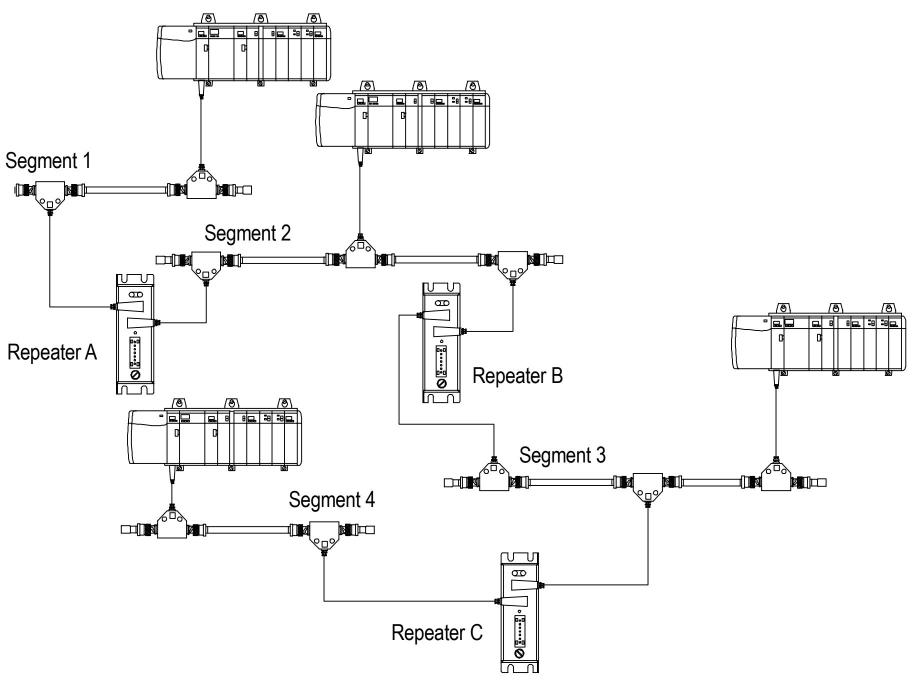
Configuration:	Maximum number of repeaters:
Series	5
Parallel	48
Series/Parallel Combination	5 in Series, and 48 in Parallel

Repeaters in series

When you install repeaters in series, you can install a maximum of five repeaters (or six segments) to form a link.

The following figure illustrates an example of repeaters installed in series. In this link,

- segments 1 and 4 each have two taps and each is 1000 m (3280 ft).
- segments 2 and 3 each have three taps and each is 983.7 m (3226.6 ft).
- the total length of this link is 3967.4 m (13013.2ft).
- there are three repeaters in series (A, B, C).



Repeaters installed in series

Repeaters in parallel

When you install repeaters in parallel, you can install a maximum of 48 repeaters (the maximum number of taps per 250 m segment) on any one segment.

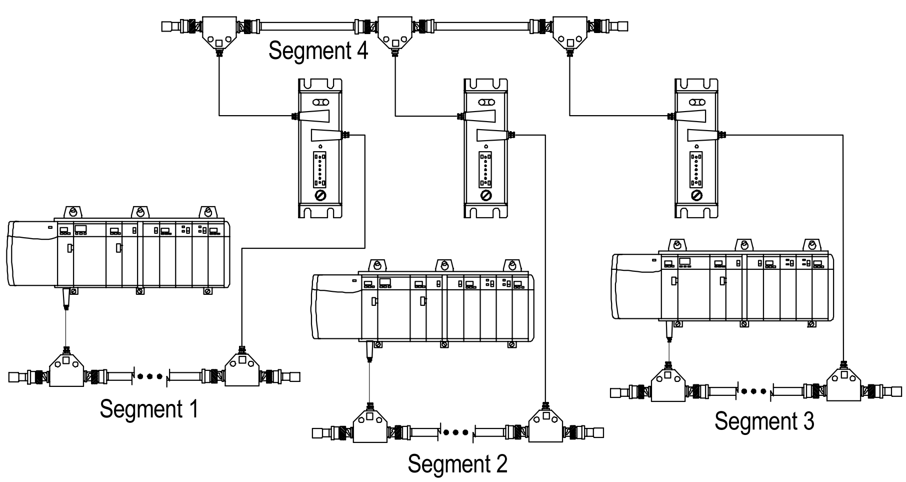
If your link is configured using repeaters in parallel, you count one of the repeater taps for one segment and the other repeater tap for the parallel segment that the repeater is connecting to the backbone network.

The following figure is an example of repeaters installed in parallel. In this link,

- segment 4 is 983.7 m (3226.6 ft).
- segments 1, 2 and 3 (if they have an equal number of nodes) can each have up to 33 nodes on them (a link can have 48 connections, not including repeaters).
- segments 1, 2, and 3, with 33 nodes on them, cannot exceed 478.4 m.

ATTENTION

In the example in the following figure, Segment 1 counts only one repeater tap (as well as the taps for the nodes). The other repeater tap is counted toward the limitations of Segment 4.



Repeaters installed in parallel

Repeaters in a combination of series and parallel

CAUTION

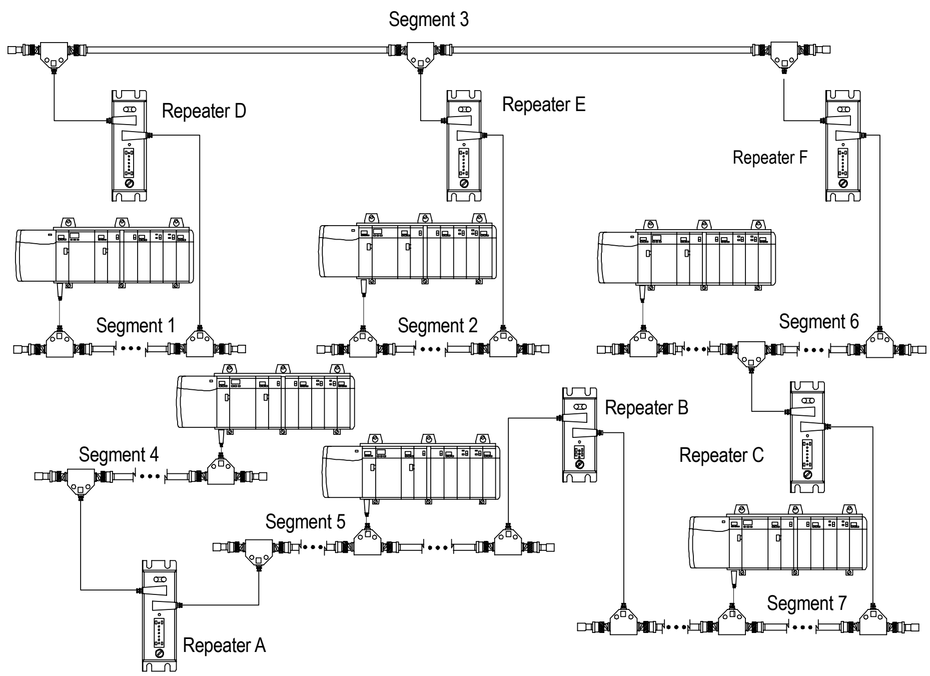
There can be only one path between any two nodes on a ControlNet link. Multiple repeater connections between two nodes are not allowed.

You can install repeaters in a combination of series and parallel connections, following the guidelines listed for each to form a link. For mixed topologies (series and parallel), the maximum number of repeaters between any two nodes is five.

If your network is configured using repeaters in combination of series and parallel, you need to count the taps and repeaters in all segments.

The following figure illustrates an example of repeaters installed in a combination of series and parallel. In this link, if each segment contains 500 m (1640 ft) of cable,:

- segment 3 can contain up to 29 nodes, since it already contains 3 taps.
- segments 1, 2, and 4 can contain up to 31 nodes each, since they already contain one tap for a repeater.
- segments 5, 6, and 7 can contain up to 30 nodes, since they already contain 2 taps for repeaters.
- the maximum number of nodes that can be connected to this link is 48 (not including repeaters).
- there are 5 repeaters in series. This is the maximum number allowed (repeaters A, B, C, F, and D or A, B, C, F, and E).



Repeaters installed in a series/parallel combination

Planning Your Physical Media

Trunk cable

The trunk cable is the bus, or central part, of the ControlNet network. The trunk is composed of multiple sections of cable. The standard cable used to construct trunk sections is quad-shield RG-6 type coax.

Determining what type of cable you need

There are several types of RG-6 Quad Shield cable that may be appropriate for your installation, depending on the environmental factors associated with your application and installation site.

You should install all wiring for your ControlNet cable system in accordance with the regulations contained in the National Electrical Code (NEC), Canadian Electrical Code (CEC), or any other applicable local codes. Refer to the ESD and EMI Immunity Planning section in this document for additional information concerning safe and compliant installation of cables and wiring.

Table 6, lists the recommended cable types for general applications.

Table 8 Determining the type of cable you need

If your application...	then use...
is Light Industrial	Standard-PVC
is Heavy Industrial	Lay-on Armored and Interlocking Armor
Includes High and Low Temperatures, and Corrosive Areas (Harsh Chemicals)	Plenum-FEP CMP-CL2P
Requires Festooning	High Flex
Requires Moisture Resistance; Direct Burial, with Flooding Compound, Fungus Resistance	Flooded Burial

Keep the use of high-flex RG-6 cable to a minimum. Use BNC bullet connectors to isolate areas that require high-flex RG-6 cable from areas that require standard RG-6 cable. This allows the high-flex RG-6 section to be replaced before flexure life is exceeded. Use the equation below to determine an allowable total length of high-flex RG-6 cable. The maximum number of taps allowed per segment is 48, with each tap decreasing the cable's maximum length.

$$\text{Maximum allowable segment length of high-flex cable} = \frac{\textbf{(20.29 db -- number of taps in segment x .32 db)}}{\textbf{Cable attenuation @ 10 Mhz per 304 m (1000 ft)}}$$

Note: Cable attenuation is defined as the signal loss measured at 10 Mhz per 1000 ft. (304 m) of cable.

General Wiring Guidelines

Follow these guidelines for routing any ControlNet coaxial cable:

- If it must cross power feed lines, it should do so at right angles.
- Route at least 1.5m (5 ft) from high-voltage enclosures, or sources of rf/microwave radiation.
- If the cable is in a metal wireway or conduit, each section of that wireway or conduit must be bonded to each adjacent section so that it has electrical continuity along its entire length, and must be bonded to the enclosure at the entry point.

Wiring External to Enclosures

Cables that run outside protective enclosures are relatively long. To minimize cross-talk from nearby cables, it is good practice to maintain maximum separation between the ControlNet cable and other potential noise conductors. You should route your cable following these guidelines:

Cable in a contiguous metallic wireway or conduit?	Route your cable at least:	From noise sources of this strength:
Yes	0.08m (3 in)	Category-1 conductors of less than 20A
	0.15m (6 in)	ac power lines of 20A or more, up to 100 KVA
	0.3m (12 in)	ac power lines greater than 100KVA
No	0.15m (6 in)	Category-1 conductors of less than 20A
	0.3m (12 in)	ac power lines of 20A or more, up to 100 KVA
	0.6m (24 in)	ac power lines greater than 100 KVA

Wiring Inside Enclosures

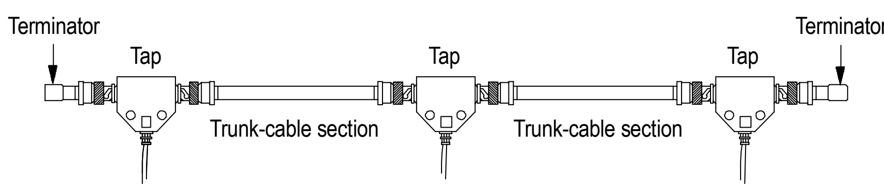
Cable sections that run inside protective equipment enclosures are relatively short. As with wiring external to enclosures, you should maintain maximum separation between your ControlNet cable and Category-1 conductors.

When you are running cable inside an enclosure, route conductors external to all raceways in the same enclosure, or in a raceway separate from Category-1 conductors.

Route your cable at least:	From noise sources of this strength:
0.08m (3 in)	Category-1 conductors of less than 20A
0.15m (6 in)	ac power lines of 20A or more, up to 100 KVA
0.6m (24 in)	ac power lines greater than 100KVA

Trunk sections

As illustrated in the following figure, a segment is comprised of several sections of trunk cable separated by taps. The total cable length of a segment is equal to the sum of all of the trunk-cable sections.



ControlNet trunk sections

Determining trunk section lengths

ATTENTION

When determining the cable length of trunk sections, make sure you measure the actual cable path as it is routed in your network. Consider vertical dimensions, as well as horizontal. You should always calculate the three-dimensional routing path distance when determining cable lengths.

To minimize the amount of cable you need, select the shortest path for routing. The specific details of planning such a cable route depends upon the needs of your network.

As illustrated in the following example, the total allowable length of a segment depends upon the number of taps in your segment. There is no minimum requirement for the length of a trunk-cable section. The maximum allowable total length of a segment is 1,000 m (3,280 ft), with two taps connected. Each additional tap decreases the maximum length of the segment by 16.3 m (53 ft). The maximum number of taps allowed on a segment is 48, with a maximum length of 250 m (820 ft). Total trunk length or number of taps can be increased by installing repeaters on the segment, creating another segment.

Example

The following figure provides an example of calculating the maximum segment length.

If your ControlNet segment requires 10 taps, the maximum segment length is:

...In meters	**… In feet**
1000m - (16.3m x (10 - 2))	3280ft - (53.4ft x (10 - 2))
1000m - (16.3m x (8))	3280ft - (53.4ft x (8))
1000m - 130.4m	3280ft - 427.7ft
896m maximum segment length	**2852.3ft maximum segment length**

Maintaining Experion ControlNet Cabling

WARNING

Loss of communications between controller and I/O will result in outputs reverting to their default (i.e., HOLD or OFF) states. If this loss of communications is intermittent, the outputs could effectively oscillate (cycle between commanded and default state). The following could cause such loss of communications:

Failure-induced cabling (trunks, drops, terminators) faults.

Operator-induced cabling (trunks, drops, terminators) faults.

Faulty CNI modules.

Faulty backplanes or module backplane interfaces.

Excessive electromagnetic interference.

The following are meant to assist the user in minimizing ControlNet faults.

- DO use dual media ControlNet in systems where cable faults could have critical consequences (partial or full loss of control)
- DO mark both ends of media trunks and drops (e.g., “A” and “B”) when using dual media to simplify identification during installation and maintenance.
- DO perform installation audits and testing to verify the channel isolation of dual media installations (i.e., ensure trunks and drops are not crossed).
- DO review the settings of output modules as to their default state (HOLD, OFF) should a loss of connection (to the controller) occur. This is much more important with single media installations (where there is no backup channel).
- DO take a control system OFF-LINE if CNI faults (vs. media) are suspected (and therefore require CNI restart or replacement).
- DO repair media faults in dual media systems AS SOON AS POSSIBLE. ControlNet redundancy, for this and earlier releases is not designed to handle simultaneous faults on both media.
- DO NOT disconnect the media (trunks, drops, terminators) of single media networks while a system is ON-LINE.

- DO NOT disconnect the media of the surviving channel of a dual media network when a media fault occurs and the system is ON-LINE. For example, if the "A" channel is faulty and requires troubleshooting, DO NOT disconnect anything on the "B" channel (trunks, drops, terminators) while the system is ON-LINE.
- DO NOT disturb the CNIs (remove, power down chassis) when troubleshooting network media.

TIP

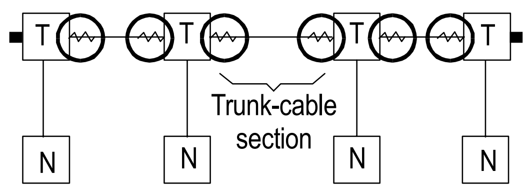
There are currently no tools associated with this Experion release that will pinpoint a faulty cabling component. Therefore, recovery from a ControlNet fault involves the organized replacement of cabling components until the problem disappears.

It is suggested to start with the drops associated with those nodes referenced in the alarms, proceeding out from there (to the trunk cables, other drops, terminators).

Planning for Your ControlNet Cable Connectors

Background

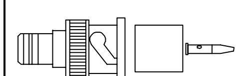
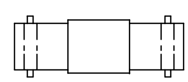
A cable connector (TC-MC1BNC) attaches coax trunk-cable sections to the tap's BNC connector, as illustrated in the following figure.

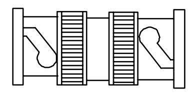
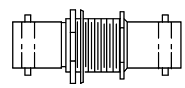
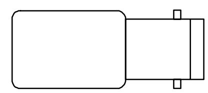
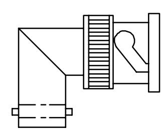


Connector types

Honeywell also offers optional cable connectors for use in your network configuration as listed in Table 7.

Table 9 Connector types and their application

Type	Connection	Application	Diagram	Model #
Cable Connector	Cable-to-Connector	Attach trunk cable sections to a tap's BNC connector		TC-MC1BNC
Bullet	Jack-to-Jack	Reserve a space in the trunk for future installation of a tap or to splice a trunk cable		TC-MC2BNC

Type	Connection	Application	Diagram	Model #
Barrel	Plug-to-Plug	Connect two adjacent taps without a trunk cable section between them.		TC-MC3BNC
Isolated Bulkhead	Jack-to-Jack	Go through grounded panel walls while maintaining the shield isolation of the trunk cable		TC-MC5BNC
Tap Dummy Load	Plug-cap	Cap off installed taps that have yet to be connected to a node.		1786-TCAP
Right Angle	Jack-to-Plug	Provide a 90-degree bend in your cable (prevent bending your cable excessively)		TC-MC6BNC

Example of connector type applications

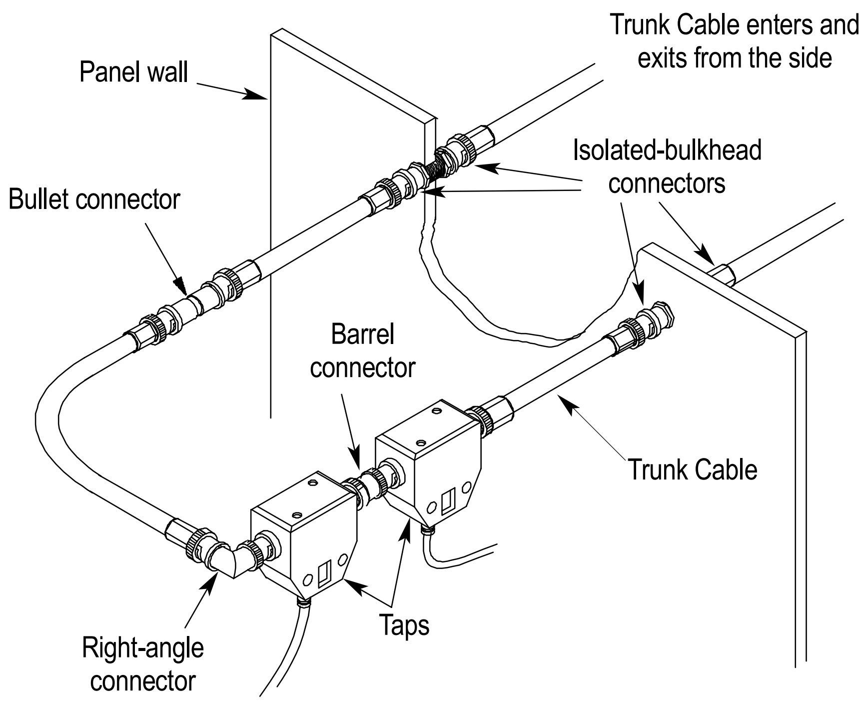
CAUTION

Do not allow any of the metallic surfaces on the BNC connectors, plugs, or optional accessories to touch any grounded metallic surfaces.

The following figure is an example using a combination of connectors and their typical applications. In this example, the ControlNet network:

- enters and exits the panel enclosure from the side, using isolated-bulkhead connectors.
- contains two adjacent taps, connected by a barrel connector.

- reserves one future tap location with a bullet connector.
- makes a sharp bend with a right-angle connector.



Connector application examples

ATTENTION

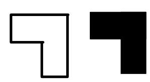
If you are installing a bullet connector for future tap installations, count the bullet as one of the tap allotments on your segment (and decrease the maximum allowable cable length by 16.3 m). This helps you to avoid reconfiguring your network when you install the tap.

Using redundant media (optional)

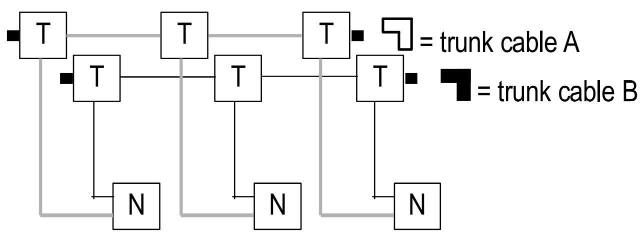
You can run a second trunk cable between your ControlNet nodes for redundant media. With redundant media, nodes send signals on two separate segments. The receiving node compares the quality of the two signals and accepts the better signal to permit use of the best signal. This also provides a backup cable should one cable fail.

Trunk cables on a redundant cable link are defined by the segment number and the redundant trunk-cable letter.

Actual ControlNet products are labeled with these icons.



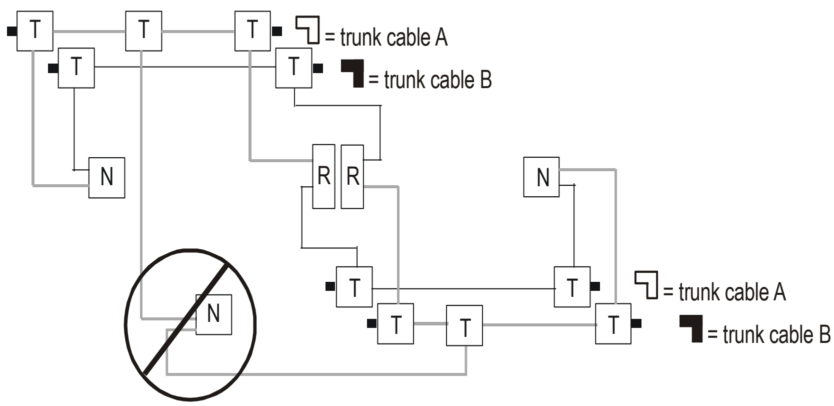
In the following figure, trunk cable B is redundant.



Observe these guidelines when planning a redundant media system.

- Route the two trunk cables (trunk cable A and trunk cable B) differently to reduce the chance of both cables being damaged at the same time.
- The minimum allowed bend radius anywhere along the installed fiber-optic cable is 4.5 cm (1.8 in.).
- Each node in a redundant-cable link must support redundant connections and be connected to both trunk cables at all times. Any nodes connected to only one side of a redundant-cable link will result in media errors on the unconnected trunk cable.
- Install the cable system so that the trunk cables at any physical device location can be easily identified and labeled with the appropriate icon or letter. Each redundant ControlNet device is labeled so you can connect it to the corresponding trunk cable.

- Both trunk cables (trunk cable A and trunk cable B) of a redundant-cable link must have identical configurations. Each segment must contain the same number of taps, nodes and repeaters. Connect nodes and repeaters in the same relative sequence on both segments.
- Each side of a redundant-cable link may contain different lengths of cable. The total difference in length between the two trunk cables of a redundant-cable link must not exceed 800m (2640 ft.)
- Avoid connecting a single node's redundant trunk cable connections on different segments; this will cause erratic operation. See problem in figure below where a node is incorrectly reconnected to A on one segment and B on another segment.



ATTENTION

Do not mix redundant and non-redundant nodes.

Planning for Your ControlNet Taps

CAUTION

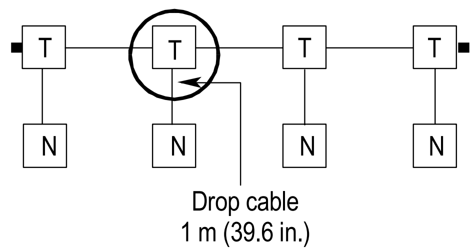
The following cautionary reminders should be observed regarding cable taps.

- The ControlNet cable system is a ground-isolated coaxial network. Proper selection of cable, connectors, accessories, and installation techniques is necessary to ensure that it is not accidentally grounded.
- Taps contain passive electronics; and must be used for the network to function properly. Other methods of connecting to coax trunk cable will result in reflected energy that will disrupt communications.
- A disconnected drop-cable can be a point of noise ingress onto the network. Because of this, we recommend having no unconnected drop-cables. Unused drop cables should be terminated with a Tap Dummy Load (1786-TCAP).

Be sure to keep the dust cap on any unconnected drop-cable. If you are planning future installation of additional nodes, install the additional taps ahead of time and use Tap Dummy Loads or install BNC bullet connectors as described in the *Cable Connectors* subsection of this section.

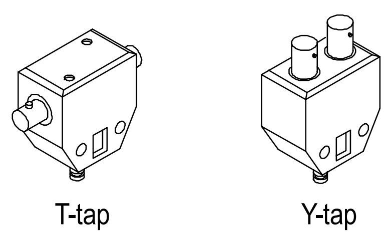
Background

Taps connect each node on a network to the cable system via an integral 1 m (39.6 in) drop-cable as illustrated in the following figure. Taps may be installed at any location on the trunk cable. Drop cable length must remain at 1m (39.6 in).

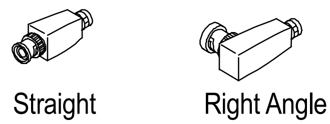


There are four physical versions of taps available with:

- T- or Y-placement of BNC connectors, as illustrated in the first of the following figures, and
- straight or right angle connector on the drop-cable, as illustrated in second figure that follows.



T and Y taps



Straight and right angle connectors

Determining how many taps you need

The number of taps you need depends on the number of devices you want to connect to the network. You need a tap for each node and repeater on a segment.

If you plan to add nodes at a later date, you should consider ordering and installing the cable and connectors for these additional nodes when you install the initial cable system. This will minimize disruption to the network later during operation.

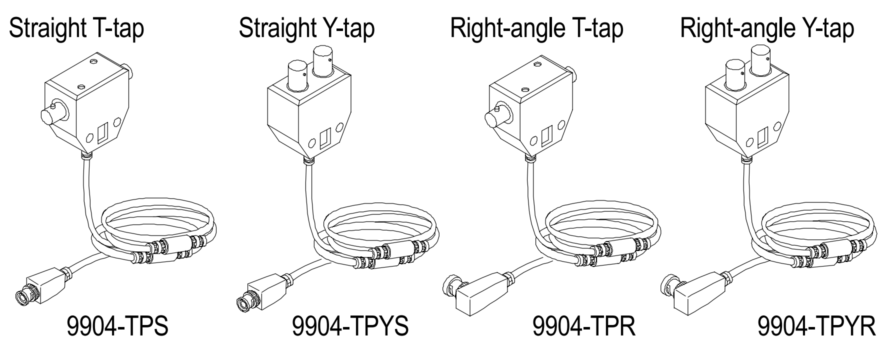
The following table identifies how many taps are allowed on a segment.

Maximum number of taps allowed:	On this type of cable:	With a cable length of:
2	RG6 RG6F	1000m (3280 ft) 666m (2187 ft)
48	RG6 RG6F	250m (820 ft) 166.6m (546.75 ft)

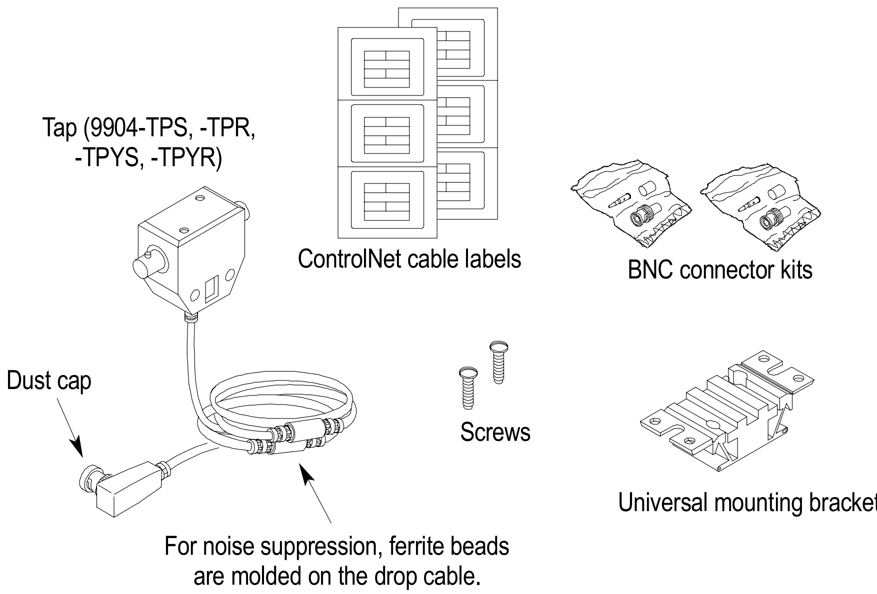
Tap kits

There are four tap kits available, as illustrated in the first of the following two figures. They are based on four types of taps. As illustrated in the second figure that follows, each tap kit contains:

- a tap,
- drop-cable,
- BNC connector kits (not needed for pre-assembled trunk cables)
- screws,
- mounting bracket, and
- cable labels.



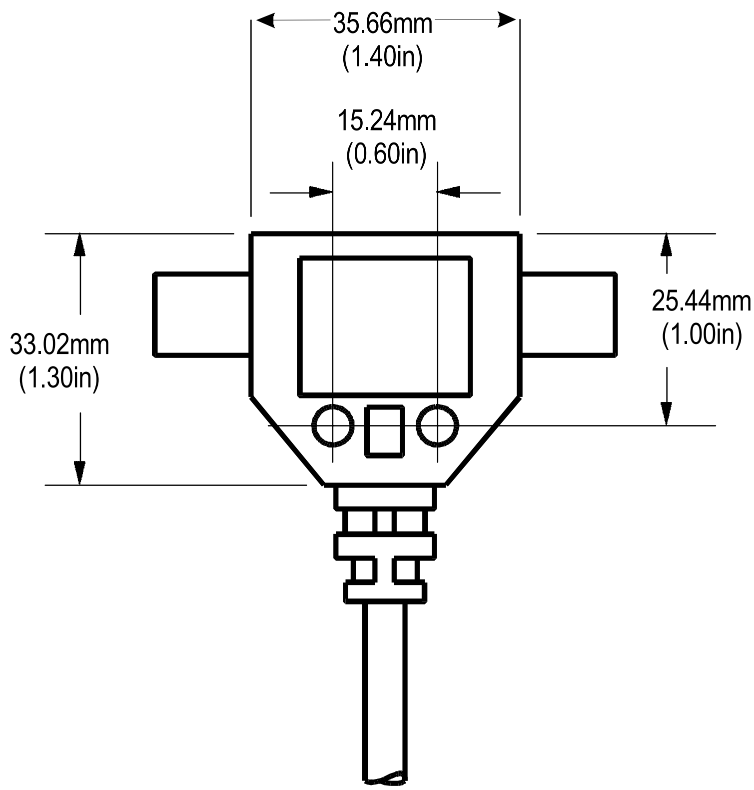
Available tap kits



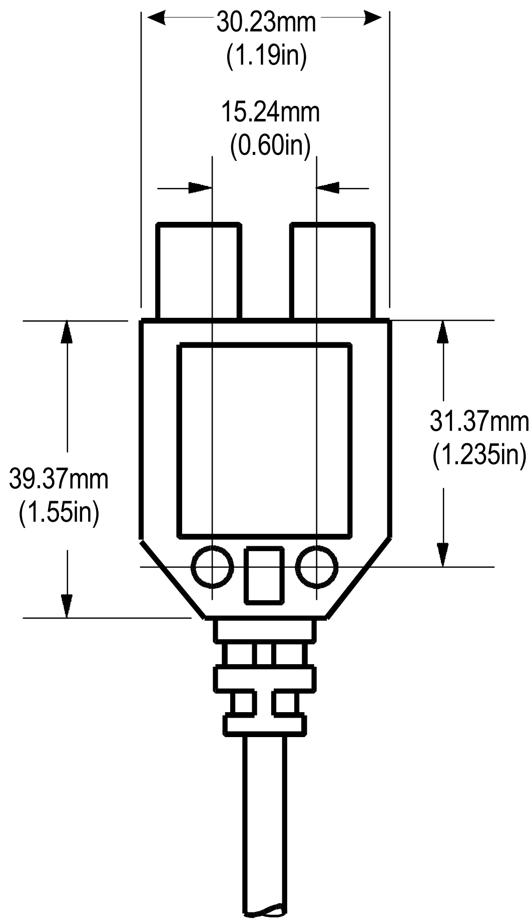
Tap kit contents

Mounting dimensions

The following two figures illustrate the T and Y type taps, and their mounting dimensions, respectively.



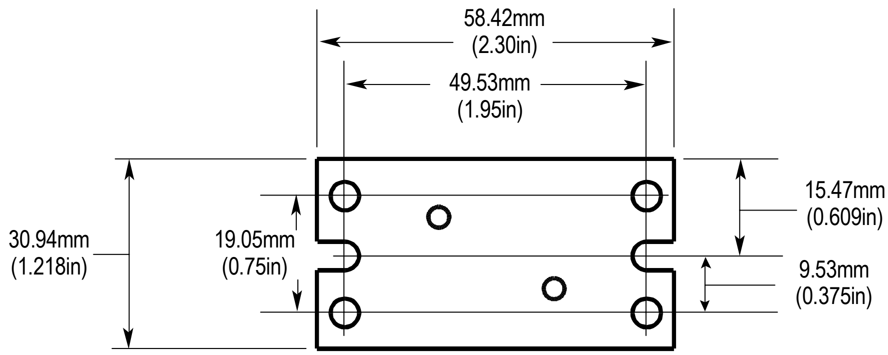
T-tap mounting dimensions



Y-tap mounting dimensions

Universal mounting bracket

The Universal Mounting Bracket is used to mount your T- and Y-taps. The following figure illustrates the Universal Mounting Bracket and its dimensions.

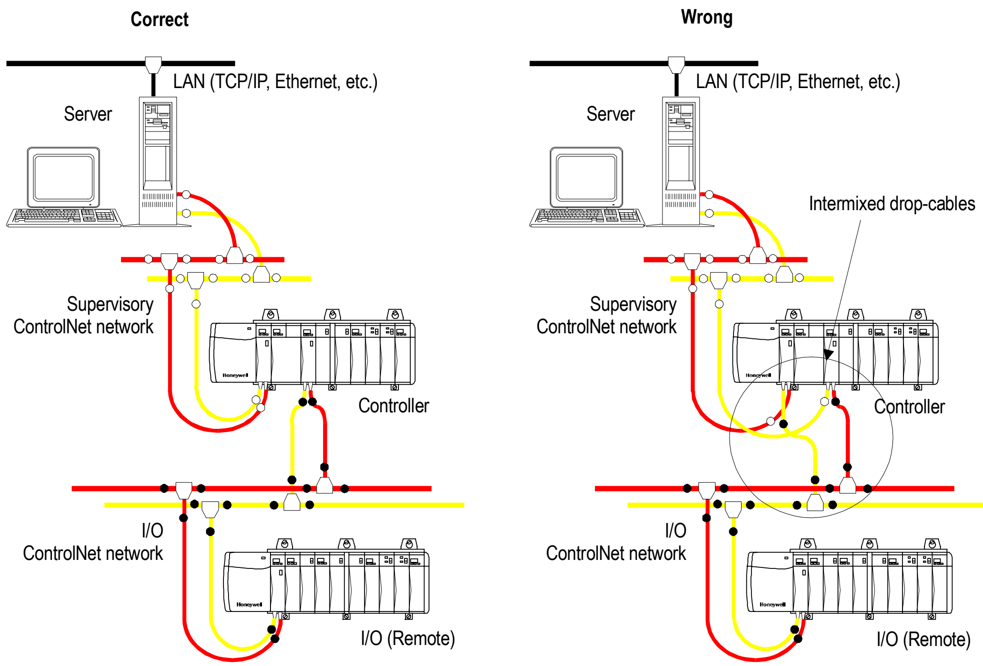


Planning for drop-cable identification

WARNING

It is imperative that your drop-cables are correctly labeled as “A” or “B” and indicate whether they are connected to a Supervisory or I/O ControlNet network.

The CNI modules and tap/drop-cable sets are identical regardless of where they are being used. When the drop-cables for these CNI modules are in close proximity to each other, it is possible to inadvertently intermix your drop-cables and connect a Supervisory ControlNet CNI to an I/O ControlNet network, and an I/O ControlNet CNI to a Supervisory ControlNet network as illustrated in the following figure. Doing so can have unexpected and undesirable results, including potential loss of control.



ControlNet drop-link intermixing example

To help prevent the intermixing of Supervisory and I/O ControlNet drop-cables, you should establish some convention for ControlNet network identification. While you should follow any established conventions or standards at your site, one simple solution is to use the red and yellow labels provided in the taps kits (2 each per kit). In this convention you place the dots next to the "A" and "B" on the label and then, at both the node and tap (trunk) ends of each drop-cable:

- attach ONE red "A" labels to the Supervisory ControlNet "A" drop-cable connector.
- attach TWO red "A" labels to the I/O ControlNet "A" drop-cable connector.
- attach ONE yellow "B" label to the Supervisory ControlNet "B" drop-cable connector.
- attach TWO yellow "B" labels, to the I/O ControlNet "B" drop-cable connector.

In this sample identification convention,

- red always indicates the "A" ControlNet trunk cable
- yellow always indicates the "B" ControlNet trunk cable
- a single "A" or "B" label always indicates the Supervisory ControlNet drop-cable
- a double "A" or "B" label always indicates the I/O ControlNet drop-cable

TIP

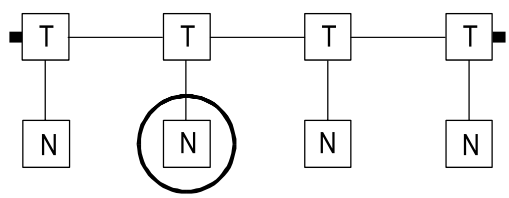
This marking code using one or two red/yellow marks should be extended to module connections, taps, and trunk cables.

Planning Your ControlNet Nodes

Background

Nodes are physical devices connected to the ControlNet cable system via a tap. They require a network address in order to function on the network. The following figure illustrates the location of nodes. In the Experion system, these nodes may include:

- Experion servers through the PCIC card (TC-PCIC01), and
- Controller and I/O chassis through ControlNet Interface (CNI) modules (TC-CCN014 and TC-CCR014).



Communications Integrity

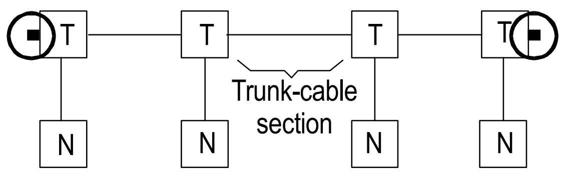
Once a node is configured, Experion will attempt to communicate with it. Once communication is established, the network will reach a level of stability. Should a node be physically disconnected from the network after configuration or should a node be configured and never be physically connected to the network, Experion will go into a continuous mode of attempting to establish a connection to a non-existent node. This will force an unnecessarily high load on the communication architecture and have an adverse affect on network performance to the point where the system may crash. Therefore, it is strongly recommended that users avoid situations in the Experion system where communication is attempted to configured nodes that are non-existent.

1. DO NOT configure a node unless it is or will soon be present, connected, and active (powered)
2. DO NOT leave nodes disconnected for long periods of time.

Planning for ControlNet Terminators

Background

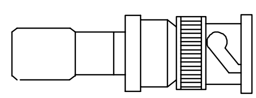
A 75-ohm terminator (TC-TCXBNC) must be installed on the tap at each end of a segment, as illustrated in the following figure.



Determining how many terminators you need

You must use 75-ohm trunk terminators (TC-TCXBNC provides 2) at the end of each segment, as illustrated in the following figure for the ControlNet network to work.

You will need two trunk terminators for each cable "A" segment and two for each cable "B" segment.



75 Ohm terminator

Planning Your ControlNet Addressing

Background

Each node on a given ControlNet supervisory or I/O network must have a unique ControlNet address in the valid range of 1 to 24 (32 maximum) for supervisory network or 1 to 20 for I/O network, established by setting switches in the node hardware according to the guidelines below.

TIP

Each ControlNet Network must have a ControlNet Interface Card configured with a MAC ID of 1 (assigned as the ControlNet moderator) for the ControlNet default override setting to be utilized for the network. It is recommended that for each I/O ControlNet network, the CNI card in the remote chassis that connects to the I/O ControlNet to be assigned as MAC ID = 1. Failure to configure at least one CNI card on a ControlNet network to a MAC ID of 1 may cause erratic connections to remote I/O.

Non-redundant controller addressing

When setting up Supervisory or I/O ControlNet networks in a non-redundant controller configuration, it is recommended that you allocate two consecutive addresses for the controller (i.e., 1 and 2). The lower, or odd number of these two addresses is set on the non-redundant controller's CNI module.

By reserving the next higher address, you will minimize the effort required to upgrade to a redundant controller configuration in the future.

ATTENTION

The MAC Address 1 must appear on each ControlNet Network (Supervisory and I/O) as shown in the following examples.

Redundant controller addressing

When setting up Supervisory or I/O ControlNet in a redundant controller configuration, you must allocate two consecutive addresses for the controller chassis pair.

Redundant controllers connected to the same physical ControlNet must have their address switches set to the same address. Although both partners have the same switch settings, software assigns the primary controller the address from the switches, then assigns the secondary controller the next highest address (the switch setting plus one). This is why you must skip every other address when setting CNI addresses in a controller with multiple CNI cards.

Supervisory ControlNet addressing

On the supervisory network, each Experion Server and Controller must have a valid ControlNet address. The valid default address range is 1 to 24 (32 maximum). Following are the recommended settings and guidelines:

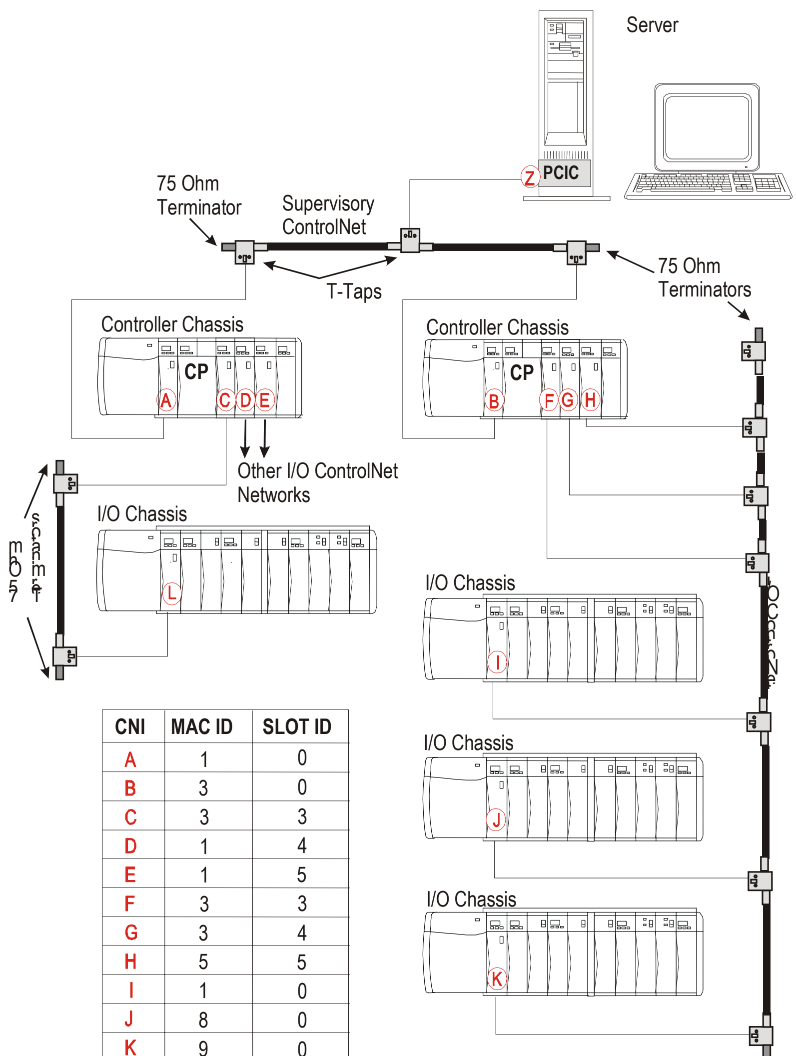
Experion Server(s)

- Redundant servers: Server A - set address to 24
  Server B - set address to 23.
- Non-redundant servers: Set the ControlNet address to 23 (or 24), but reserve address 24 for a possible future upgrade to redundant servers.

Controller Chassis

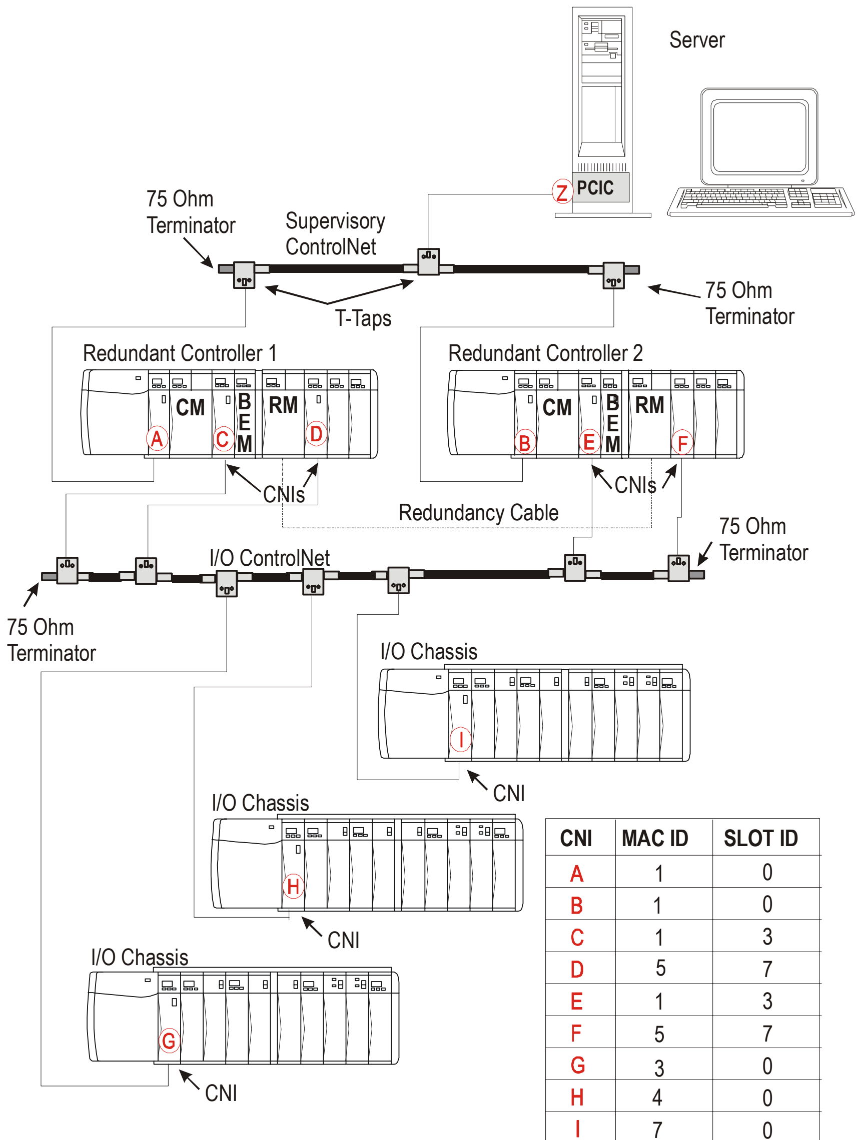
- Set only odd addresses (starting at 1), reserving next higher even-numbered address for use with possible future redundant partner.
- There must be one CNI with an address of 1 within every ControlNet segment, including the I/O ControlNet segments. The CNI node with the MAC ID of 1 controls the NUT timing for the CNET segment it is in.
- When you assign an address of 1 to an operating CNI in an RCP, do not assign the next higher used address above 2 (in the same physical network) to another CNI in that RCP. Never assign addresses 3 and 4 to CNI in the RCP. Assign addresses 3 and 4 to the CNIs in the first I/O chassis. Failure to follow this addressing scheme can result in lost outputs upon an RCP switchover. You must assign the next higher used address above 2 to a CNI in another Controller chassis, a CNI in a remote I/O chassis, or the PCIC card in the Server in the same physical network. The down link CNI are also Sequential in the example but as the Rule indicates they should be.
- Set both partners of a redundant-controller pair to the same odd address. The system software will assign the next higher, even-numbered address to one of the partners, making an address pair (e.g., you assign 1, the system assigns 2). In the redundant example below, both controller CNI boards are set to a MAC address of 1.
- Skipping even-numbered addresses and using odd-numbered addresses for a series of non-redundant controller chassis allows for easier future addition of redundant partners, with a logical assignment of odd/even address pairs for RCP applications.
- Within the controller chassis, both the Supervisory and I/O CNI addresses can be set to any address, as long as the redundant-partner controller (when present) is set to the same address. This is illustrated in the redundant example where the Supervisory CNI addresses are set to 1 and the I/O CNI addresses are set to 1 and 5 in both controllers. Note how this configuration also satisfies the requirement that each ControlNet network has a CNI addressed to 1 and partners in a redundant system have the same address.

Network Example 1: Two Non-Redundant Controllers (each with remote I/O chassis)



CNI	MAC ID	SLOT ID
A	1	0
B	3	0
C	3	3
D	1	4
E	1	5
F	3	3
G	3	4
H	5	5
I	1	0
J	8	0
K	9	0
L	1	0
Z	23	N/A

Network Example 2: Redundant Controllers with One I/O ControlNet



CNI	MAC ID	SLOT ID
A	1	0
B	1	0
C	1	3
D	5	7
E	1	3
F	5	7
G	3	0
H	4	0
I	7	0
Z	23	N/A

I/O ControlNet addressing

On each physically separate I/O ControlNet network, each Experion controller and I/O chassis CNI must have a ControlNet address in the range 1-20. The following is a list of recommended settings and guidelines applicable to each physically separate I/O ControlNet network:

Controller Chassis

- Set the first CNI that connects to a separate physical I/O ControlNet to 1 (Example 1 - Left System). For each additional CNI attached to the same physical I/O ControlNet, use the next odd address (Example 1 - Right System).

I/O Chassis

- Set the first I/O chassis address, starting with the first unused odd address on this I/O ControlNet, and progress sequentially (3, 4, 5, etc.) for each additional I/O chassis connected to the same physical I/O ControlNet.
- Do not skip any addresses (leaving address “gaps”), since ControlNet communications performance is optimized by the absence of gaps between the lowest and highest addresses. I/O chassis are not redundant and do not require address pairs, therefore both odd and even addresses are to be utilized.
- I/O chassis addresses can be set to any unique (mutually exclusive) addresses in the range 1-20, but it is recommended that lower addresses starting at 1 be used.

ATTENTION

The MAC Address 1 must appear on each ControlNet Network (Supervisory and I/O) as shown in the examples provided.

MAC address guidelines summary

Please refer to the following *Configuration Rules (MAC)* and *Configuration Rules (CNI)* sections for more information about MACID configuration rules.

Configuration Rules (MAC)

The following table lists rules for assigning MAC addresses (MACID) in an I/O ControlNet network.

If Assigning MACID . . .	Then, Observe These Rules:	
	Reference	***Description***
1 (ControlNet Keeper and Moderator)	CR_MAC.0	MACID number 1 must be configured on every physical I/O ControlNet segment.
	CR_MAC.1	Must be assigned to the Downlink CNI in the Controller chassis or to both Primary and Secondary Downlink CNIs in a Redundant Chassis Pair (RCP) for each physically separate I/O ControlNet segment (except for the following Rule CR_MAC.2).
	CR_MAC.2	When the I/O ControlNet is configured with a NUT less than 10 ms. to support the AB Drive Controller, MACID number 1 should be configured ***outside*** of the Redundant Chassis Pair, on the AB Drive Controller. The RCP should then be configured starting with MACID number 3/4.
2	CR_MAC.3	Must not be assigned to any Node when using Redundant Controller with MACID number 1 assigned to the Downlink CNI in the RCP. (Note that the Secondary CNI is physically set to MAC ID number 1, but logically becomes MAC ID number 2 while in the secondary redundancy role.)
	CR_MAC.4	Should be reserved when using non-redundant Controller for future Redundant upgrade.
	CR_MAC.5	When MACID number 1 is configured as in Rule CR_MAC.2 above, MACID number 2 should also be assigned ***outside*** the RCP on another AB Drive Controller.
3	CR_MAC.6	Must not be assigned to a Downlink CNI in a Controller chassis or Redundant Chassis Pair when MACID number 1 (and 2) are used in the RCP.
	CR_MAC.7	Must be assigned to a Remote I/O chassis CNI or Remote

If Assigning MACID . . .	Then, Observe These Rules:	
	Reference	***Description***
		Series A or H Rail Gateway Module, in conjunction with each MACID number 1 assignment.
	CR_MAC.8	When MACID number 1 is configured as in CR_MAC.3 above, MACID number 3 should be assigned to the first Downlink CNI in the RCP, while reserving MACID number 4 as stated in CR_MAC.11 below.
4	CR_MAC.9	Should be used by or reserved for additional Remote I/O chassis CNI or Series A or H Rail Gateway.
	CR_MAC.10	Must not be assigned to any Node when using Redundant Controller with MACID number 3 assigned to the Downlink CNI in the RCP. (Note that the Secondary CNI is physically set to MAC ID number 3, but logically becomes MAC ID number 4 while in the secondary redundancy role.)
5 and Up	CR_MAC.11	Should be used consecutively from low to high values with the following guidelines CR_MAC.12 and CR_MAC.13.
	CR_MAC.12	Odd addresses should be used for additional Downlink CNIs in Controller chassis or RCP (with next even address not used), when additional Downlink CNIs are connected to a common physical I/O ControlNet segment.
	CR_MAC.13	After Downlink CNIs are assigned, remaining addresses may be used for additional Remote I/O chassis CNIs or Rail Gateways.

Configuration Rules (CNI)

The following table lists some additional rules to follow when configuring an I/O ControlNet network.

Reference	Description
CR_CNI.0	Multiple I/O ControlNet Downlink CNIs may be connected to a common physical I/O ControlNet segment and must adhere to the MAC Configuration Rules listed in the previous configuration rules (*MAC*). ***Exception to this rule***: When using AB Drive Controllers, separate ***isolated*** physical segments must be configured for just the Drive Controllers and these ***isolated*** segments must follow

Reference	Description
	the MACID assignment in rules CR_MAC.2, CR_MAC.3, CR_MAC.5 above and CR_CNI.5 below
CR_CNI.1	When using a common physical I/O ControlNet segment connected to more than one Downlink CNI in the Controller chassis as described in the previous rule, all I/O or all FIMs in a single remote I/O or FIM-only chassis must be assigned through the same Downlink CNI; for example, you should not ***split*** communication paths to the same remote chassis components through different Downlink CNIs. Violating this rule may cause Redundancy and On-Process Migration issues.
CR_CNI.2	PLCs or other ControlNet Devices may not reside on any I/O ControlNet segment using Series A I/O of any type connected to a C200 Controller.
CR_CNI.3	A single I/O ControlNet segment cannot be ***shared*** by more than one C200 Controller
CR_CNI.4	The ControlNet Keeper is the lowest configured MACID per physical ControlNet segment. This table assumes that MACID number 1 exists per ControlNet segment. The ControlNet Keeper periodically broadcasts keeper information using scheduled ControlNet bandwidth. Since the default maximum number of scheduled nodes (SMAX) is set to 1, every ControlNet segment should intentionally have a keeper at MACID number 1.
CR_CNI.5	When connecting to AB Drive Controllers, the ControlNet Parameters for that segment must be configured for NUT = 6.25 ms. and SMAX = to the Highest MACID used (but less than or equal to UMAX), using Network Tools (NTools).
CR_CNI.6	The maximum number of nodes (UMAX) permitted on the I/O ControlNet is 20.
CR_CNI.7	An I/O network can have up to four downlink CNIs installed in a C200 chassis with multiple uplink CNIs and Rail Gateways physically connected to the same network. However, be sure each Rail Gateway has **configured communication paths** from only **one** downlink CNI. The downlink CNIs may have **configured communication paths** to multiple Rail Gateways and chassis mounted I/O modules through uplink CNIs. Each downlink CNI may have a maximum number of 24 **configured communication paths** with a maximum of 64 I/O modules on the controller's I/O network.

Single or Multiple Network Strategy

ATTENTION

Multiple CNI may be required to support I/O module requirements. Each CNI can handle a limited number of I/O modules. See the system specifications for the maximum allowed I/O modules connected to a single CNI.

The previous section, *Network Example 1: Two Non-Redundant Controllers (each with remote I/O chassis)*, shows a non-redundant system. The system on the left in the example uses a unique I/O ControlNet network for each I/O CNI, and the system on the right uses one ControlNet network for all I/O CNIs. The MAC addressing scheme is different depending on the strategy used.

The single network strategy might be used where all of the I/O chassis are close to each other. The multi-network strategy would be used where the I/O chassis are separated by large distances where using a single network would exceed the maximum allowable distance for a network. The network strategies may be mixed within a single system.

Site Selection and Planning

Planning for General Considerations

Site selection is an important factor in planning and preparing for the installation of a Experion system. Issues that need to be addressed during the site planning are described below.

Location

Location of the system is flexible, given the interconnection of different modules on the ControlNet communications network. Your Manufacturing Engineer is best suited to determine requirements such as cable length, routing, and shielding for these interconnections. Other guidelines include:

- Locate your equipment to obtain the best operating efficiency. Consider such things as proper lighting, noise, and proximity to related work areas.
- Consider accessibility of the site for delivery of equipment and supplies; and allow for access to service the equipment.
- Determine the need (if any) for remote termination panels.

Interim development location

Consider installing the Experion equipment in a quiet office environment **(**during the development phase of the installation) before implementing it on the factory floor, where it will have an impact on actual operations.

Facilities

The use of pre-existing facilities speeds installation, reducing costs. Whether the facility is existing or new, however, it must comply with the specifications (e.g., safety, environmental, electrical, and other) described in this manual. Electrical power, grounding, air conditioning, and data communication requirements must all be addressed as part of the site preparation.

Insurance and zoning

Insurance costs may be affected by the type of building construction used and the location of system equipment (in relation to fire hazards and fire-fighting facilities). Zoning regulations may also affect installation plans and future expansion.

Planning for Environmental Considerations

In planning for the environmental conditions for electronic equipment, the following factors should be considered.

Corrosion and dust

Consider both major (usually from process sources) and minor pollutants (often from nonprocess sources). Conformally coated assemblies are recommended for use in areas where corrosive vapors are present.

Fire prevention

Consult with the local fire-prevention authority to select fire extinguishers deemed suitable for electrical fires.

Lightning protection

A Lightning ground system safely dissipates lightning energy, protecting personnel, control system equipment, and the building. The ground system must conform to applicable codes and design construction criteria.

A good earth ground system minimizes the need for individual channel protection. However, if your facility is located in an area that has a history of severe lightning storms or if you have had a problem with lightning induced surges in the past with other instrumentation, you are probably aware of available surge protection devices. Properly sized surge protection devices incorporating solid state voltage limiters should be installed on power lines and all input/output wires associated with the system. You are responsible for evaluating your particular needs based on equipment location and the probability of a direct strike in the immediate area.

Temperature and humidity

The ambient temperature limits are specified in the Experion specifications. Relative humidity must be addressed, both in terms of magnitude and rate of change.

The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm. Just follow the Experion product links.

Ventilation and filtration

An air distribution system is recommended when atmospheric contaminants (from process fumes, road dust, or cooking fumes) are present. To protect the electronics from various fumes and contaminants, arrange an air flow moving towards the source and away from the electronics.

All air flow should be routed through a mechanical (non-electronic) dust filter. The mechanical filter should have a rating of not less than 20% after performing the Bureau of Standards discoloration test. The filter must meet all local fire codes.

Vibration

Flooring, desk tops, and shelves/mounting chassis must be stable and capable of supporting control system hardware in accordance with acceptable vibration levels (as specified in the Experion specifications.

The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm. Just follow the Experion product links.

ATTENTION

Consult your Honeywell Account Manager if any characteristics of your site do not meet the requirements specified in this or any other referenced manuals.

Planning for Installation in Hazardous (Classified) Locations

The Experion system is CSA Certified and FM Approved Nonincendive Equipment for installation in Class 1, Division 2, Group A, B, C & D Hazardous (Classified) Locations. It is the user's responsibility to insure that all parts of the Experion system, and any other equipment in the Division 2 area, are listed for installation in a Class 1, Division 2 Hazardous (Classified) Location.

WARNING

Unless the location is known to be non-hazardous **do not**:

- connect or disconnect cables
- connect or disconnect Removable Terminal Blocks (RTBs)
- install or remove modules

CAUTION

While control hardware modules are designed to permit removal and insertion under power (RIUP) without damaging the module, Honeywell recommends that you do **not RIUP** any module in an Experion control system since it may cause an indeterminable upset in the process.

North American Hazardous (Classified) Locations

Installation of electrical equipment within hazardous (classified) locations in the United States is in accordance with provisions of the National Electrical Code (NEC), ANSI/NFPA 70, Article 500, and within Canada in accordance with the provisions of the Canadian Electrical Code (CEC) C22.1, Part 1, Section 18.

Hazardous (classified) locations, in both the United States and Canada, are divided into three classes:

- Class 1- Presence of flammable gases or vapors may be present in quantities sufficient to produce explosive or ignitable mixtures.
- Class 11- Presence of combustible dusts, powders or grains.
- Class 111- Presence of easily ignitable fibers or flyings.

Hazardous Location Level of Risk

The classes listed above are further categorized based upon the level of risk present:

- Division 1- Locations in which hazardous concentrations of flammable gases or vapors- or combustible dust in suspension- continuously, intermittently or periodically under normal operating conditions.
- Division 2- Locations in which flammable gases or vapors are present, but normally confined within closed containers or systems from which they can escape only under abnormal or fault conditions. Combustible dusts are not normally in suspension nor likely to be thrown in to suspension.

Hazardous Group Classifications

Flammable gases, vapors and ignitable dusts, fibers and flyings are classified into groups according to the energy required to ignite the most easily ignitable mixture within air. Group classifications are:

- Class 1 group classifications-
  - Group A- Atmospheres containing acetylene.
  - Group B- Atmospheres containing hydrogen, fuel and combustible process gases containing more than 30 percent hydrogen by volume or gases or vapors of equivalent hazard.
  - Group C- Atmospheres such as ethyl ether, ethylene, or gasses or vapors of equivalent hazard.
  - Group D- Atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, propane or gases or vapors of equivalent hazard.
  - Group E- Atmospheres containing combustible metal dusts including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics.
  - Group F- Atmospheres containing combustible carbonaceous dusts including carbon black, charcoal, coal or other dusts that have been sensitized by other materials so they present an explosion hazard.
  - Group G- Atmosphere containing combustible dusts no included in Group E or F, including flour wood, grain and other dusts of similarly hazardous characteristics.
- Class 111 group classifications-
  - Class 111/Division 1- A Class 111, Division 1 location is a location in which easily ignitable fibers or material processing combustible flying are handled, manufactured or used.
  - Class 111/Division 11- A Class 111, Division 2 location is a location in which easily ignitable fibers are stored or handled.

Nonincendive FTAs

Wiring to the FTAs that are listed in the following table has been approved as Nonincendive wiring by Factory Mutual Research, Inc. When the wiring is opened, shorted, or grounded and the Controller is in its normal operating state, the wiring cannot release enough energy to cause the ignition of a flammable atmosphere.

FTA Type	FTA Models
24 Vdc Digital Input	MU/MC-TDID11 MU/MC-TDID12 MU/MC-TDID52 MU/MC-TDID72 MU/MC-TDIY22 MU/MC-TDIY62
4-20 mA Analog Output	MU/MC-TAOX01 MU/MC-TAOX02 MU/MC-TAOX12 MU/MC-TAOX52 MU/MC-TAOY22 MU/MC-TAOY23 MU/MC-TAOY52 MU/MC-TAOY53 MU/MC-THAO11 (HART)
High Level Analog Input	MU/MC-TAIH01 MU/MC-TAIH02 MU/MC-TAIH03 MU/MC-TAIH12 MU/MC-TAIH13 MU/MC-TAIH52 MU/MC-TAIH53
Low Level Analog Input	MU/MC-TAIL01 MU/MC-TAIL02 MU/MC-TAIL03
Smart Transmitter Interface Input	MU/MC-TSTX03 MU/MC-TSTX13 MU/MC-TSTX53

ATTENTION

When digital output circuits of a digital output FTA are current and voltage limited to suitable levels by the user, the digital output FTA can also be considered Nonincendive.

Electrical code approval

In general, field wiring in Division 2 hazardous locations must be done according to local codes; however, in some jurisdictions, Nonincendive wires need not conform to the normal Division 2 wiring rules but can use wiring methods that are suitable for ordinary locations.

See ANSI/ISA S12.12, the section *Electrical Equipment For Use In Class I, Division 2 Hazardous [Classified] Locations*.

Current limiting resistor value

The value of the resistors on the listed FTAs were selected to assure worst case short circuit currents in a hazardous area of less than 150 milliamps for normal operating equipment. According to NFPA publication #493, *Intrinsically Safe Apparatus for Use in Division 1 Hazardous Location*s, 150 milliamps from a 24 Vdc source is below the ignition threshold in a resistive circuit for gases in Groups A through D environments.

Cable size and load parameters

To ensure that the circuits are incapable of igniting a specific flammable atmosphere, the size of cable and load parameters must be controlled. The maximum permissible values of the parameters are given in the following table for the listed FTAs.

ATTENTION

The data in the following table is controlled by the Honeywell drawing 51109499 and cannot be changed without the approval of Factory Mutual Research, Inc.

FTA Model Number (MU- or MC-)	TAIL01 TAIL02 TAIL03	TAIH01 TAIH02 TAIH03 TAIH12 TAIH13 TAIH52 TAIH53 TSTX03 TSTX13 TSTX53	TAIH22 TAIH23 TAIH62	TAOX01 TAOX02 TAOX12 TAOX52 TAOY22 TAOY23 TAOY52 TAOY53	TDID12 TDID52 TDID72
V_{OC} — Maximum Open Circuit Voltage	9 Vdc	26 Vdc	26 Vdc	26 Vdc	30 Vdc
I_{SC} — Maximum Short Circuit Current	0.3 mA	186 mA	40 mA	22 mA	152 mA
C_a — Maximum Allowable Connected Cable Capacitance	15 µF	0.4 µF	0.4 µF	0.4 µF	0.25 µF
L_a — Maximum Allowable Cable Inductance	1 H	2.3 mH	35 mH	130 mH	3 mH
C_n — Maximum Allowable Connected Capacitance (Cable + Load)	15 µF	0.4 µF	0.4 µF	0.4 µF	0.25 µF
L_n— Maximum Allowable Connected Inductance (Cable + Load)	1 H	150 mH	150 mH	130 mH	400 mH

Galvanically Isolated FTAs

A family of Field Termination Assemblies (FTAs) are available that accept plug-in Galvanic Isolation Modules. These FTAs are used for connecting input and output signals to field devices in Division 1 (Zone 0 and Zone 1) hazardous areas. The FTAs are compatible with the IOPs that support the companion standard FTAs. See the FTA models section for a complete list of available Galvanically Isolated FTAs.

REFERENCE - INTERNAL

Refer to Appendix F for more information about planning for Galvanically Isolated type FTAs.

Planning for Power and Grounding

Compliance

Guidelines for complying with required electrical codes are listed below:

- All plant wiring (including power and signal cables) must be installed in accordance with the National Electrical Code (NEC), Canadian Electrical Code CEC), and all other local regulations.
- Power wiring must conform to the local electrical code. Use of a qualified contractor and approval by the local wiring inspector ensures compliance to this code
- Power wiring and signal cables installed by Honeywell (an optional service) will conform to the NEC or CEC. Upon your request, Honeywell will institute optional changes that will conform with the code, as well as adhere to local regulations and requirements.
- Always install C200 power wiring in accordance with the *Experion Control Hardware Installation Guide:*
  - *Preparing to Install the Power Supply*
  - *Installing the Power Supply*
  - *Preparing for Operation*
  - *Redundant Power Supply General Wiring Guidelines*

Circuit capacities

Circuit capacity limits are governed by the NEC and CEC codes. Refer to these, and any other applicable local codes, to determine circuit capacities.

Outlet capacities

Outlet capacity limits are governed by the NEC and CEC codes. Refer to these, and any other applicable local codes, to determine outlet capacities.

Indicate the number and location of these outlets on your system layout drawing when designing your system. Outlets should be marked so that nothing, other than a system component, is plugged into them.

Multiple systems

Where multiple computer systems are installed, be sure to separate electrical power sources.

Convenience outlets

WARNING

All convenience outlets in the vicinity of this equipment must be grounded. The grounding conductors servicing these receptacles must be connected to earth ground at the service equipment, or at some other acceptable building earth ground (such as the building frame, in the case of a high-rise steel frame structure).

Supply separate and adequate convenience outlets in the Experion System area for items such as test equipment, vacuum cleaners, and floor buffers. To prevent noise interference from devices using these receptacles, convenience outlets must be on a circuit that has its transformer isolated from the circuits used for the system. One solution is to supply power for the components of the Experion System through an isolation transformer.

Honeywell products

Honeywell offers a line of regulators and power conditioners suitable for any system configuration. Consult your Honeywell Account Manager for further information.

REFERENCE

For detailed information on the power source requirements of the modules and computer systems used in your Experion System, refer to the Experion specifications

The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm. Just follow the Experion product links.

General grounding guidelines

WARNING

The grounding system must be installed in accordance with the National Electrical Code (NEC), Canadian Electrical Code (CEC), and any other applicable electrical codes (to include: IEEE-142; Lightning Protection Institute Installation Code LPI-175; NFPA-78 (ANSI); IEEE Std. 142-1972).

A broken or high resistance safety ground creates a potentially lethal situation, especially in equipment that incorporates line filters. The line filters include appreciable line-to-chassis capacitance. As a result, if the green or green/yellow ground wire is not intact, a person touching the equipment and ground can receive a serious and possibly fatal shock.

REFERENCE

For detailed information on equipment grounding, refer to the documents below:

- *Experion ControlNet Installation Guide,* Introduction
- *Experion Control Hardware Installation Guide, Make ground connections*

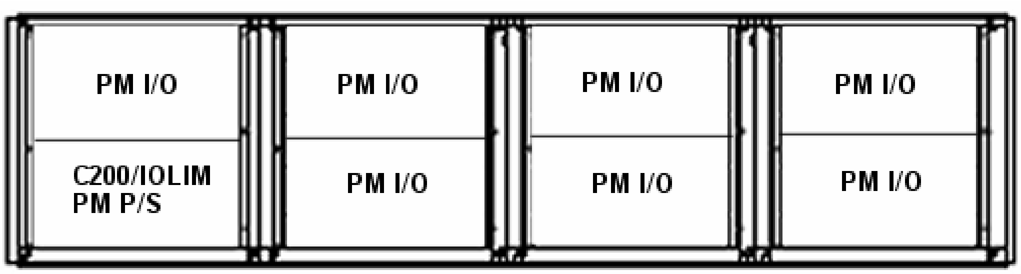
Adequate grounding is important for safety considerations and for reducing electromagnetic noise interference. All earth-ground connections must be permanent and provide a continuous low impedance path to earth ground for induced noise currents and fault currents. Refer to the following guidelines when considering the grounding requirements of your system:

- For safe operation of your equipment, a high-integrity grounding system must be installed as part of the building's wiring system.
- Electrical outlets for workstations and any other higher-level computer connected to the ControlNet communications network must be on a separate AC circuit from its peripherals. If the existing installation does not have an equipment grounding conductor in the branch circuits, consult your Honeywell Account Manager. Consult local codes for ground wiring.

- When providing the female receptacles or connectors, consider the following:
  - An equipment ground wire must be enclosed with the circuit conductors (phase and neutral wires),
  - The isolated ground wire must run directly from the outlet to the power source
  - The size of the ground conductor must be the same as, or larger, than the circuit conductors supplying the equipment
  - The ground conductor must be securely bonded to the building-ground electrode
  - Grounding provisions must be in accordance with the NEC, CEC, and any other local codes.

Grounding considerations for C200 with PM I/O

The following guidelines apply to installations that include C200 Controllers including I/O Link Interface Modules (IOLIM) for use with Process Manager (PM) I/O, as shown in the following sample quad dual access cabinet complex illustration.



TIP

Existing Experion system configuration rules do not allow C200 Controller chassis with ac-input power supplies to be used in PM I/O systems. The ac-input and dc-input power supplies in the C200 Controller chassis include an internal connection between input safety ground, which is the bottom third terminal, and power supply dc output common or C200 logic common; but do not include any internal connection between the negative (-) input, which is the middle second terminal, to a dc-input power supply and power supply dc output common or C200 logic common. This means the Process Manager 24V common is not connected to C200 logic common or safety ground through any connections in the C200 power supplies or chassis.

Grounding guidelines for CE compliant PM I/O (CEP)

Reference	Description
GG_CEP.0	Install the I/O Link cable shield grounding jumpers in every I/O Link Module (IOLIM) and in every PM I/O file. (For more information on I/O Link cable shield grounding jumpers, see *Setting I/O link interface cable shield ground* section in the *Control Hardware Installation Guide*.)
GG_CEP.1	Connect Process Manager 24V common to safety ground inside the cabinet.
GG_CEP.2	Connect the system to a single external safety ground, like you would install an EC compliant High Performance Process Manager (HPM) system. (For reference to a typical single-ground Process Manager IOP installation that is EC-compliant, see the *Typical AC power and ground connections for IOP* section in this document.)

Grounding guidelines for Non-CE compliant PM I/O (NCE)

Reference	Description
GG_NCE.0	Do **NOT** install the I/O Link cable shield grounding jumpers in any I/O Link Module (IOLIM). Be sure the jumpers in all IOLIMs are disconnected. (For more information on I/O Link cable shield grounding jumpers, see the *Setting I/O link interface cable shield ground* section in the *Control Hardware Installation Guide*.)
GG_NCE.1	Install the I/O Link cable shield grounding jumper in only **ONE** of the PM I/O files. (For more information on I/O Link cable shield grounding jumpers, see the *I/O link interface cable shield grounding* section in the *Control Hardware Installation Guide*.)
GG_NEC.2	Do **NOT** connect Process Manager 24V common to safety ground inside the cabinet.
GG_NEC.3	Connect the system to two external grounds (safety ground and master reference ground), like you would install a Non-EC compliant High Performance Process Manager (HPM) system. (For reference to a typical multi-ground Process Manager IOP installation that is **Non**-EC compliant, see the *Typical AC power and ground connections for IOP* section in this document.)

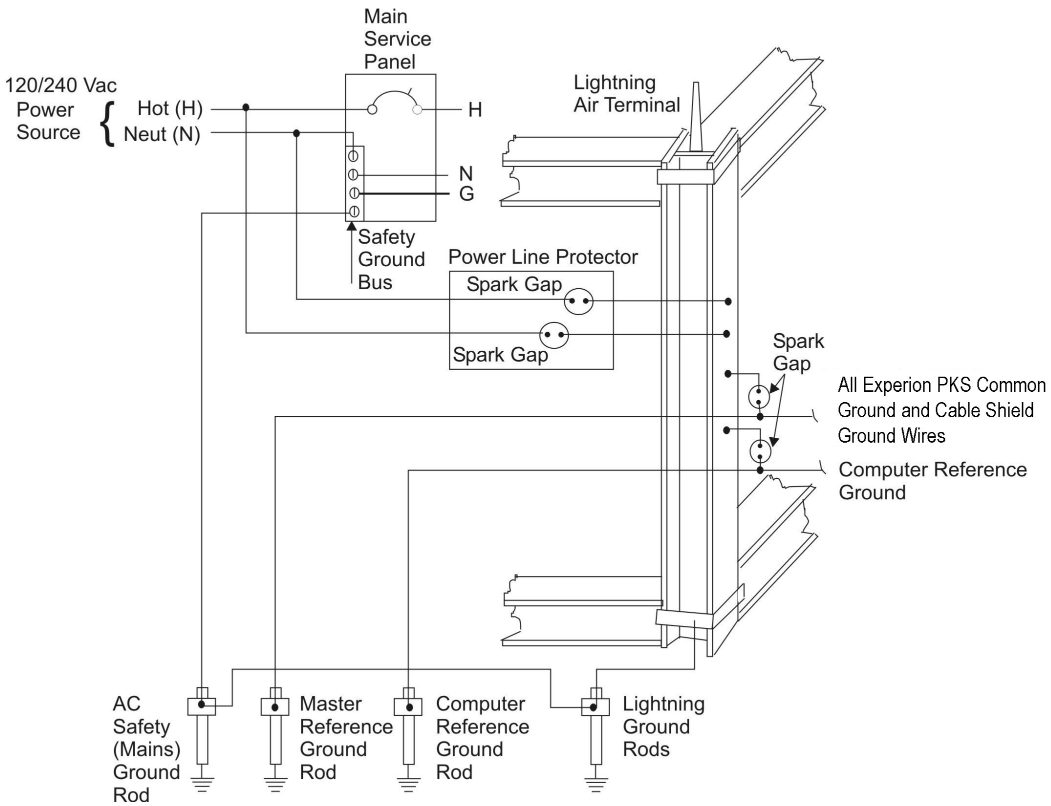
About Lightning Grounds

Lightning grounds must conform to applicable codes such as NFPA No. 78 (ANSI), IEEE Std. 142-1972, Code LPI-175, and other local codes. A typical lightning ground system consists of 10ft (3m) ground rods bonded (connected) to vertical structure members every 100ft (30m) along the building perimeter.

The mains ground is usually bonded to the lightning ground. Master reference grounds must be isolated from all other grounds. Where ground wires are close together in an enclosure, there is always the possibility for arcing (flashover) between ground wires when lightning strikes.

To inhibit this hazardous arcing, some codes require all ground wires to be connected through spark gap devices at the building perimeter. The following example shows the master reference (common) ground and the low-level shield grounds connected to a building vertical steel frame structure that is also connected to the lightning ground rod. Spark gap devices connect all ground wires to avoid an excess voltage difference that may be created by a lightning strike. We recommend 90 Volt, 150KA spark gaps for system grounds.

Lightning Ground Example (General Purpose Area)



Planning for Process Manager I/O Power Requirements

Power system types and features

The following two types of power systems are available to power IOP subsystems.

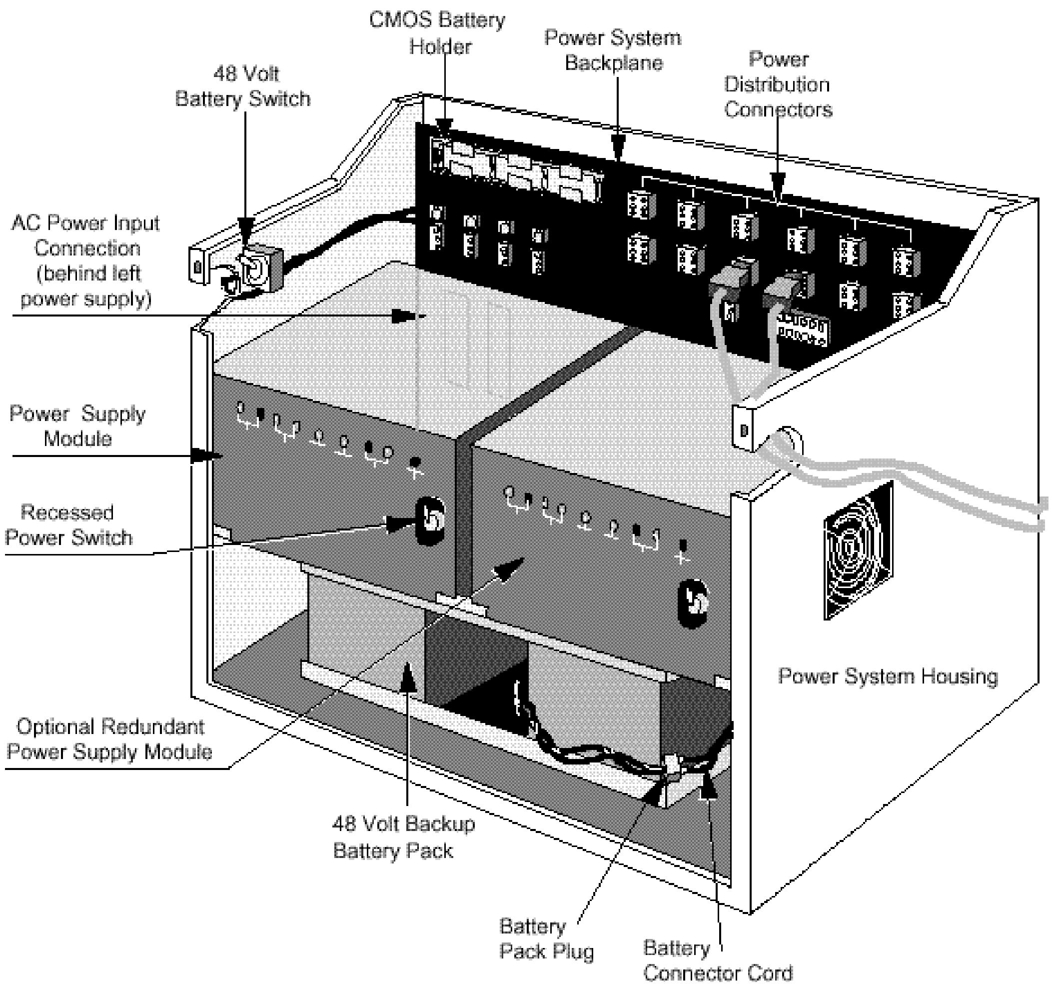
- Standard Power System
- AC Only Power System

Both types provide these features:

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

Standard power system

The Standard Power System, model MU-PSRX04, is available as shown in the following figure. Input power can be either 120 Vac or 240 Vac and provide CMOS memory NiCad battery backup (3.6 Vdc). The model MU-PSRX04 system provides 45 hours of backup with failure detection.



Model MU-PSRX04 Standard Power System

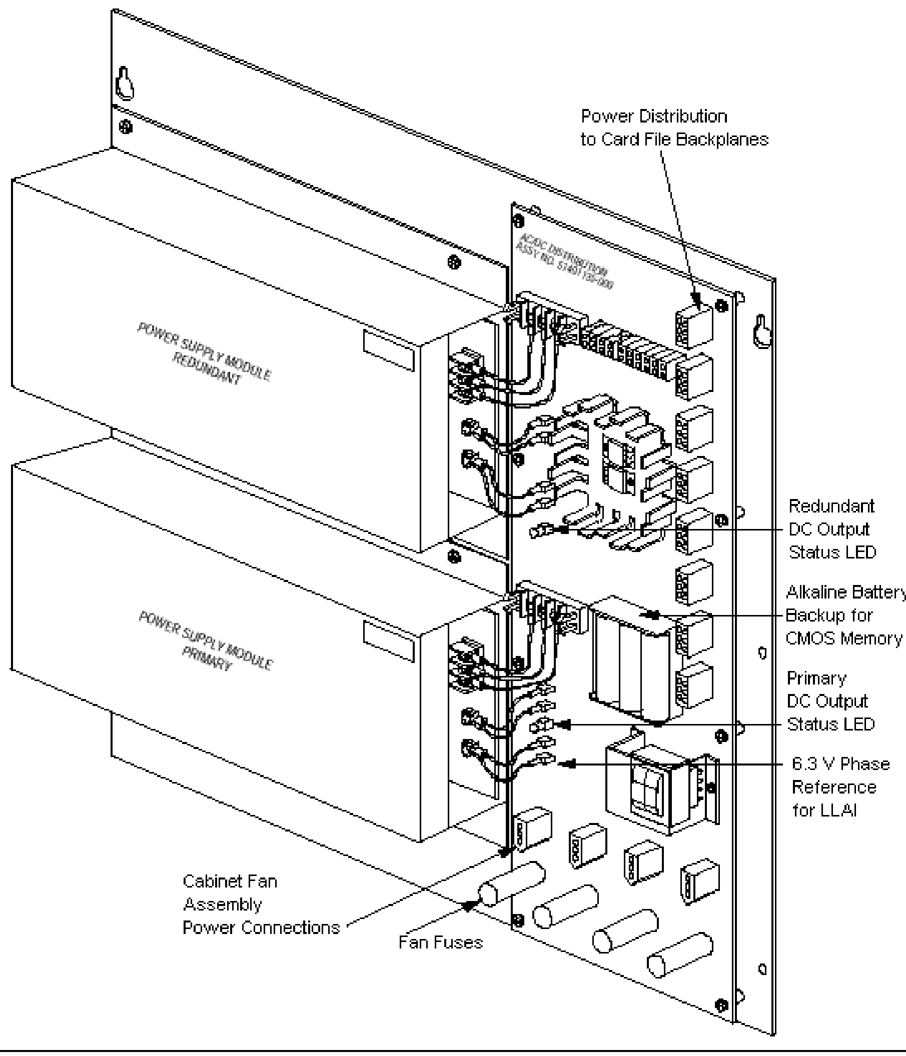
The following optional features are available.

- An optional redundant Power Supply Module.
- A single or dual source of input power can be connected when the optional redundant Power Supply Module option is used.
- An optional 48 Vdc Battery Backup Module with a disconnect switch that backs up the 24 Vdc for 25 minutes.

AC Only Power System

The AC Only Power System shown in the following figure 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.



Typical AC power and ground connections for IOP

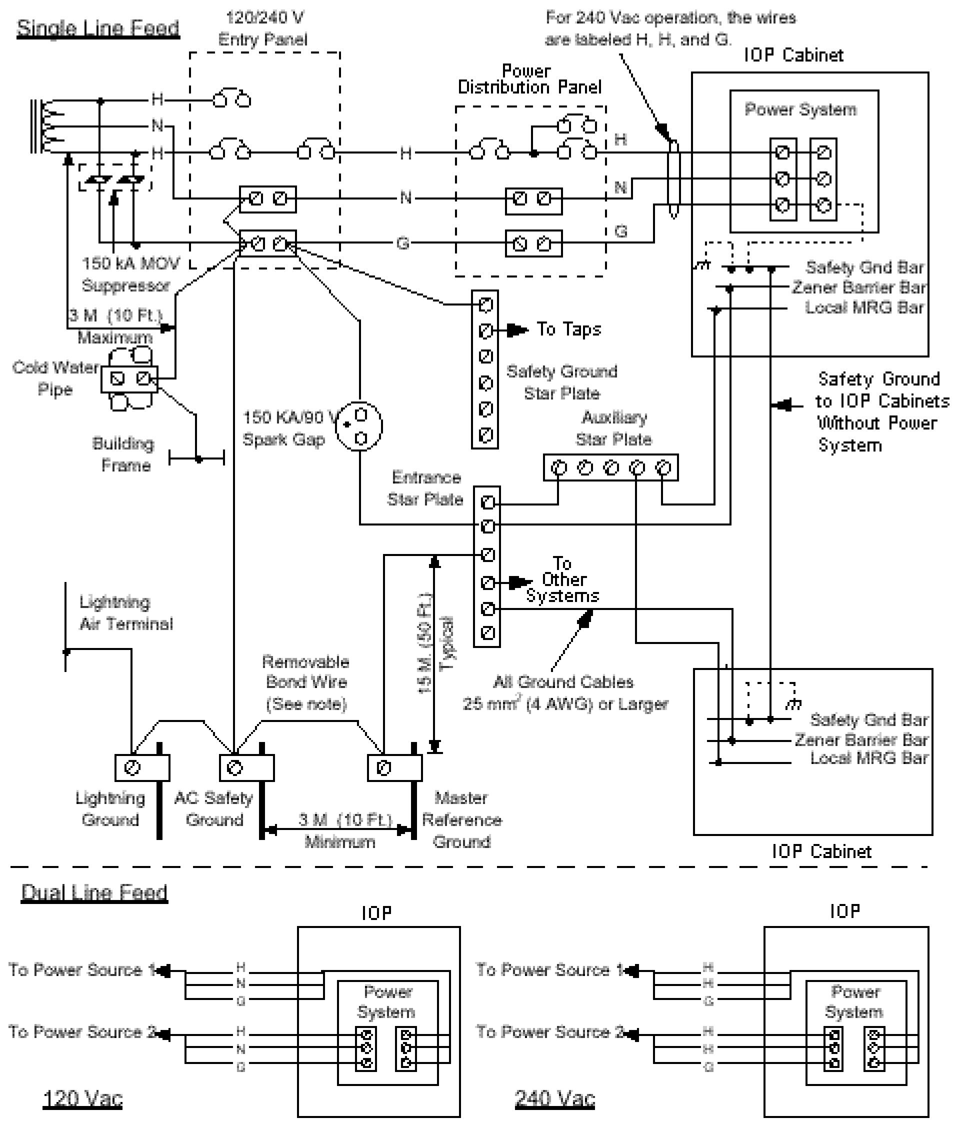
The following figures show typical power and ground connections for the IOP. The two ac feeder sources do not have to be of the same phase, frequency, voltage, or from the same service as long as each meets the following power quality.

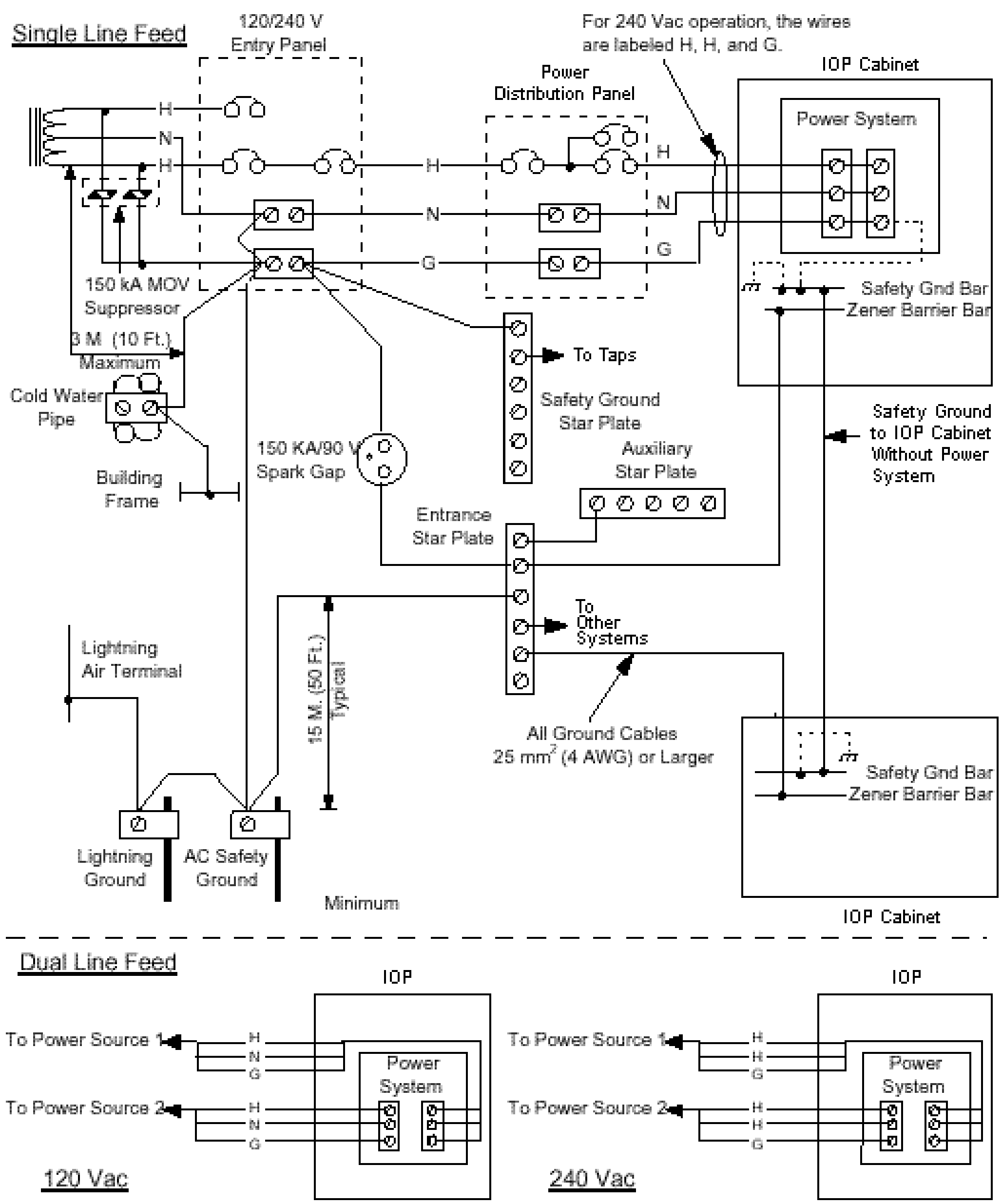
- Voltage: 100-132/187-264 Vac, single phase
- Frequency: 47-63 Hz
- Total Harmonic Distortion (THD): 8 percent maximum

The first figure below shows a typical multi-ground IOP installation that includes Master Reference Ground (MRG). The ground system is non-CE Compliant. The second figure below shows a typical single-ground IOP installation that is designated Safety Ground. The Safety Ground system is CE Compliant.

REFERENCE - INTERNAL

Refer to Appendix E for more information about the power draw for IOP components.


Single Line Feed
120/240 V
Entry Panel
For 240 Vac operation, the wires are labeled H, H, and G.
IOP Cabinet
Power Distribution Panel
Power System
H
N
G
150 kA MOV Suppressor
3 M (10 Ft.) Maximum
Cold Water Pipe
Building Frame
150 KA/90 V Spark Gap
To Taps
Safety Ground Star Plate
Auxiliary Star Plate
Safety Gnd Bar
Zener Barrier Bar
Local MRG Bar
Safety Ground to IOP Cabinets Without Power System
Entrance Star Plate
To Other Systems
15 M (50 Ft.) Typical
All Ground Cables 25 mm² (4 AWG) or Larger
Lightning Air Terminal
Removable Bond Wire (See note)
Lightning Ground
AC Safety Ground
3 M (10 Ft.) Minimum
Master Reference Ground
IOP Cabinet
Dual Line Feed
IOP
To Power Source 1
To Power Source 2
120 Vac
240 Vac


Single Line Feed
120/240 V
Entry Panel
For 240 Vac operation, the wires
are labeled H, H, and G.
Power
Distribution Panel
IOP Cabinet
Power System
H
N
H
H
N
G
N
G
Safety Gnd Bar
Zener Barrier Bar
150 kA MOV
Suppressor
3 M (10 Ft.)
Maximum
To Taps
Cold Water
Pipe
Safety Ground
Star Plate
Safety Ground
to IOP Cabinet
Without Power
System
150 KA/90 V
Spark Gap
Auxiliary
Star Plate
Building
Frame
Entrance
Star Plate
To
Other
Systems
Lightning
Air Terminal
15 M. (50 Ft.)
Typical
All Ground Cables
25 mm2 (4 AWG) or Larger
Safety Gnd Bar
Zener Barrier Bar
Lightning
Ground
AC Safety
Ground
Minimum
IOP Cabinet
Dual Line Feed
IOP
IOP
To Power Source 1
To Power Source 2
H
N
G
Power
System
H
H
G
120 Vac
240 Vac

Power and I/O Link Interface cable for Controller and IOLIM

The following table lists the model numbers for the combination power and I/O link interface cable used to connect the I/O Link Interface Module to the IOP card file and the IOP power system The cable includes leads for connecting 24 Vdc power to the C200 Process Controller chassis power supply.

Cable Length (Meters / Feet)	Model Number
2.0/6	TC-KIOL02
5.0/16	TC-KIOL05
10.0/32	TC-KIOL10

Power cables for IOPs

The following tables list the model and part numbers for power cables that are available for use in an IOP. The power cables that are listed in first two tables have an integral I/O Link protection network attached to the cable. The network protects the I/O Link Interface transceivers from surges when each I/O link Interface cable is routed through a protection network at the card file. The cables that are listed in the third table do not have protection network. For the feature to be effective, all card files in the subsystem (for example, a subsystem being all the IOPcard files that are connected to the IOLIM through the metallic I/O Link Interface cable) must have the I/O Link protection network feature installed.

Non-CE Compliant Subsystem Power Cables

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link Protection Network (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable – Internal or External to Cabinet)
1.0/3	51204126-001	51201397-001
1.5/5	51204126-915	51201397-915
2.0/6	51204126-002	51201397-002
3.0/9	51204126-003	51201397-003

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link Protection Network (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable – Internal or External to Cabinet)
4.0/13	51204126-004	51201397-004
5.0/16	51204126-005	MU-KDPR05
6.0/19	51204126-006	51201397-006
10.0/32	N/A	MU-KDPR10
15.0/49	N/A	MU-KDPR15
20.0/65	N/A	MU-KDPR20
30.0/98	N/A	MU-KDPR30
40.0/131	N/A	MU-KDPR40
50.0/164	N/A	MU-KDPR50

CE Compliant Subsystem Power Cables

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link Protection Network (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable)	
		Internal to Cabinet	***External to Cabinet***
1.0/3	51204138-001	51201397-001	N/A
1.5/5	51204138-915	51201397-915	N/A
2.0/6	51204138-002	51201397-002	N/A
3.0/9	51204138-003	51201397-003	N/A
4.0/13	51204138-004	51201397-004	N/A
5.0/16	51204138-005	MU-KDPR05	MU-KSPR05

6.0/19	51204138-006	51201397-006	N/A
10.0/32	N/A	N/A	MU-KSPR10
15.0/49	N/A	N/A	MU-KSPR15
20.0/65	N/A	N/A	MU-KSPR20
30.0/98	N/A	N/A	MU-KSPR30
40.0/131	N/A	N/A	MU-KSPR40
50.0/164	N/A	N/A	MU-KSPR50

Power Cables without I/O Link Protection Network

Cable Length (Meters / Feet)	Part Number To Card File Without I/O Link Protection Network (Single Cable)
1.0/3	51204138-001
1.5/5	51204138-915
2.0/6	51204138-002
3.0/9	51204138-003
4.0/13	51204138-004
5.0/16	51204138-005
6.0/19	51204138-006

Non-CE Compliant subsystems

In non-CE Compliant subsystems, the 51204126-xxx power cable set must be used to provide power to the card files. These power cables have the integral I/O Link protection network feature.

If a system without I/O Link protection network is being modified, and the feature is desired, all 51201397-xxx power cables must be upgraded by adding a 51204140-100 CE Compliant type I/O Link protection network adapter cable set to the card file end of each power cable set. The appropriate I/O Link Interface cables must then be used with the I/O Link protection network. For the Digital Input and Galvanic Isolation Power Distribution Assemblies that are mounted inside the cabinet, use the 51201397-xxx power cable.

For power distribution to Digital Input and Galvanic Isolation Power Distribution Assemblies that are located external to the cabinet, use the shielded model MU-KSPRxx power cables listed in the tables above.

CE Compliant subsystems

For CE Compliant subsystems, a 51204138-xxx power cable set is required to provide power to a card file. This power cable has the integral I/O Link protection network feature.

If a subsystem without I/O Link protection network is being upgraded, and the feature is desired, all 51201397-xxx power cables must be upgraded by adding CE Compliant type 51204140-100 I/O Link protection network adapter cable sets to the card file ends of the existing power cables. The adapter cables are available as a set of two cables that are labeled Link A and Link B. The appropriate I/O Link Interface cables must then be used with the I/O Link protection network.

For the Digital Input and Galvanic Isolation Power Distribution Assemblies that are mounted inside the cabinet, use the 51201397-xxx power cable. For power distribution to Digital Input and Galvanic Isolation Power Distribution Assemblies that are located external to the cabinet, use the model MU-KSPRxx shielded power cables that are listed in the tables above.

Planning for Bonding and Grounding

After establishing all layouts, you can begin defining the mounting, bonding, and grounding for each chassis.

CAUTION

Do not lay one ground lug directly on top of the other. This type of connection can become loose with the compression of the metal lugs. Sandwich the first lug between a star washer and a nut with a captive star washer. After tightening the nut, sandwich the second with a captive star washer lug between the first and second nut.

Mounting and bonding chassis

You can mount the chassis with either bolts or welded studs. The following figure shows details for:

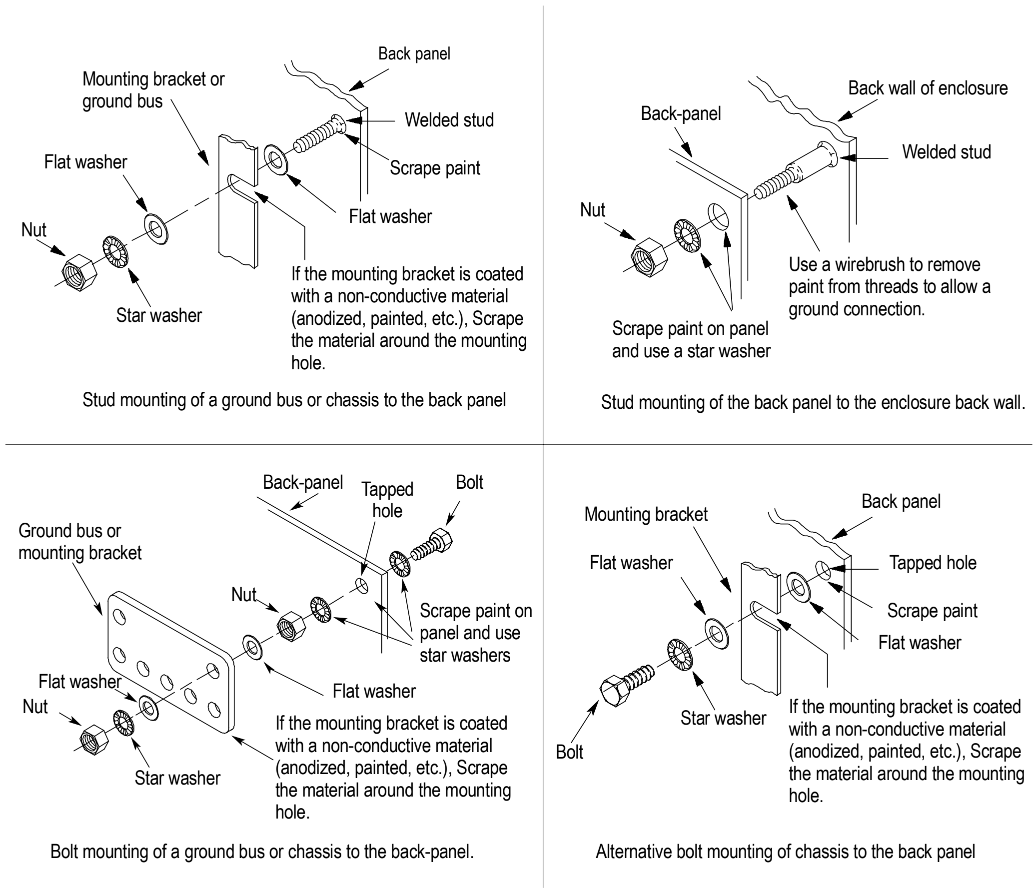
- stud-mounting a ground bus or chassis to the back panel of the enclosure.
- stud-mounting a back panel to the enclosure.
- bolt-mounting a ground bus or chassis to the back panel of the enclosure.

If the mounting brackets of a chassis do not lie flat before the nuts are tightened, use additional washers as shims, so that the chassis does not bend when you tighten the nuts.

Make good electrical connections between each chassis, back-panel, and enclosure through each mounting bolt or stud. Wherever contact is made, remove paint or other non-conductive finish from around studs or tapped holes.

CAUTION

Do not bend the chassis. Bending the chassis might damage the backplane, thus resulting in poor connections.

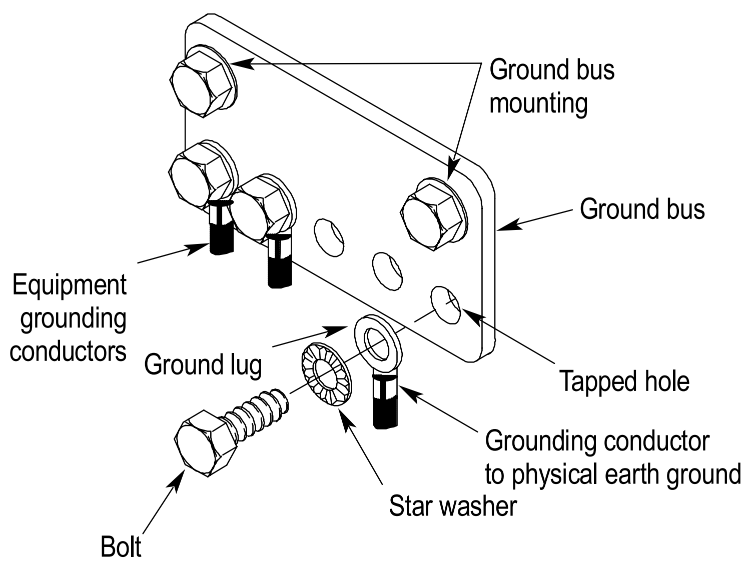


Chassis mounting and bonding

Bonding and grounding chassis

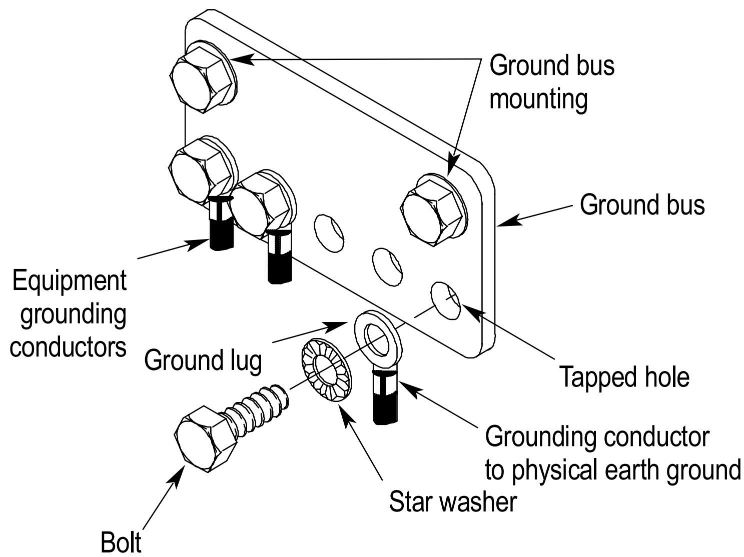
With solid-state controls, proper bonding and grounding helps reduce the effects of EMI. Also, since bonding and grounding are important for safety in electrical installations, national/local codes (e.g., National Electrical Code – NEC) and ordinances dictate which bonding and grounding methods are permissible.

In addition to making good connections through each bolt or stud, use either a 1-inch copper braid or an 8 AWG stranded copper wire to connect each chassis, enclosure and central-ground bus mounted on the backpanel. The following figure shows typical ground-bus connection details.

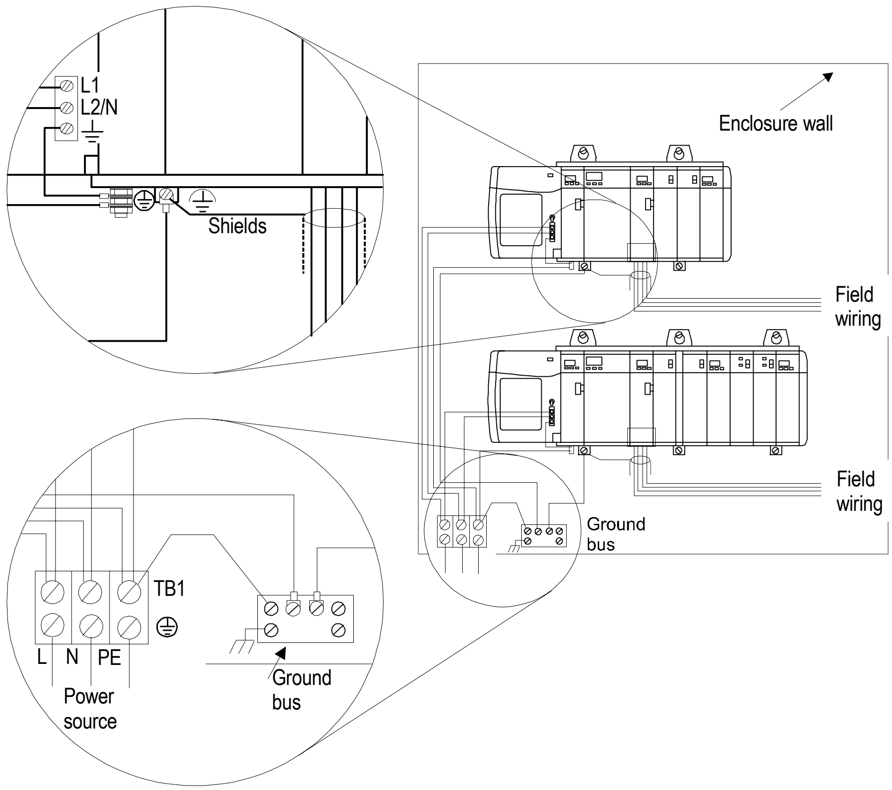


Control cabinet grounding

The following figure shows typical control-cabinet wall-ground connection details. Use a steel enclosure to guard against EMI. If the enclosure door has a viewing window, it should be a laminated screen or a conductive optical substrate to block EMI. Do not rely on the hinge for electrical contact between the door and the enclosure; install a bonding wire.



Typical control cabinet ground connection



Grounding Configuration

Power supply grounding

Each power supply and chassis is grounded by connecting a grounding conductor (grounding pig-tail) from the ground lug on the power supply, to the chassis ground tab, and to the enclosure's ground bus. See the previous figure.

DIN rail mounted component grounding

Some products have no visible groundable chassis and no ground lug or ground terminal, but will mount on a DIN rail. The chassis of these products are grounded only through the DIN rail. For these products, connect an equipment-grounding conductor directly from the mounting bolt on the DIN rail to an individual bolt on the ground bus.

Grounding-electrode conductor

Connect the ground bus to the grounding-electrode system through a grounding-electrode conductor. The grounding-electrode system is at earth-ground potential, and is the central ground for all electrical equipment and ac power within any facility. Use an 8 AWG copper wire minimum for the grounding-electrode conductor to help guard against EMI. The National Electrical Code specifies safety requirements for the grounding-electrode conductor.

Cable shields on process wiring

Certain connections require shielded cables to help reduce the effects of electrical noise coupling. Ground each shield at one end only. A shield grounded at both ends forms a ground loop which can cause a processor to fault.

Ground each shield at the end (specified in the appropriate publication for the product). Never connect a shield to the common side of a logic circuit (this would introduce noise into the logic circuit). Connect each shield directly to a chassis ground.

Avoid breaking shields at junction boxes. Many types of connectors for shielded conductors are available from various manufacturers. If you do break a shield at a junction box, do the following:

- Connect only Category-2 conductors in the junction box.
- Do not strip the shield any further than necessary to make a connection.
- Connect the shields of the two cable segments to ensure continuity along the entire length of the cable.

Planning Your Cabling and Wiring

Cabling and wiring

Table 8 describes procedures for cabling and wiring.

Table 10 Cabling/routing procedures

Step	Action
1	Determine physical installation and routing.
2	Consider cable type, cable distance, and redundant cable run paths.
3	Avoid installing cable through areas of high human traffic and high EMI/RFI.
4	Determine the maximum cable lengths and the number of drops.
5	Prepare a wiring list.
6	Maintain a blueprint with location of wiring.
7	Plan for expansion.
8	Plan for diagnostics such as attachment spots for diagnostic tools (e.g. a protocol analyzer).
9	Address separation issues for power, communications, and signal wiring/cabling.

REFERENCE

Before beginning installation, refer to the *Experion ControlNet Installation Guide, Installing Trunk Cable* for detailed instructions.

Planning to Minimize ESD/EMI

Introduction

ATTENTION

This section gives you general guidelines for reducing static discharge and establishing noise immunity within a Experion System. While these guidelines apply to the majority of installations, certain electrically harsh environments may require additional precautions.

Use these guidelines as a tool for helping avoid potential electrostatic discharge (ESD), electromagnetic interference (EMI) and transient EMI that could cause problems, such as adapter faults, chassis faults, communication faults, etc. These guidelines are not intended to supersede local electrical codes.

Planning for Static Electricity Minimization

Ways to reduce electric static discharge

Static electricity can influence electronic equipment, and cause equipment malfunctions or damage. The effects may range from momentary "glitches" to outright failures, data loss, and intermittent failures that are difficult to locate and correct. The situation becomes even more acute with high-resistance materials, such as carpets and plastic seat covers, in work areas that are not environmentally controlled.

Devices and techniques that can be used to reduce electrostatic discharge include:

- an increase in the relative humidity — This may be practical in only relatively small, closed work areas.
- conductive overcovering for shoes
- antistatic floor surfaces — These floor surfaces have all the attributes of conventional floor surfaces, except they are conductive to suppress static electricity build-up.
- low-pile antistatic carpets — These carpets are conductive to suppress static electricity. Carpets are available in a wide variety of patterns and colors, can be placed over most existing floor surfaces and some carpets.
- antistatic grounded pads — These pads are for operator work station areas, and can be placed over most existing floor surfaces and carpets. They are meant primarily for the immediate vicinity of the work area, and require proper grounding.
- avoiding synthetic materials — Avoid linoleum and synthetic carpets, and other materials that generate static. If such floor coverings are already in place, antistatic mats can be installed on the floor near the terminals. Refer to Honeywell's *National Distribution Operations Supplies and Accessories Sales Catalog* (Order Number GF60).

Planning for Interference Minimization

General considerations

Before deciding on an installation site, a planning review should be conducted to assess the environment and to determine any special product considerations or installation needs that may be necessary to ensure normal system operation and product protection.

Magnetic interference

Strong magnetic fields generated by some industrial machinery can cause malfunction of electronic equipment and magnetic storage media in shop-located devices. Avoid installing the Experion computer equipment close to sources of magnetic disturbance.

Electromagnetic and radio frequency interference

In some situations, the proposed site may experience electromagnetic interference (EMI) or radio frequency interference (RFI). These interference's can result from nearby radio-frequency sources (for example, two-way radios, TV, or radio transmitters) or industrial equipment (such as arc welders, fluorescent lights, or electronic air cleaners). Sources of EMI include electric floor heaters, transformers, and rotating machinery (such as fans or drills) and power distribution lines.

The effects of RFI and EMI can be reduced or eliminated by properly shielding and grounding the cables and equipment chassis, and by routing the cables away from potential interference sources.

Removal and Insertion Under Power (RIUP)

CAUTION

While control hardware modules are designed to permit removal and insertion under power (RIUP) without damaging the module, Honeywell recommends that you do **not RIUP** any module in an Experion control system since it may cause an indeterminable upset in the process.

Planning Raceway Layouts

General considerations

The raceway layout of a system is reflective of where the different types of I/O modules are placed in an I/O chassis. Therefore, you should determine I/O-module placement prior to any layout and routing of wires. However, when planning your I/O-module placement, segregate the modules in accordance with the conductor categories (published for each I/O module). These published guidelines specify requirements for the installation of electrical equipment to minimize electrical noise inputs to controllers from external sources in IEEE standard 518-1982.

Categorizing conductors

Segregate all wires and cables into the three categories defined in Table 9.

Table 11 Categorizing conductors for noise immunity

Category	Description
1	Control, ac Power, and High-Power Conductors Control, ac Power, and High-Power conductors are those that are more tolerant of electrical noise than Category 2 conductors, and may also cause more noise picked up from adjacent conductors. Category 1 corresponds to IEEE Levels 3 (low susceptibility) and 4 (power). Examples include: • ac power lines for power supplies and I/O circuits. • high-power digital ac I/O lines connected to ac I/O modules rated for high power and high noise immunity. High-power digital dc I/O lines connected to dc I/O modules rated for high-power, or with input circuits with long time-constant filters for high noise rejection. They typically connect devices such as hard-contact switches, relays, and solenoids.

Category	Description
2	Signal, Communication, and Low-Power Conductors Signal, Communication, and Low-Power Conductors are those that are less tolerant of electrical noise than Category 1 conductors, and should also cause less noise picked up from adjacent conductors. They typically connect to sensors and actuators relatively close to the I/O modules. Category 2 Corresponds to IEEE Levels 1 (high susceptibility) and 2 (medium susceptibility). Examples include: • Analog I/O lines and dc power lines for analog circuits • Low-power digital ac/dc I/O lines connected to I/O modules that are rated for low power, such as low-power contact output modules. • Low-power digital dc I/O lines connected to dc I/O modules that are rated for low power and have input circuits with short time-constant filters to detect short pulses. They typically connect to devices such as proximity switches, photo-electric sensors, TTL devices, and encoders. • Communication cables (Ethernet, Process Control Network, RS-232-C, RS-422, RS-423 cables) connected between processors or to I/O adapter modules, programming terminals, computers, or data terminals.
3	Intra-Cabinet Conductors Intra-cabinet conductors are those that interconnect the system components within a control cabinet or enclosure. Category 3 corresponds to IEEE Levels 1 (high susceptibility) and 2 (medium susceptibility). Examples include: • Low-voltage dc power cables providing backplane power to the system components. • Communication cables connected between system components within the same enclosure.

Routing conductors

CAUTION

Please note that these guidelines are for noise immunity only. Follow all local codes for safety requirements. Also, observe the following cautionary measures:

- Use the spacing given in these general guidelines, with the following exceptions:
  - where connection points (for conductors of different categories) on nodes are closer together than the specified spacing.
  - application-specific configurations, for which the spacing is described in a publication for that specific application.
- These guidelines assume that you follow the surge-suppression guidelines described in this document.

While these guidelines apply to the majority of installations, certain electrically harsh environments may require additional precautions.

To guard against coupling noise from one conductor to another, follow the general guidelines defined in Table 10 when routing wires and cables (both inside and outside of an enclosure).

Table 12 Routing conductors for noise immunity

Category	Description
1	These conductors can be routed in the same cable tray or raceway with machine power conductors of up to 600 Vac (feeding up to 100 hp devices).
2	The following rules must be observed when routing Category 2 conductors: a) When crossing power feedlines, do so at right angles. b) Route at least five ft from high-voltage enclosures, or sources of RF and microwave radiation. c) When using metal wireways or conduits, each segment of that wireway or conduit must be bonded to each adjacent segment (so that it has electrical continuity along its entire length), and must be bonded to the enclosure at the entry point. d) Properly shield (where applicable) and route in a raceway separate from Category 1 conductors. e) When using a contiguous metallic wireway or conduit, route at least: – 0.08 m (3 in) from Category-1 conductors of less than 20 A, – 0.15 m (6 in) from ac power lines of 20 A or more, but only up to 100 kVA, and – 0.3 m (1 ft) from ac power lines of greater than 100 kVA. f) When not using contiguous metallic wireways or conduits, route at least: – 0.15 m (6 in) from Category 1 conductors of less than 20 A – 0.3 m (1 ft) from ac power lines of 20 A or more, but only up to 100 kVA – 0.6 m (2 ft) from ac power lines of greater than 100 kVA.
3	Route conductors outside all raceways in the enclosure or in a raceway separate from any Category-1 conductors with the same spacing listed for Category-2 conductors (where possible).

Planning for Power Distribution

Transformer connections

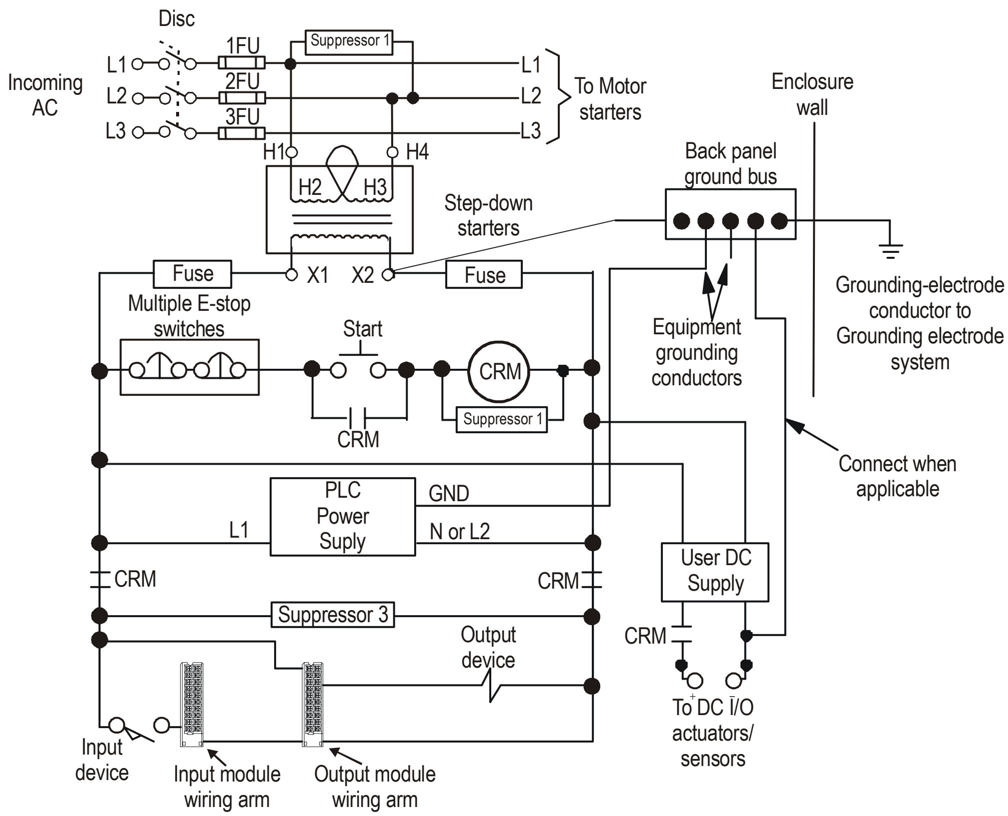
You can minimize noise induced by the power-distribution system by connecting the power supply directly to the secondary of a transformer as shown in the following two figures. The transformer provides dc isolation from other equipment not connected to that transformer secondary.

Connect the transformer primary to the ac source. Connect the high side of the transformer secondary to the L1 terminal of the power supply; connect the low side of the transformer secondary to the neutral (common) terminal of the power supply.

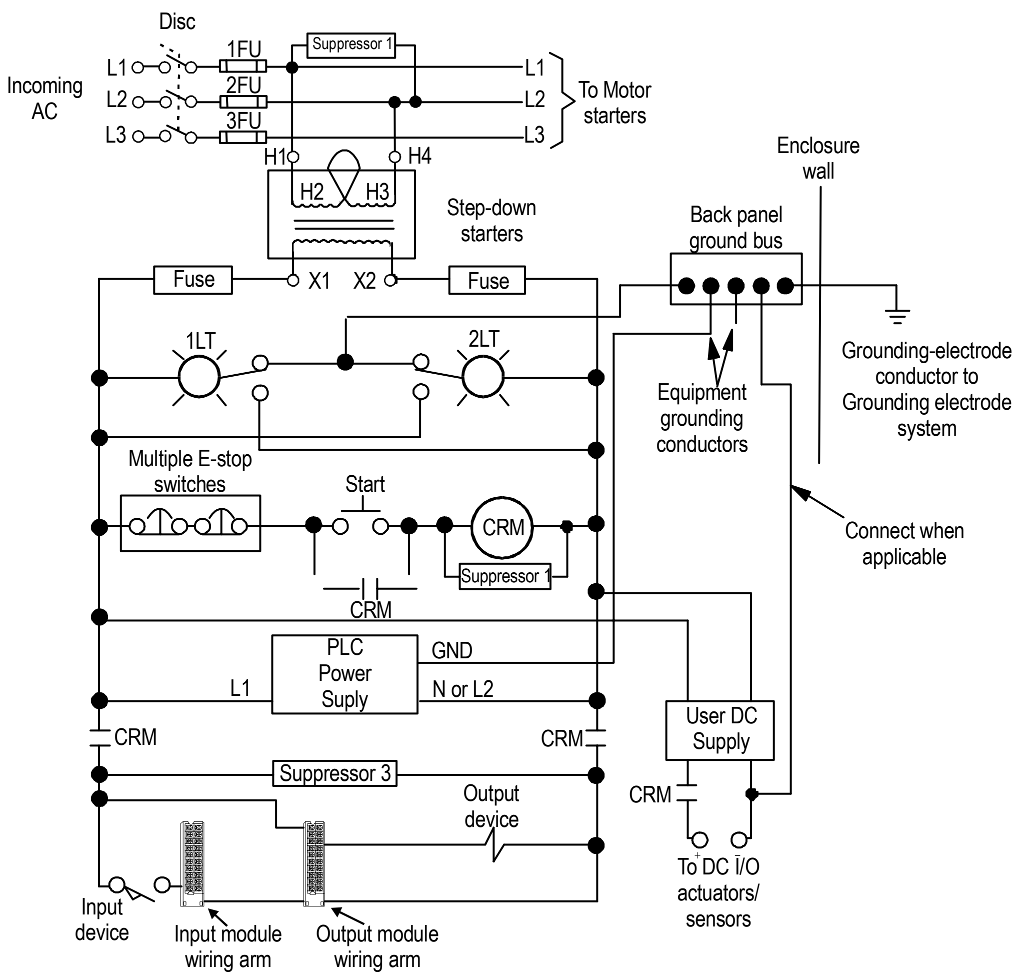
ATTENTION

Three EMI minimization techniques utilized in the following two figures include:

- Connection of a suppressor across an inductive load (such as the CRM coil).
- Inclusion of a second transformer providing power to the input circuits and power supplies, and isolating them from the output circuits.
- Connection of a suppressor to minimize the EMI generation from the net inductive load switched by the CRM contacts.



Grounded ac power distribution system with master-control relay



Ungrounded ac power distribution system with master-control relay

Monitoring the master control relay

The master-control relay can be monitored in your control applications, in order to hold all outputs off anytime its contacts are open. To do this, connect one input directly to the L1 side of the line, on the load side of the CRM contacts as shown in the previous figure and the following figure. In the control application, this input is used to hold off all outputs, anytime the CRM contacts are open.

If you fail to do this, closing the CRM contacts could generate transient EMI because outputs are already activated. To have outputs turned on when CRM contacts are closing, would be analogous to squeezing the trigger on a hand-power tool as you're plugging it in the electrical outlet.

Sizing the transformer

To determine the required rating of the transformer, add the external-transformer load of the power supply and all other power requirements (input circuits, output circuits). The power requirements must take into consideration the surge currents of devices controlled by the processor. Choose a transformer with the closest standard transformer rating above the calculated requirements.

ATTENTION

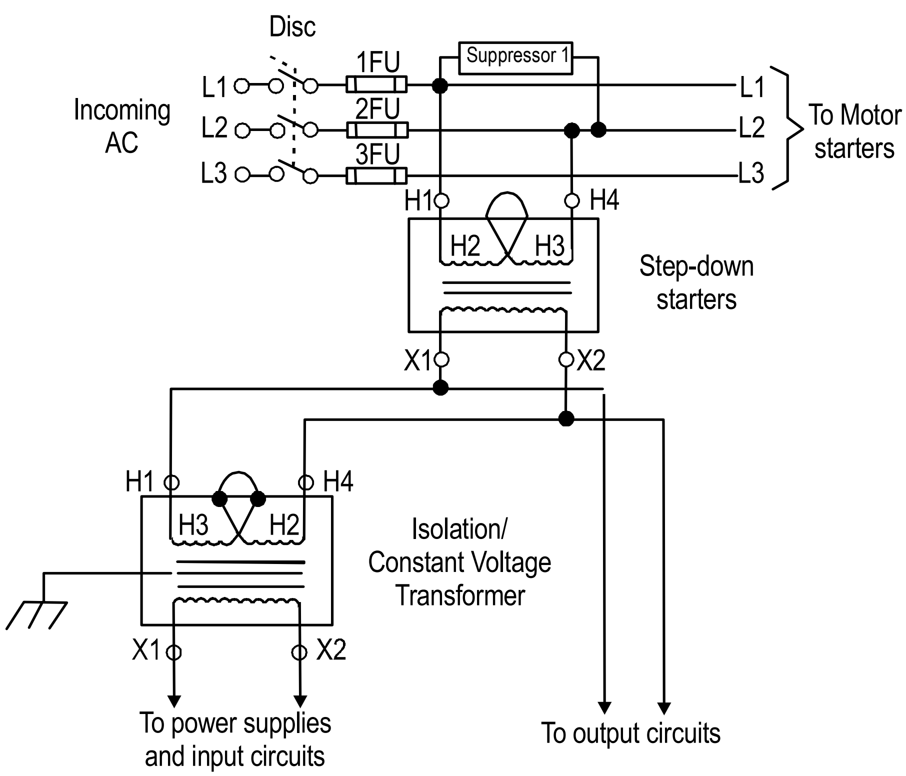
Each power supply with under-voltage shut-down protection generates a shut-down signal on the backplane, whenever the ac line voltage drops below its lower voltage limit. The power supply removes the shut-down signal whenever the line voltage comes back above the lower voltage limit. This shut-down is to guard against invalid data being stored in memory.

Because a capacitive-input power supply converting ac to dc draws power only from the peak of the ac voltage waveform, the external transformer load (in VA) of each power supply is 2.5 times its real power dissipation (in Watts). If the transformer is too small, the peaks of the sine wave are clipped. Even if the voltage is still above the lower voltage limit, the power supply senses the clipped wave as low voltage and sends the shut-down signal.

Transformer separation of power supplies and circuits

Experion power supplies have circuits that suppress electromagnetic interference from other equipment. However, you should isolate output circuits from both power supplies and input circuits, this will help prevent output transients from being induced into inputs and power supplies. In many applications, power is provided to the input circuits and power supplies through a separate transformer as shown in the following figure.

Refer to *Isolation transformers* and *Constant-voltage transformers* in this document, for information about the use of additional transformers.



Second transformer in a power distribution system

ATTENTION

To minimize transient EMI generation when power is interrupted by the interrupt switch, connect a suppressor across the primary of the transformer (as shown in the figure above).

Isolation transformers

For applications near excessive electrical noise generators, an isolation transformer (for the separate transformer) provides further suppression of electromagnetic interference from other equipment. The output actuators being controlled should draw power from the same ac source as the isolation transformer, but not from the secondary of the isolation transformer.

Constant-voltage transformers

In applications where the ac power source is especially "soft" and subject to unusual variations, a constant-voltage transformer can stabilize the ac power source to the processor and minimize shutdowns. The constant-voltage transformer must be of the harmonic neutralizing type.

If the power supply receives its ac power through:

- constant-voltage transformer, the input sensors connected to the I/O chassis should also receive their ac power from the same constant-voltage transformer.
- another transformer, the ac source voltage could go low enough that erroneous input data enters memory while the constant-voltage transformer prevents the power supply from shutting down the processor.

The output actuators being controlled should draw power from the same ac sources as the constant-voltage transformer, but not from the secondary of the constant-voltage transformer (See the previous figure).

Transformer ground connections

When ac power is supplied as a separately derived system through an isolation/step-down transformer, you can connect it as a grounded ac system or an ungrounded ac system. For a grounded ac system, connect one side of the transformer secondary to the ground bus. For an ungrounded ac system, connect one side of each test switch for the ground-fault-detector lights to the ground bus. We do not recommend an ungrounded system. Follow local codes in determining whether to use a grounded system.

When bringing ac power into the enclosure, do not ground its raceway to the ground bus on the back-panel. Connecting the raceway to the ground bus may cause the processor to fault by introducing EMI into the grounding circuit. Local codes may provide an exception for permitting isolation from the raceway. For example, article 250-75 of the National Electrical Code has an exception that explains the conditions under which this isolation from the raceway is permitted.

Suppressing Power Surges

Why do they occur?

Transient electromagnetic interference (EMI) can be generated whenever inductive loads (such as relays, solenoids, motor starters, or motors) are operated by hard contacts (such as pushbutton or selector switches). The wiring guidelines are based on the assumption that you guard your system against the effects of transient EMI by using surge-suppressors; these will suppress transient EMI at its source. Inductive loads switched by solid-state output devices alone do not require surge-suppression. However, inductive loads of ac output modules (that are in series or parallel with hard contacts) require surge-suppression to protect the module output circuits as well as to suppress transient EMI.

Surge-suppressors

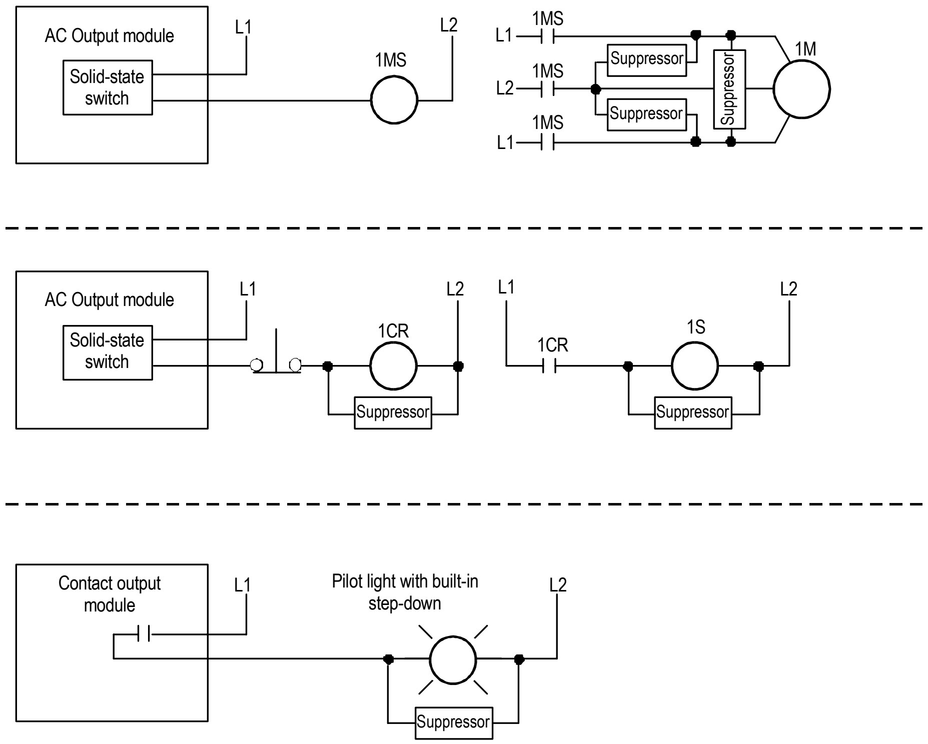
Surge-suppressors are usually most effective when connected at the inductive loads. They are still usable when connected at the switching devices; however, this may be less effective, because the wires connecting the switching devices to the inductive loads act as antennas that radiate EMI. You can see the effectiveness of a particular suppressor by using an oscilloscope to observe the voltage waveform on the line.

Ferrite beads

Ferrite beads can provide additional suppression of transient EMI. Fair-Rite Products Corporation manufactures a ferrite bead (part number 2643626502) which can be slipped over Category-2 and Category-3 conductors. You can secure them with heat-shrink tubing or tie-wraps. With a ferrite bead located near the end of a cable (or cable segment in the case of a daisy-chain or dropline configuration), transient EMI induced onto the cable can be suppressed by the bead before it enters the equipment connected to the end of the cable.

Typical suppression circuitry

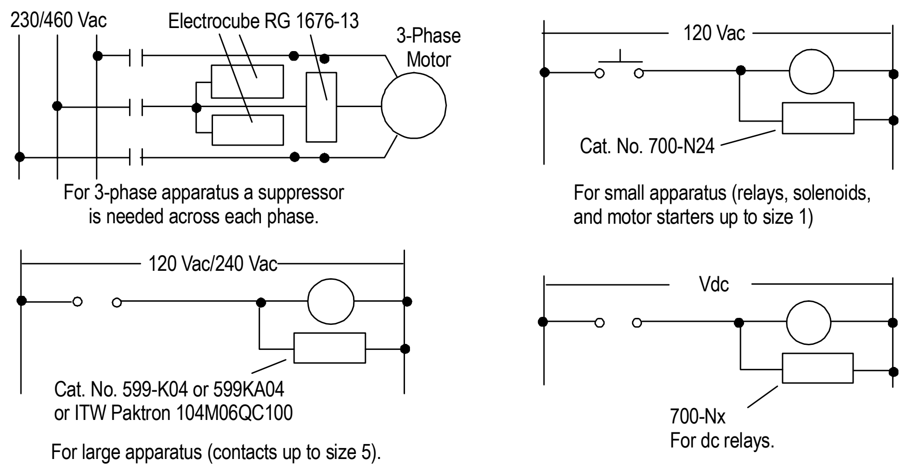
The following shows typical suppression circuitry for different types of loads.



Examples

The following figure shows three examples of where to use suppressors.

- In example 1, although the motor starter-coil is an inductive load, it does not need a suppressor; this is because it is switched by a solid-state device alone.
- In example 2, the relay coil needs a suppressor, because a hard-contact switch is in series with the solid-state switch. However, in both examples 1 and 2, we show a suppressor on the motor and solenoid, because it is an inductive load switched by the hard contacts of the motor starter or relay. Even if they have no interaction with the control system, regularly cycled loads of this type need suppression, if conductors connecting to these loads are:
  - connected to the same separately derived system as that of the control system, or
  - routed near the control system conductors, as per the routing guidelines
- In example 3, the pilot light has a built-in step-down transformer that needs a suppressor because it is an inductive load being switched by the hard contacts of a contact output module; without suppression, the transient EMI would be generated inside the I/O chassis. Lights with built-in step-down transformers that are switched by hard contacts may not need to be suppressed, because the noise spike they can generate may be only approximately one tenth that of a relay or motor starter.



ATTENTION

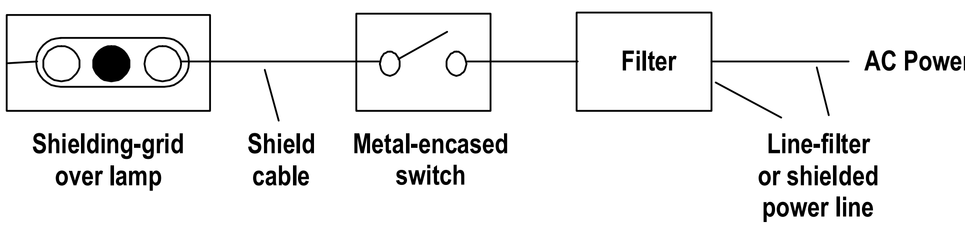
In all cases, the ac power coming into the I/O modules must be switched by the CRM contacts. Therefore, a suppressor is needed across the line at the load side of the CRM contacts. The application (voltage, net load of I/O circuits) dictates the specific suppressor needed across the line at the load side of the CRM contacts.

Planning Enclosure Lighting

Minimizing fluorescent lamp interference

Fluorescent lamps are also sources of EMI. If you must use fluorescent lamps inside an enclosure, the following precautions may help guard against EMI problems, as shown in the following figure:

- Install a shielding grid over the lamp.
- Use shielded cable between the lamp and its switch.
- Use a metal-encased switch.
- Install a filter between the switch and the power line, or shield the power-line cable.
- Do not use dimmers.



Avoiding Unintentional Momentary Turn-on of Outputs

Minimizing the probability

WARNING

Unintentional turn-on of outputs as the power source is connected or disconnected (even if momentary) can result in injury to personnel as well as damage to equipment. The danger is greater with fast-response actuators.

You can help minimize the probability of unintentional momentary turn-on of ac and dc circuits by following each of these guidelines according to your specific application:

- Follow the surge-suppression guidelines in this document.
- Follow the bonding and grounding guidelines in this document.
- Do not unnecessarily disconnect the power source from output circuits.
- Where possible, turn off all outputs before using CRM contacts to interrupt the output circuit power source.
- Hold off all outputs anytime the CRM contacts are open to be certain that they are off as power is reconnected.

Minimizing the effect

Even if unintentional momentary turn-on does occur, the effects can be minimized if:

- actuators have a home position, i.e. defined by a spring return.
- (for latching actuators in the ladder logic), you use non-retentive energize Logic Function Blocks with hold-in (seal-in) paths to maintain the established position, until power turnoff. Leave outputs off initially at power turn-on.
- each input or other load device connected to an output has an input-filter time-constant no lower than necessary for the application.

Testing the minimization

After designing and installing your system following these guidelines to minimize unintentional momentary turn-on and any effects thereof, test the system by de-energizing, and re-energizing the CRM relay.

Control Processing Considerations

Control Processor Load Performance

Background

The Control Processor provides a very flexible execution environment for performing all types of control at different execution speeds. To determine how much control can be performed by a Processor, Processor Usage and Memory Usage are considered. The number of modules or blocks a Control Processor can execute is determined by available CPU and memory resources. Other constraints, such as total number of CMs and SCMs, must also be taken into account.

Load performance calculation example

The following table represents an example control strategy configuration (not necessarily typical) calculations to determine control processor load performance.

REFERENCE

For detailed information regarding processing units and memory units, refer to the Experion specifications.

The Experion specifications can be found on the Honeywell website: http://hpsweb.honeywell.com/Cultures/en-US/default.htm. Just follow the Experion product links.

Table 13 Control Processor load performance calculation example

Module Type	No. of Modules	Period, sec	Module PU	Module MU	Total PUs[1]	Total MUs
Analog Data Acquisition CM	10	1	4	9	40	90
Regulatory Control CM	40	0.5	2	4	160	160
Auxiliary Function CM	5	0.5	8	18	80	90
Digital Data Acquisition CM	20	0.1	1	3	200	60
Device Control CM	100	0.1	1	3	1000	300
Logic Control CM	10	0.1	1	3	100	30
Sequence Control Module (SCM)	4	0.1	2	90	80	360
Sequence Control Module (SCM)	32	1	2	90	64	2880
				Total	***1724***	***3970***
				Max	***2000***	***4000***

PU = Processing Unit per Control Cycle; MU = Memory Unit, Kbytes
PUs for any given CM = (PU per Cycle) / (Cycle Time, sec.)

Available Period for all CM and SCM types are 0.05, 0.1, 0.2, 0.5, 1.0 and 2.0 sec.

a) [1] Total PUs = (No. of Modules) x (Module PU) / (Period, sec.) for each CM type.

Process Manager I/O Integration Planning

System Topology and Performance Considerations

System configuration guidelines

- The Input/Output Link Interface Module (IOLIM) must be mounted in a non-redundant or redundant C200 Process Controller chassis.
- The Supervisory network must use the ControlNet or Fault Tolerant Ethernet (FTE) media.
- A redundant controller chassis using PM I/O must contain at least a Supervisory ControlNet Interface module (CNI) for ControlNet network or Fault Tolerant Ethernet Bridge (FTEB) for FTE network, CPM, RM, and IOLIM.
- A non-redundant controller chassis using PM I/O must contain at least a Supervisory ControlNet Interface module (CNI) for ControlNet network or Fault Tolerant Ethernet Bridge (FTEB) for FTE network CPM, and IOLIM.
- Two (2) is the maximum number of IOLIMs supported per C200 Controller chassis. All output channels assigned to an IOLIM must be contained in Control Modules that reside in the same CPM.
- The C200 Controller chassis can contain additional CNIs connected to other Experion I/O families. **Note:** Only Serial Interface Module (SIM), Pulse Input, and Fieldbus Interface Modules are supported with C200 Controller using PM I/O.
- Twenty (20) is the maximum number of IOLIMs supported per Server.
- Forty (40) is the maximum number of primary Input/Output Processors (IOPs) supported per IOLIM. A primary and secondary IOP pair is considered as one Input/Output Module (IOM) for system performance calculations. (Note that the maximum number allowed may vary depending on the required sampling period of the IOPs.)
- Sixty-Four (64) is the maximum number of primary IOPs supported per Control Processor Module (CPM). (Note that each IOP block is the equivalent of one (1) IOM in this calculation.)
- The communication update interval between the IOP points and the function blocks is individually configurable for each IOP device in pre-determined intervals between 100 ms and 2 seconds.

- To insure fresh I/O data in the associated Control Module (CM), configure the IOP scan rate to be twice the execution period of the CM. For example, if the CM execution period is set to 1s, set the IOP scan rate to 500ms.
- The maximum number of AO connections per IOLIM is 320. The maximum number of DO connections per IOLIM is 640. The maximum number of AO and DO connections per IOLIM is 640.

Link Units and I/O Link overruns

The amount of I/O Link bandwidth available for I/O scanning per second is divided into 1000 units called Link Units (LUs). A Link Unit is roughly equivalent to one parameter read or write per second.

If a user configuration exceeds 1000 LUs, an I/O Link Access Overrun can occur. This type of overrun occurs when parameter reads and writes are not completed within their cycle time. This indicates too many parameter access requests were attempted through the I/O Link. The IOLINK block generates an alarm when an I/O Link overrun occurs.

If I/O Link overruns persist, users can reduce the I/O Link traffic by:

- Descreasing the IOP's Scanning Rate parameter [SCANRATE]
- Descreasing the Execution Period of Control Modules containing Output Channel blocks.
- Reducing the number IOPs configured.

See the following table for typical Link Units usage per cycle.

Block Type	Data Processing	Link Units/ Cycle *	Cycle Time
Each Primary and Secondary IOP	Event Collection	1	500 ms
DI, DISOE, DI24V	PV Scanning	1.75	IOP block's SCANRATE
DO, DO32	BACKCALC Scanning	1.25	IOP block's SCANRATE
HLAI, HLAIHART, STI, LLMUX, RHMUX	PV Scanning	5	IOP block's SCANRATE
LLAI	PV Scanning	3	IOP block's SCANRATE

Block Type	Data Processing	Link Units/ Cycle *	Cycle Time
AO Channel	BACKCALC Scanning	1	IOP block's SCANRATE
AO Channel	OP Store	1	OP connector's CM Execution Rate
DO Channel (status output)	SO Store	1	SO connector's CM Execution Rate
DO Channel (pwm)	BACKCALC Scanning	1	IOP block's SCANRATE
DO Channel (pwm)	OP Store	1	OP connector's CM Execution Rate

Link Unit versus event collection

Under normal conditions, every IOP configured on the I/O Link, whether primary or secondary, uses 2 Link Units for event collection. This activity is periodic and can be accounted for, however, conditions in which numerous events and alarms are generated are less predictable and may cause I/O Link overruns and delays in display updates.

The following table lists IOLIM Event generation performance (burst and sustained.

FIM and IOLIM Notifications Performance	
Maximum number of events (burst condition)*	50 events
Maximum number of events/second (sustained)	2/sec
***Note:** Event bursts will be throttled to one per minute.	

PV and Back Calculation Scanning

The frequently used I/O parameters shown in the following table are automatically scanned by the IOLIM as soon as the IOP block is loaded.

IOP Block	Scanned Parameters
HLAI, HLAIHART, STI, LLMUX, RHMUX, STI-MV	PV, PVSTS
DI, DISOE, DI24V	PVFL, BADPVFL
DO, DO32	SO, INITREQ

The number of AI and DI channel blocks used does not increase LU consumption. Note the DO channel blocks used will not increase LU consumption for Back Calculation scanning, but will increase it for each OP or SO store.

Link Unit versus output stores

Outputs are written to the IOPs only when they change. LU consumption increases with the number of output channel blocks configured in the system.

The cycle time used for calculating LUs is the execution period of the Control Module (CM) containing the block connected to the channel's output (OP).

Link Unit calculations

Use the following spreadsheet as an aid in calculating LU totals.

I/O Processors	IOP Scan Rate (ms)	#IOPs		Link Units per IOP		Link Units
DI, DISOE, DI24V	100		X	20	=	
DI, DISOE, DI24V	200		X	11	=	
DI, DISOE, DI24V	250		X	9	=	
DI, DISOE, DI24V	500		X	6	=	
DI, DISOE, DI24V	1000		X	4	=	
DI, DISOE, DI24V	2000		X	3	=	
DO, DO32	100		X	15	=	
DO, DO32	200		X	8	=	
DO, DO32	250		X	7	=	
DO, DO32	500		X	5	=	
DO, DO32	1000		X	3	=	
DO, DO32	2000		X	3	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	100		X	52	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	200		X	27	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	250		X	22	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	500		X	12	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	1000		X	7	=	
HLAI, HLAIHART, STI, LLMUX, RHMUX	2000		X	5	=	
LLAI	100		X	32	=	
LLAI	200		X	17	=	
LLAI	250		X	14	=	

I/O Processors	IOP Scan Rate (ms)	#IOPs		Link Units per IOP		Link Units
LLAI	500		X	8	=	
LLAI	1000		X	5	=	
LLAI	2000		X	4	=	
AO, AO16, AO16HART	All		X	2	=	
Any Secondary IOP	All		X	2	=	

I/O ChannelReads	IOP Scan Rate	#IOCs		Link Units per IOP		Link Units
AO Connections (Back Calc)	100		X	10	=	
AO Connections (Back Calc)	200		X	5	=	
AO Connections (Back Calc)	250		X	4	=	
AO Connections (Back Calc)	500		X	2	=	
AO Connections (Back Calc)	1000		X	1	=	
AO Connections (Back Calc)	2000		X	1	=	

I/O ChannelWrites	CM Exec Period	#IOCs		Link Units		Link Units
SCM Reads per second	N/A		X	1	=	
SCM Writes per second	N/A		X	4	=	
AO Connections (Output writes)	100		X	10	=	

I/O ChannelWrites	CM Exec Period	#IOCs		Link Units		Link Units
AO Connections (Output writes)	200		X	5	=	
AO Connections (Output writes)	500		X	2	=	
AO Connections (Output writes)	1000		X	1	=	
AO Connections (Output writes)	2000		X	1	=	
DO Connections	100		X	10	=	
DO Connections	200		X	5	=	
DO Connections	500		X	2	=	
DO Connections	1000		X	1	=	
DO Connections	2000		X	1	=	
HART Digital Scanning	**HART Scan Rate (ms)**	**# Vars**		**Link Units**		**Link Units**
EACH Device or Dynamic Variable Note 5	1000	0	X	1	=	
			Total Link Units		=	
			Link Bandwidth Used (%)		=	

Note 1: Link Unit usage for AO connections are included in two places. The outputs are written at the CM execution period, and back initialization data is read at the Scan Rate of the channel's assigned IOP.

Note 2: Re. AO, DO connections -- CMs executing at 50 ms is not supported.

Note 3: When the IOLIM indicates I/O Link Overload, or any IOP indicates 02, 04 or 05 Soft Failure, or an IOP shows "loss of sync", the user should adjust the IOP Scan Rates and CM Execution Rates.

Note 4: Fractional Link Unit values are always rounded up to the next whole number.

Note5: The IOLIM polls the IOP once per second for this data regardless of the HSCANCFG parameter.

IOLIM communication performance

The following table lists typical IOLIM communication specifications.

Maximum Total Parameter Access Response Rate (Note: Includes all Server Data Requests and peer communications to other CEE/CPMs**)**	6000 PPS
Maximum IOLIM to CEE Parameter Access Response Rate **(**PEERRATEAVG **and** PEERRATEMAX**)**	5120 PPS (Max 1280 channels @ 250 ms publish rate)
Maximum number of Display Parameters per IOLIM **(**DISPRATEAVG **and** DISPRATEMAX**)**	1000 PPS
Maximum Initiator Node Pull/Get Request Rate (PEERINITAVG and PEERINI AX) (Note: IOLIM from CEE is fixed at 100 ms)	1000 PPS (Restricted by Link Unit limit of 1000, assuming 1 Link Unit = 1 parameter/sec.
Maximum Target Node Response Rate to Push/Store Requests (Note: **Currently the SCM Step Output and the Push FB are the only blocks that can initiate push/store requests from CEE to IOLIM.)**	50 PPS

Monitoring Network Loading

Viewing the ControlNet Loading

Please refer to the *Network Tools in the* Troubleshooting and Maintenance Guide for more information.

Application Licensing Considerations

Licensing Overview

When the user tries to launch an Engineering Tool (for example, Control Builder), the license availability is checked and the tool is launched only if license is available. If the number of specific Engineering Tool applications exceeds the maximum number permitted, then an error will be reported to the user and an error message will be logged into the Engineering Tools error log.

<Error Message><Description>

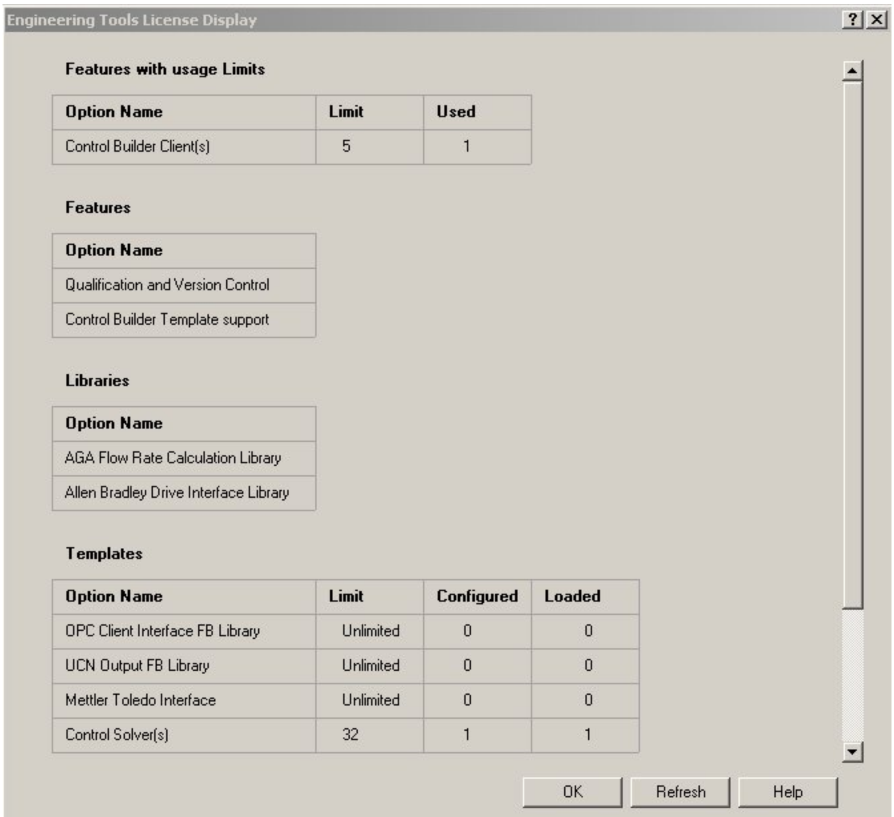
For Example,

PS_E_<Application Name>LAUNCHLICLIMITERROR <Application Name> can not be launched. Maximum Licensed number <Number> exceeded.

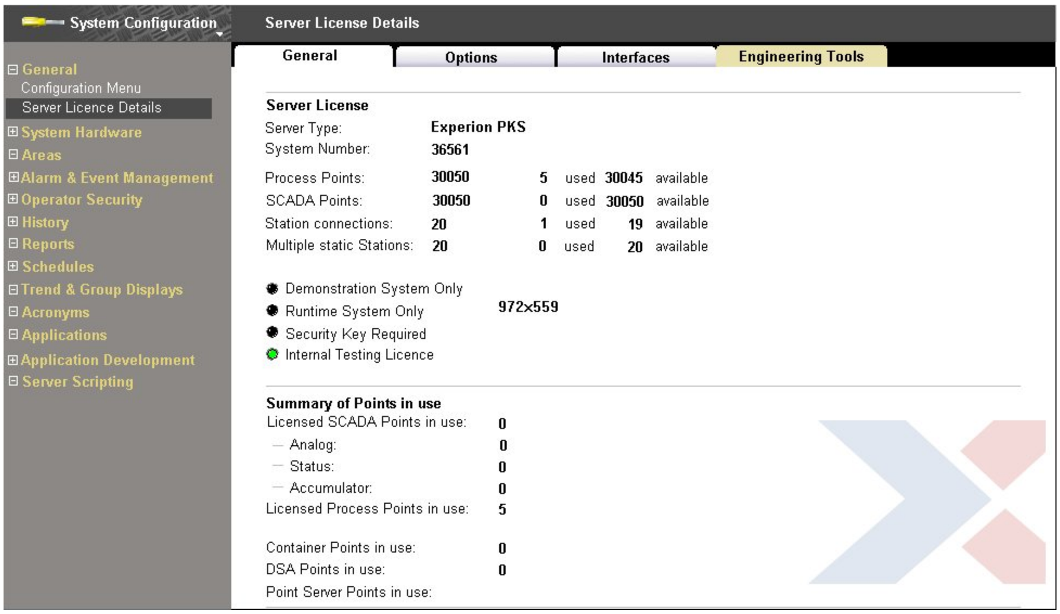
Licensing will be checked when:	Possible result:
• Launching Control Builder	• Error
• Configuring Function Blocks	• Warning
• Loading Function Blocks	• Error

Viewing Licenses

- To view licenses in Control Builder, select Tools -> License Display.
  - Features section: This section contains license information for Experion Engineering Tool Options that are not related to template libraries or individual template usage.
  - Libraries section: This section indicates the set of libraries that a user has licensed. If a library is licensed, all the templates in the library are available to the user. If the name of a library option is grayed out, the option is not enabled for the Experion System.
  - Templates section: This section indicates the set of options for Experion system templates that a user has licensed. Some user templates may be licensed for "unlimited" use, while others have usage limits. If the system template license option is limited, the user may configure as many instances as they like, however, the maximum number of instances that may be simultaneously loaded in the system is indicated by the contents of the Limit column. To help the user manage the use of limit licensed system templates, the Configured column indicates the number of instances that the user has configured, and the Loaded column indicates the number loaded.
  - If a template option is "grayed", it is not licensed for use in the system, and the Limit, Configured, and Loaded columns will be empty.



- To view licenses in Station, select Configure -> Server License Details. Select the Engineering Tools tab.
  - All purchased options appear with a green indicator, with all other options in black.
  - If the option is a countable option (Fixed Number and Enum options), the display indicates how many instances are purchased, and how many are used. For example, if 20 instances of a particular template are purchased, and only 8 used, the display will indicate both.


System Configuration
Server License Details
General
Configuration Menu
Server Licence Details
System Hardware
Areas
Alarm & Event Management
Operator Security
History
Reports
Schedules
Trend & Group Displays
Acronyms
Applications
Application Development
Server Scripting
General
Options
Interfaces
Engineering Tools
Server License
Server Type: Experion PKS
System Number: 36561
Process Points: 30050 5 used 30045 available
SCADA Points: 30050 0 used 30050 available
Station connections: 20 1 used 19 available
Multiple static Stations: 20 0 used 20 available
Demonstration System Only
Runtime System Only
Security Key Required
Internal Testing Licence
972x559
Summary of Points in use
Licensed SCADA Points in use: 0
Analog: 0
Status: 0
Accumulator: 0
Licensed Process Points in use: 5
Container Points in use: 0
DSA Points in use: 0
Point Server Points in use:

License Validation

Licensing at Configuration time

During Configuration, users are allowed to configure the blocks irrespective of the license purchased. Warnings will be generated only when the chart is closed. The user will be allowed to continue or cancel the configuration. Basic Block warnings will be generated when the chart is closed. Warnings for tagged objects are generated at Instantiation time. Warnings will be logged into the Engineering Tools error log, using standard error reporting interfaces.

The Warning Dialog is given below,

<Warning Message> < Description >

For Example,

PS_E_<ET Name>_<FB Name. Member name>LICLIMITWARNING <FB name> configuration exceeded the maximum licensed limit <number>

Licensing at Load time

During load time, an error message will be displayed if a block load is attempted that exceeds the licensed capabilities. The function block will not be loaded, and the error will also be logged to the Engineering Tools error log, using standard error reporting interfaces.

The Error Dialog is given below,

<Error Message> < Description >

For Example,

PS_E_<ET Name><Template Name>LOADFAILERROR <FB name.membername> Load exceeded the maximum licensed limit <number>

PS_E_<ETName>BLKLOADFAIL <FB Name> Load failed.

There are three ways of loading a function block:

Load from Project:	License checks will be applied.
Load from Snapshot:	License checks will not be applied.
Load from Monitoring:	License checks will not be applied.

Multiple Block Load scenario

In case of multiple block load scenarios, where the user loads more than one block at a time, the load can continue even if there is an error. The blocks exceeding the licensed capabilities will not be loaded, and all other blocks will be loaded to the controller. An Error will be reported and logged to the error log indicating the blocks not loaded.

Attempting to launch an Engineering Tool when the license limit is reached

The license availability is checked and an error is reported to the user that the number of simultaneous applications exceeded the licensed number. The severity will be indicated by a stop icon in the error message box. The user will not be able to launch that application. And an error message will be logged into the Experion Engineering tools error log.

Handling Application failures

Whenever a new application is launched, an attempt will be made to communicate with the other instances of the tool to ensure that they are still running. If there is a communication failure or communication time out due to crashing of any of the application, that particular application will not be included in license checks.

Maintaining Licensing Information

License information is refreshed upon SR Service startup.

Online License Change

If the user applies for a new license online and tries to use the modified license, the tool does not need to be restarted to access the new license information. SR queries the license key directly whenever the clients want to access the license information and there is no caching of license information.

Appendix A

Corrosion Protection Planning

Conformal coating versus corrosion

Corrosion is one of the leading causes of electronic printed circuit assembly board failure in harsh environments. One method used to protect printed circuit boards used in harsh environments is to conformally coat them with a thin layer of a special plastic material. The conformal coating is resistant to the corrosive effects of humidity and most chemical gases to extend the life of the printed circuit assemblies.

The following table recommends the minimum equipment requirement that is based on environmental classification tests at the site where the equipment is installed.

Environment Classification Minimum	Equipment Requirement
Mild (G1)	No conformal coating
Moderate (G2)	Conformal coating
Harsh (G3)	Conformal coating
Severe (Gx)	Conformal coating and installation in an environmentally hardened enclosure

G3 rating

All coated assemblies will withstand the effects of a G3 (harsh) rated environment. Uncoated boards are rated for mild (G1) environments. A harsh environment is defined by ANSI/ISA-S71.04-1985, "Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminates."

The following table defines environmental harshness levels for airborne contaminates as defined by ANSI/ISA-S71.04-1985.

Severity Level	G1 (Mild)	G2 (Moderate)	G3 (Harsh)	Gx (Severe)
Copper Reactivity Level (Angstroms/Month)	Less than 300	Less than 1000	Less than 2000	Greater than or equal to 2000
Contaminant Gas	***Concentration (Parts/Billion)***			

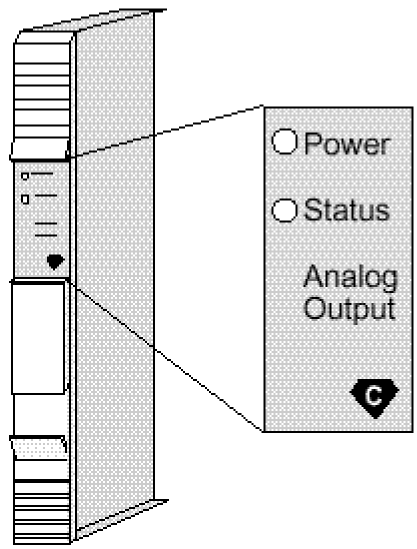
Severity Level	G1 (Mild)	G2 (Moderate)	G3 (Harsh)	Gx (Severe)
Group A H_2S	Less than 3	Less than 10	Less than 50	Greater than or equal to 50
SO_2, SO_3	Less than 10	Less than 100	Less than 300	Greater than or equal to 300
Cl_2	Less than 1	Less than 2	Less than 10	Greater than or equal to 10
NO_X	Less than 50	Less than 125	Less than 1250	Greater than or equal to 1250
Group B HF	Less than 1	Less than 2	Less than 10	Greater than or equal to 10
NH_3	Less than 500	Less than 10,000	Less than 25,000	Greater than or equal to 25,000
O_3	Less than 2	Less than 25	Less than 100	Greater than or equal to 100

Gas concentrations

Gas concentrations are for reference purposes only and are believed to approximate the reactivity levels, assuming relative humidity is less than 50 percent. For each 10 percent increase in relative humidity above 50 percent, or change in relative humidity by greater than 6 percent/hour, the severity level can be expected to increase by one

Conformal coating symbol

Conformally coated assemblies can be easily identified by a distinctive symbol located on the assembly. The symbol consists of a “C” that is surrounded by a solid diamond. The diamond universally symbolizes hardness. The symbol is intended to represent the hardened protection against harsh environments that conformal coating provides. The following figure shows the symbol on the faceplate of an Analog Output IOP.



Harsh Environment Enclosure

If the IOPs must be located in a severe environment, Honeywell offers a harsh environment enclosure that is capable of withstanding a Gx rated atmosphere. This enclosure features a sealed NEMA 4x stainless steel cabinet, a special 7-Slot card file with fans for air circulation to house conformally coated IOP and I/O Link Extender cards, and a 24 Vdc Power System that uses components found in the AC Only Power System. There is no active external cooling required for external ambient temperatures of up to 60°C (140°F). The IOPs interface with the local IOP in the control room by fiber optic I/O Link Extender. Standard IOP to FTA cables that are enclosed in sealed conduit provide the IOP to associated FTA interface. The FTAs are mounted in sealed NEMA 4x stainless steel cabinet that is provided by the user.

Model and assembly numbering schemes for conformal coating

Model numbers for conformally coated assemblies and upgrade kits are identified by a "MC" prefix, instead of the normal "MU" prefix for a noncoated assembly. For example, the model number for a Low Level Analog Input IOP with conformal coating is MC-PAIL02 and the model number for the same IOP without conformal coating is MU-PAIL02.

Typically, the part number's tab for a conformally coated assembly has the format "x5x" (non-CE Compliant) or "x7x" (CE Compliant), where "x" can be any number, 1 through 9. This provides a standard method of identifying conformally coated assemblies.

Appendix B

Fiber Optic Cable Routing

Routing methods

You can route Fiber optic cable underground (with direct burial cable), through the air (with outdoor aerial cable), or in cable and electrical wiring trays. Fiber optic cable is immune to interference from electromagnetic fields or transmissions. Fiber optic cable is safe to route through intrinsically safe areas with no danger of explosion.

Cable A and B separation

Route the A and B fiber links to the destination by different routes to avoid simultaneously damaging or cutting both cables.

ATTENTION

The difference in the total length of the routed Link A and Link B cables must be less than 500 meters (1640 feet) to limit the communications delay difference.

Direct burial hazards

You can bury heavy-duty cables directly in the ground. Use cable with a durable polyethylene.jacket material and an inner layer of steel armor to provide some protection from the effects for the following conditions -

- Freezing water,
- Heaving of rocks caused by the ground freezing,
- Ground disruption because of construction, and
- Rodents.

You can also choose to bury conduit or polyethylene pipe and run cable through it.

Aerial lashing methods

Aerial Lashing methods are similar to those used for electrical cables. Most cables are compatible with helical lashing, clamping, or tied mounting.

Vertical cable clamping

You must firmly clamp cable in vertical trays, raceways, or shafts at frequent intervals to support cable weight evenly. Clamping intervals can be as short as one meter (3.3 feet) outdoors to prevent wind slapping and minimize ice loading, or as long as 15 meters (49.2 feet) in interior locations.

Vertical fiber migration consideration

Fiber in vertical installations does not break because of its own weight; however, for vertical runs of 15 meters (49.2 feet), and greater, excess fiber can migrate downward. The crowding of excess fiber at the bottom can cause an increase in attenuation.

You can reduce this downward migration of fiber in vertical runs by placing loops in the cable, approximately 0.3 to 0.5 meter (1 to 1.5 feet) in diameter, at the top, bottom, and at 15-meter (50-feet) intervals.

Cable jacket indoor building code restrictions

Building code requirements frequently do not allow cables with polyethylene jackets to be used indoors. Jackets of polyvinyl chloride are frequently restricted to conduits, while floropolymer or other approved jacket material is required for use in cable trays and air plenums. Cable with suitable jacket material must be selected for the application.

Loose buffered cable usage

Where ambient temperature variations are 20°C (68°F) or greater on a daily basis, the life of the fibers can be significantly reduced. In applications where the ambient temperature is not controlled, loose buffered cable must be specified.

Loose buffered cable is available in polyethylene jacket material only. Fire codes may dictate that the indoor portion of the cable installation be in metal conduit, or if the temperature is controlled, a splice may be required to convert to a tight buffer cable with a PVC or Fluoride Co-Polymer jacket material.

Multiple-fiber cable requirements

Two fibers are required for one link, one for transmit and one for receive. Fiber loss is measured at 22°C (72°F) ±3° and is usually stated as a mean value. Individual fiber losses may be as much as 25 percent greater than the mean.

As insurance against future damage, such as fiber breakage, or encountering excessive loss in any one fiber, consider the inclusion of spare fibers. This is especially important for cables that have high installation cost.

Indoor cable bend restrictions

Fiber optic cable is easily damaged by over bending or kinking the cable, so a minimum bend radius is established for each different cable size and cable construction. Indoor cable is the most flexible and outdoor direct burial cable is the least flexible. The following table specifies the minimum bend radius for indoor cable.

In the table, short term minimum bend radius refers to the minimum bend radius that is safe during installation. Long term minimum bend radius refers to the minimum bend radius that is safe after the cable installation is completed and settled.

Fibers Per Cable	Minimum Bend Radius (Short Term)	Minimum Bend Radius (Long Term)
2	17.0 cm (6.7 in.)	13.0 cm (5.1 in.)
4	22.0 cm (8.7 in.)	16.5 cm (6.6 in.)
6	26.0 cm (6.7 in.)	20.0 cm (7.9 in.)
8	30.0 cm (6.7 in.)	23.0 cm (9.0 in.)

Cable Construction and Installation

Fiber optic cable selection

The selection of fiber optic cable is dependent upon satisfying installation and environmental requirements without exceeding the maximum optical losses. The factors to be considered when selecting the cable are:

- The total fiber optic cable losses,
- The cable requirements caused by the desired routing. Routing requirements can include direct burial, conduits, trays, raceways, plenums, etc., and
- The construction code requirements

62.5 micron cables

Use of 62.5 micron cable is controlled by Honeywell purchase specification 51190918 for indoor cable and Honeywell purchase specification 51190919 for outdoor cable. Indoor cables are available with 2, 4, or 6 fibers. Outdoor aerial and direct burial cables are available with 4, 6, or 8 fibers.

Installation precautions

The installation procedures for placement of fiber optic cables are the same as for electrical wires. Be sure to avoid yanking, flipping, or wrapping that can result in unnecessary tightening of the fibers. Do subject fiber optic cables to foot traffic or crushing forces. Avoid sharp bending and scraping at entrances and covers.

ATTENTION

We recommend that the fiber optic cable be installed by professional installation contractors. The installers will provide the cable, install the cable, attach ST-type connectors, and do the OTDR test.

Cable Splices and Connections

Cabling design considerations

When planning a system installation, design the cabling to have the minimum number of splices. For example, convert outdoor cable to indoor cable when entering a cabinet where the bend radius of outdoor cable will not fit in the cabinet. Where this splicing must be made, sufficient cable length must be provided for a splice loop. Thirty to 45 centimeters (12 to 18 inches) on each cable end is the usual allowance for a service loop. Also, when entering the equipment cabinet, sufficient cable length must be allowed for breakout (stripping and fanning out) and termination of the individual fibers.

Cable splice protection

Completed splices cannot withstand tensile forces and must be housed in a strain relief assembly. Moisture entry into the splice can cause degradation of performance; therefore, the splice enclosure must be sealed, and if necessary, the splice encapsulated to minimize moisture entry.

Cable breakout

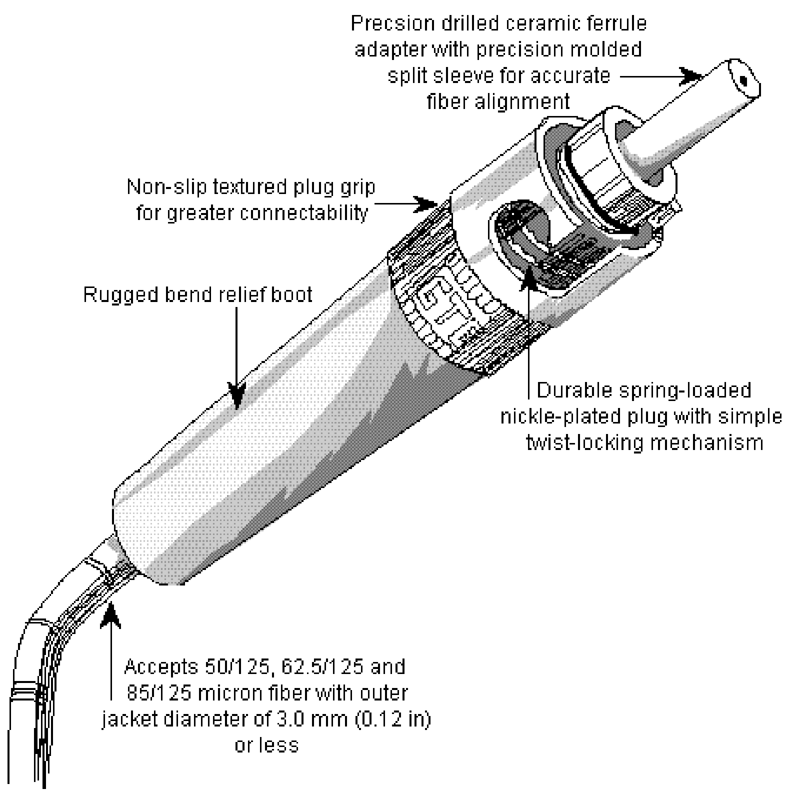
Breakout eliminates the outer sheath, leaving the more flexible individual fibers for routing within the cabinet. Tight buffer indoor cables provide strength members with each fiber, eliminating the need to use breakout kits to add strength members for each fiber.

Use of a breakout kit

In outdoor loose-buffered, gel-filled cable designs, there is no strength member or protective jacket for the individual fibers. To terminate and use this type of cable requires the use of a breakout or fan-out kit. The kit provides strength members with flexible jackets that are placed over the fibers after the outer jacket is removed. These kits can be installed over fibers as much as ten meters (33 feet) in length. The kit provides fiber protection for in-cabinet routing and termination.

Cables with connectors preinstalled

If the cable length is accurately determined and the cable does not have to be pulled through a conduit, the cables can be ordered with connectors installed on the ends. This requires less field skill and installation time. ST-type connectors, as shown in the following figure, can also be used as a means of splicing two cables; however, to minimize losses at or near maximum cable lengths, professional installation is required using fusion splices.



Signal Loss Budget

Calculation

The fiber cable signal loss budget is the difference between the transmit power and the minimum receiver sensitivity, minus the desired signal loss margin. The basic calculation formula is as follows.

Transmit Power - Receiver Sensitivity = Budgeted Losses

The values used differ for the standard type I/O Link Extender and the long distance type I/O Link Extender as follows.

Component	Standard Type Extender dB Level	Long Distance Type Extender dB Level.
Transmitter (62.5 micron fiber)	-16.0	-18.0
Receiver	(-) -24.0 / 8.0	(-) -31.5 / 13.5
Less power loss over time	(-) 2.5 / power in next row	(-) 4.5 / power in next row
Available optical cable power	5.5	9.0

ATTENTION

Because the maximum transmitter output level is -7 dB, and the maximum receiver input level is -10 dB, the receiver may be overdriven on a short link and may require a 3 dB attenuator. Connector allowances for the transmitter and receiver are included in the above power declaration.

Types of splices

The two types of splices are:

- Mechanical, and
- Fusion.

The mechanical-type of splice consists of a glass tube into which the fiber is secured by ultra violet (UV) curable epoxy.

The fusion-type splice is produced by carefully aligning the fibers and then fusing them together by heating the fibers.

In both cases, the signal loss in the resulting splice is very dependent upon the skill of the installer. The losses at all splices and cable installations need to be certified and recorded at the time of installation for future reference.

The following tables list typical cable and power losses for the standard and long distance type I/O Link Extenders based on the type of splice and cable used. .

Type of Splice	Average Power Loss (dB)	Maximum Power Loss (dB)
Fusion	0.2	0.3
Mechanical	0.3	0.5
ST - Connector	0.5	0.9

Type of Cable	Average Cable Loss (dB)		Maximum Cable Loss (dB)	
	Standard Extender (@ 850 nm)	***Long Distance Extender (@ 1300 nm)***	***Standard Extender (@ 850 nm)***	***Long Distance Extender (@ 1300 nm)***
High Performance	3.75	1.5	4.0	2.0
Premium	3.50	1.0	4.0	2.0

Cable distance calculation

Use one of the following formulas to calculate the maximum distance the cable can reliably span for a standard type or long distance type I/O Link Extender, respectively.

Standard Type:	5.5 - (losses in Splices) / Maximum cable loss in dB/km	= D, the distance
Long Distance Type:	9.0 - (losses in Splices) / Maximum cable loss in dB/km	= D, the distance

Example: the maximum distance for a Premium Performance cable with two fusion splices can be calculated as follows using power and cable loss values from the previous tables for a given I/O Link Extender type.

Standard Type:	5.5 - (2 x 0.3) / 4	= 1.2 km
Long Distance Type:	9.0 - (2 x 0.3) / 2	= 4.2 km

Example: the maximum distance for High Performance cable with two mechanical splices can be calculated as follows using power and cable loss values from the previous tables for a given I/O Link Extender type.

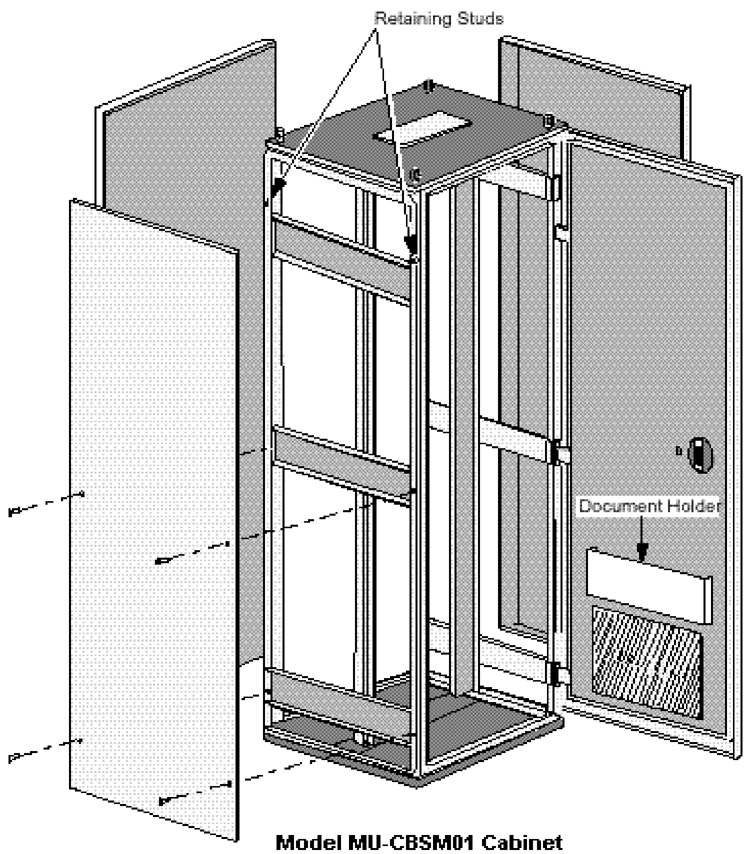
Standard Type:	5.5 - (2 x 0.5) / 4	= 1.12 km
Long Distance Type:	9.0 - (2 x 0.5) / 2	= 4.0 km

Appendix C

Model MU-CBSM01/MU-CBDM01 Cabinets

Model MU-CBSM01 Single-access cabinet

The single-access cabinet has one equipment entry point and that is in the front of the cabinet through a single door. The IOP card files, Power System, and the FTA Mounting Channels are installed inside the single-access door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBSM01 single-access cabinet.

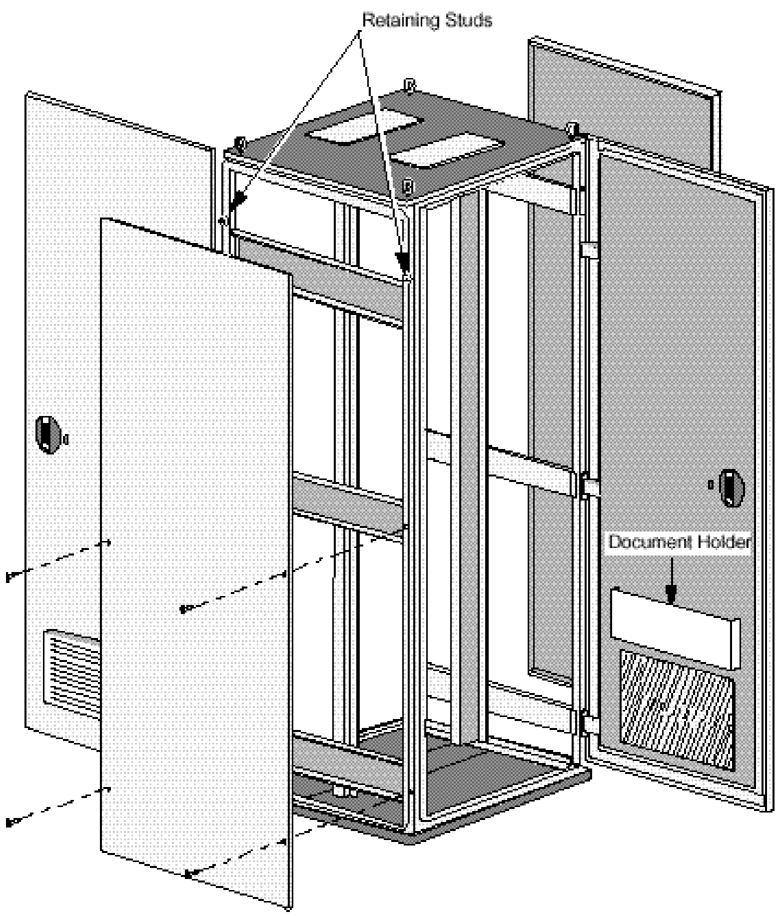


Model MU-CBSM01 Cabinet

Dimension	Width	Depth	Height
Single Access	.8 m/31.5 in.	.55 m/21.75	2.1 m/81.5 in.

Model MU-CBDM01 Dual-access cabinet

The dual-access cabinet has two entry doors. The IOP card files and the Power System are mounted inside the front access door. The FTA Mounting Channels are normally installed inside the rear door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBDM01 dual-access cabinet.



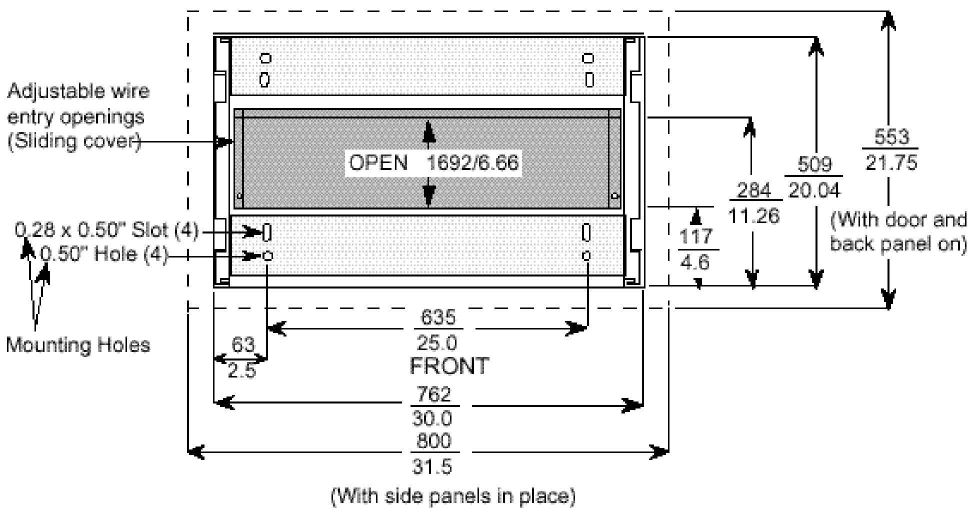
Model MU-CBDM01 Cabinet

Dimensions	Width	Depth	Height
Dual Access	.8 m/31.5 in.	.8 m/31.5 in.	2.1 m/81.5 in.

Top and bottom cabinet entry

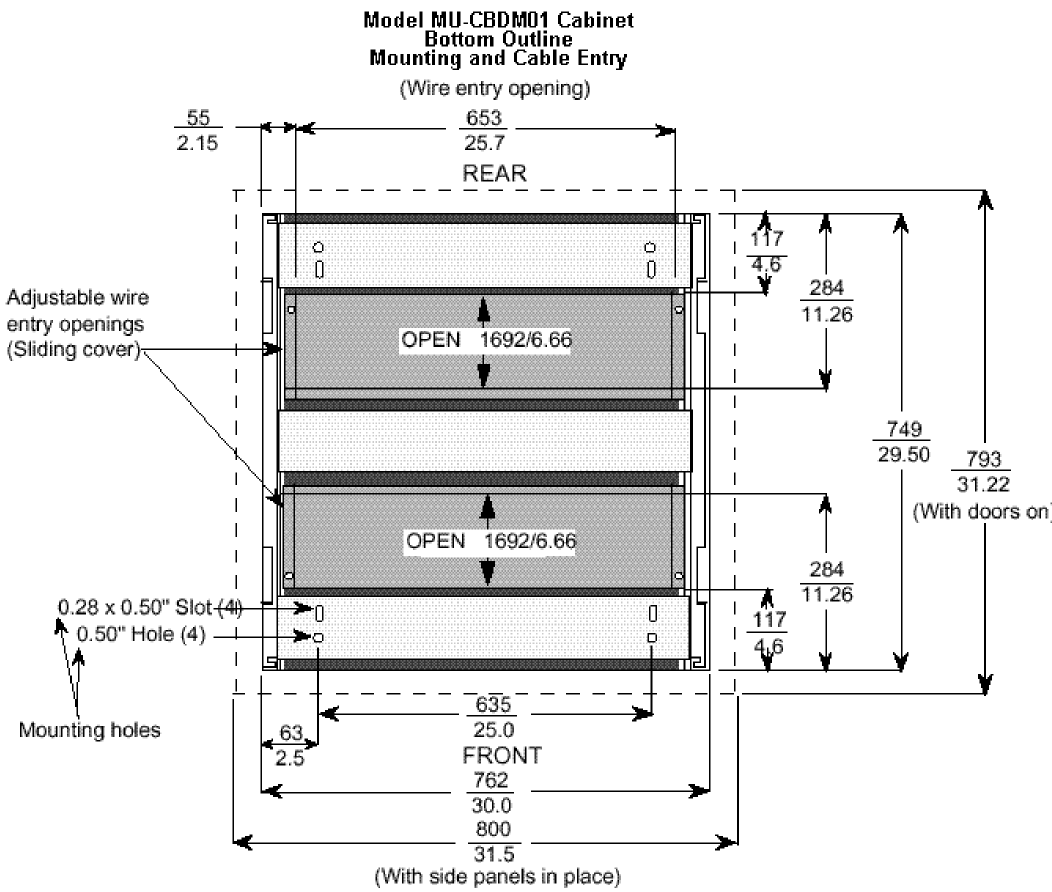
Both cabinets are NEMA 1 rated and support top and bottom entry for process control wiring. Top entry requires removal of the top panel(s), and/or associated fan assemblies, before entry holes can be punched in the panel. Honeywell will prepunch the holes if specified when ordering the cabinet. The following figures are illustrations of the bottom cable entry slots for the single and dual cabinets, respectively.

Model MU-CBSM01 Cabinet
Bottom Outline
Mounting and Cable Entry



Foot print ⟹ 800 x 572 mm/31.5 x 22.5 " (External dimensions - door and panels installed)

Note: Dimensions are in millimeters/inches.



Foot print ⟹ 800 x 800 mm/31.5 x 31.5 " (External dimensions - doors and panels installed)

Note: Dimensions are in millimeters/inches.

Independent cabinet entry

The dual-access cabinet has two independent entry doors. A single access cabinet has only one entry side. Card files and the Power System, or FTA Mounting Channels can be installed in either side of the cabinet without being constrained by the equipment installed in the other side of the cabinet. The cabinet can be ordered with doors hinged on either the left or right side. The door latch is recessed and lockable.

Cabinet complexing

A maximum of four cabinets can be complexed together without intervening side panels by a complexing kit, Honeywell part number 51109532-200 (single access cabinet) or 51109532-100 (dual access cabinet).

NEMA 12

NEMA 12 rated cabinets can be ordered from Honeywell.

Cabinet cooling

Cabinet cooling is accomplished by the use of one or more fan assemblies that are mounted over appropriate cutouts in the cabinet top. Use of a fan assembly is mandatory for a cabinet entry side containing card files or a Power System. Because of power dissipation, the cabinet configuration determines if a fan assembly is required for a cabinet entry side containing Field Termination Assemblies (FTAs). A fan assembly is mandatory when Galvanically Isolated FTAs are installed. Fan assemblies are available for voltages and frequencies noted below:

- MU-FAN501 Cabinet Fan Assembly (240 Vac, 50/60 Hz)
- MU-FAN601 Cabinet Fan Assembly (120 Vac, 50/60 Hz)
- MU/MC-FAN511 Cabinet Fan Assembly (240 Vac, 50/60 Hz) with alarm contact
- MU/MC-FAN611 Cabinet Fan Assembly (120 Vac, 50/60 Hz) with alarm contact

A blank plate is available to cover the hole(s) in the top of the cabinet in the event a fan assembly is not needed. The fan opening cabinet top cover plate is Honeywell part number 51304098-200.

Mounting hardware for C200 Controller chassis

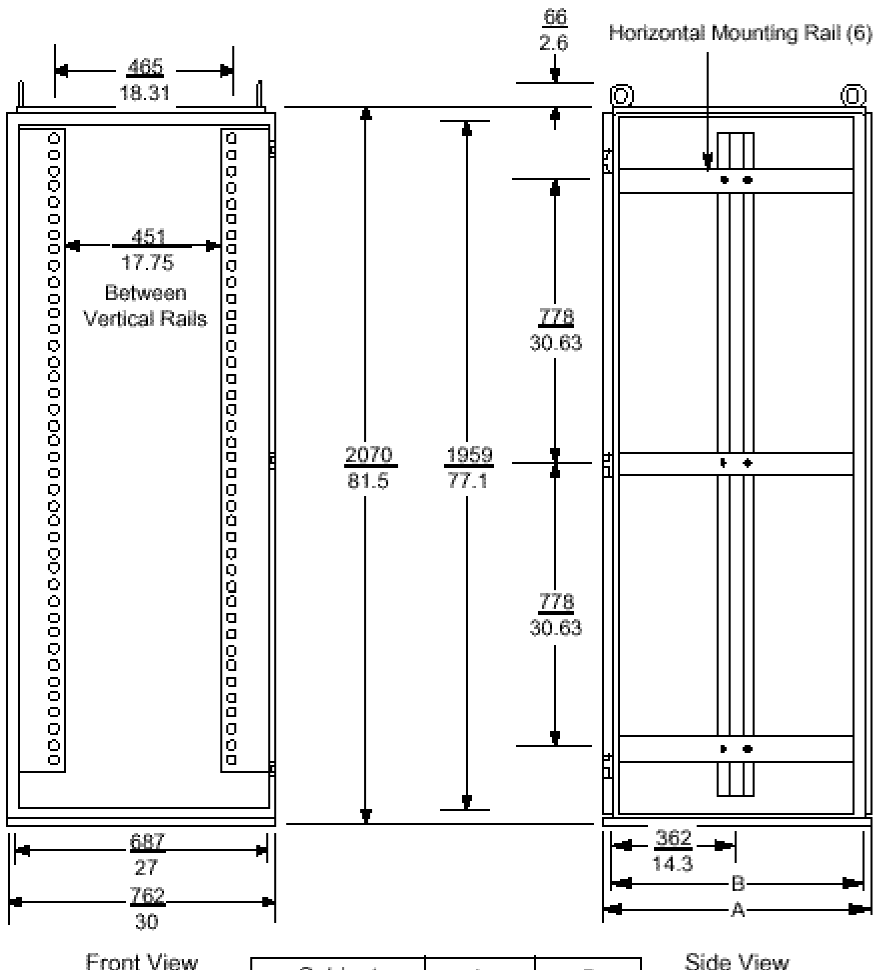
One bracket mounting plate model MU-PSBP01 (part number 51309593-100) and one Bracket Assembly model MU-PSBK01 (part number 51403454-100) are required to mount one 10-slot or 13-slot chassis in the Experion system. You can mount a second 10-slot or 13-slot chassis to the same bracket mounting plate with another bracket assembly.

This means the bracket mounting plate accommodates either one or two bracket assemblies for mounting either one or two chassis.

Cabinet internal structure

As shown in the following figure, the cabinet is provided with an internal structure ("infrastructure") that is capable of accepting a 10-slot Process Controller chassis or a 13-slot one with cabinet modifications, card file assemblies, Power Systems, and FTA Mounting Channels. When installing FTAs, you must specify the FTA Mounting Channels as discussed in the following *FTA Mounting Channel Descriptions* section in this Appendix.

Model MU-CBSM01/MU-CBDM01 Cabinet Interior Dimensions



Cabinet	A	B
Dual Access	793 31.2	749 29.5
Single Access	552 21.7	508 20

Note: Dimensions are in millimeters/inches.

Equipment Configurations

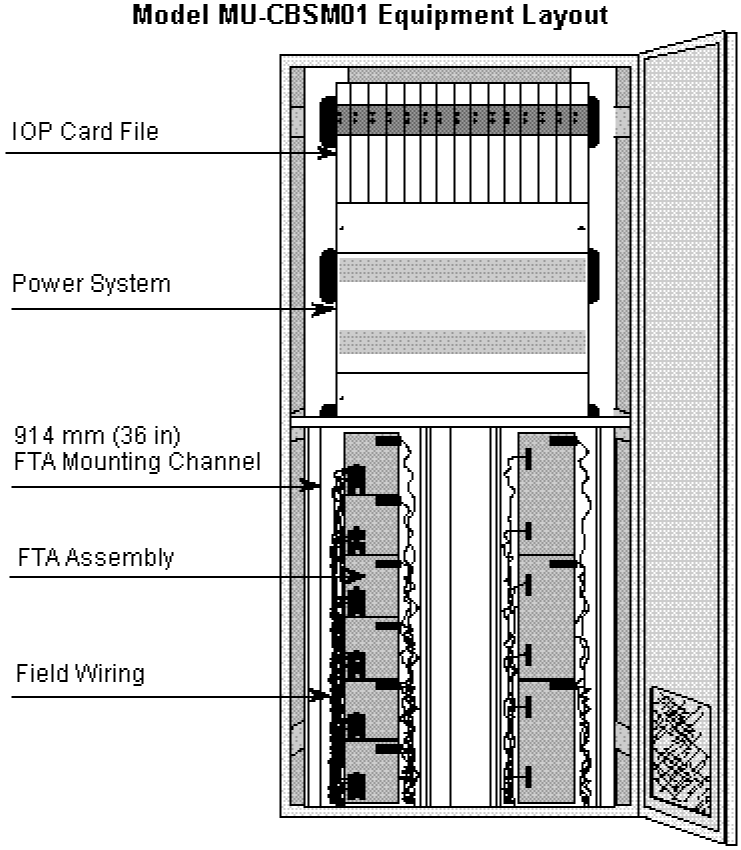
Cabinet equipment layout

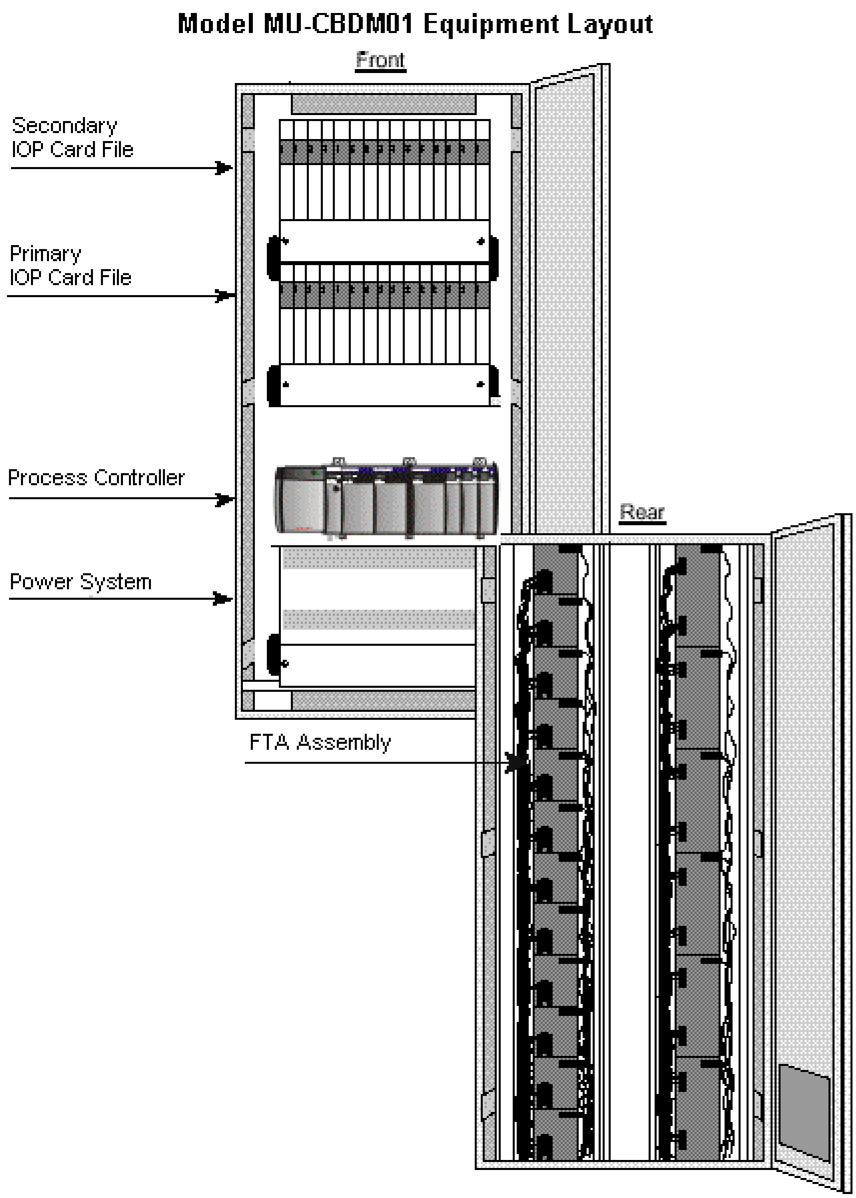
The Process Controller chassis, IOP card files, Power System, and FTA Mounting Channels install in the single- and dual-access cabinets as shown in following figures.

ATTENTION

Be sure you mount the C200 Controller chassis immediately above the power system in the bottom of the cabinet to provide the best thermal dynamics within the cabinet.

Model MU-CBSM01 Equipment Layout




Model MU-CBDM01 Equipment Layout
Front
Secondary
IOP Card File
Primary
IOP Card File
Process Controller
Power System
Rear
FTA Assembly

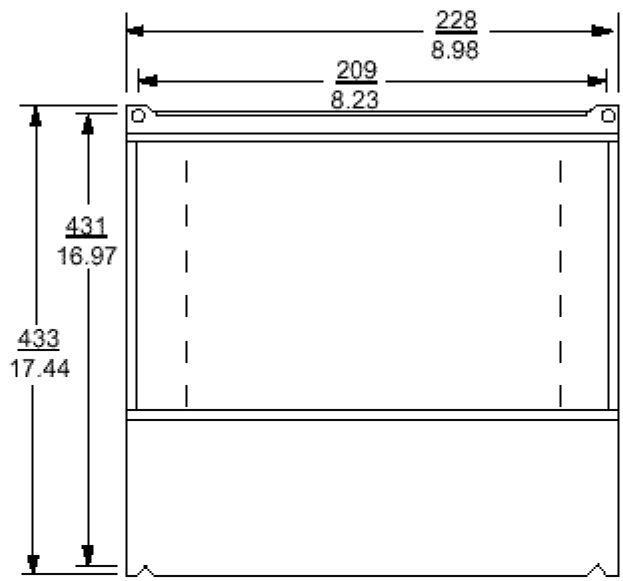
Equipment dimension references

The following figures show the mounting dimensions for 7-slot and 15-slot card files and the power system for reference. Please see the *Chassis-Mounting Dimensions* section in the Control Hardware Installation Guide in Knowledge builder for Process Controller mounting dimensions.

ATTENTION

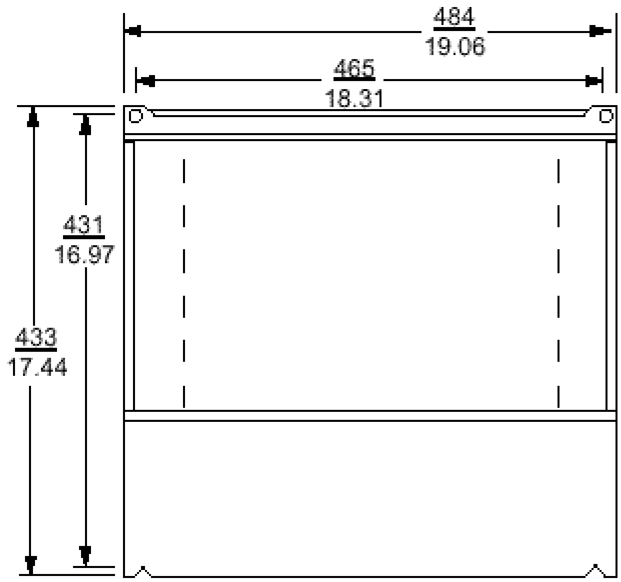
- A 10-slot Process Controller chassis can fit inside the IOP cabinet without modification. If you remove the trim panels from inside the cabinet, you can fit a 13-slot chassis inside the IOP cabinet. You can mount larger 17-slot chassis external to the IOP cabinet as long as the 10 meter (33 feet) "in-cabinet" I/O Link electrical length requirement is not exceeded.
- Do **not** mount more than two (2) Process Controller chassis in an IOP cabinet.

7-Slot Card File Mounting Dimensions



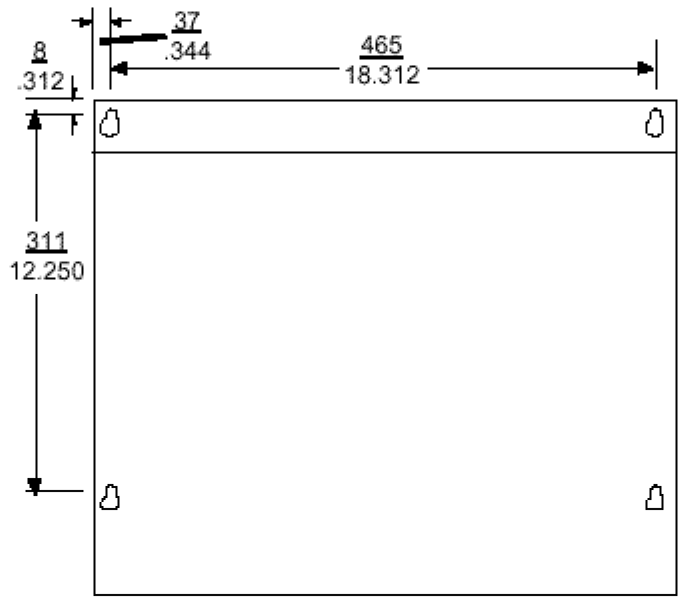
Note: Dimensions are in millimeters/inches.

15-Slot Card File Mounting Dimensions



Note: Dimensions are in millimeters/inches.

Power System Mounting Dimensions

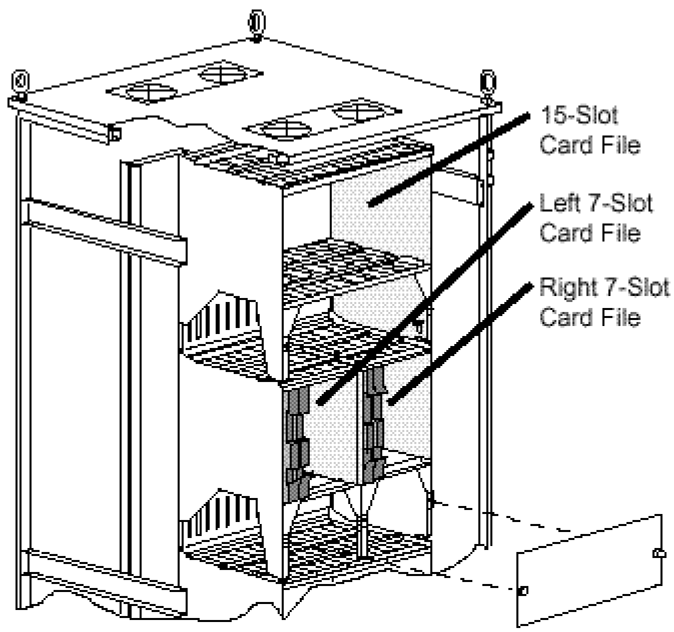


Note: Dimensions are in millimeters/inches.

7-Slot and 15-Slot card files installation

There are three types of card file assemblies, Left 7-Slot, Right 7-Slot, and 15-Slot. The Left and Right 7-Slot card files are the same size and are intended to be mounted adjacent to each other on the cabinet's 19-inch RETMA mounting infrastructure by using appropriate hardware. The 15-Slot card file mounts alone on the 19-inch RETMA mounting infrastructure. The following figure illustrates the installation of Left and Right 7-Slot and 15-Slot card files in a side-by-side configuration.

Typical 7-Slot and 15-Slot Card File Installation



FTA Mounting Channel Configurations

Vertical FTA Mounting Channel layout

ATTENTION

- It was previously a requirement that Galvanically Isolated, Intrinsically Safe (GI/IS) FTAs had to be mounted on horizontally oriented FTA Mounting Channels in an IOP cabinet. This is no longer a requirement due to 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-Galvanically Isolated) FTAs, and the wiring to them, be properly separated in the cabinet.

The vertical FTA Mounting Channel length, approximately 93 centimeters (36 inches) is approximately half the height of the cabinet. The FTA Mounting Channels can be mounted adjacent to each other in this vertical area. The FTA mounting configurations will allow:

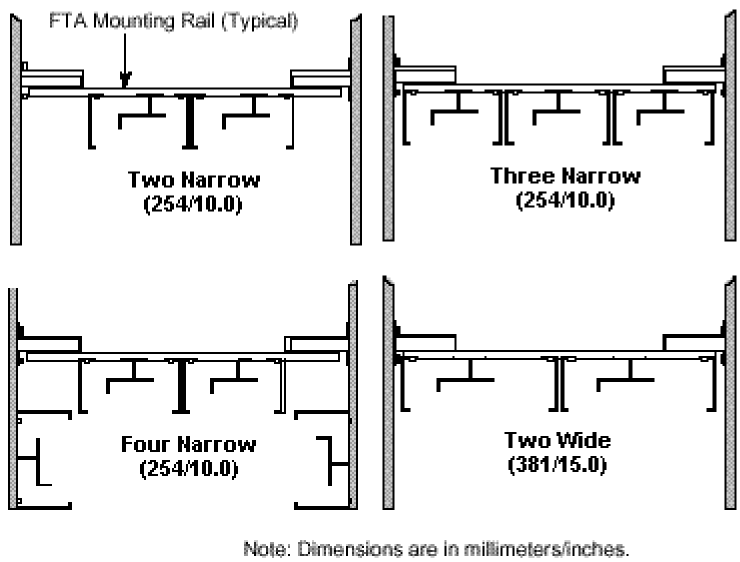
- up to four narrow channels or
- up to three wide channels.

The FTA Mounting Channels can be mounted adjacent to each other in the area below the Power System in a single-access cabinet as shown in the previous cabinet layout figures.

In the dual-access cabinet, one FTA Mounting Channel is normally installed above another, adjacently in pairs, as shown in the previous cabinet layout figures.

Normal Vertical FTA Mounting Channel orientation

When Standard type FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “normal” position where field wiring enters the left channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the right channel of the FTA Mounting Channel. The following figure shows the normal orientations for four typical vertical FTA Mounting Channel layouts in a cabinet.



Inverted Vertical FTA Mounting Channel orientation

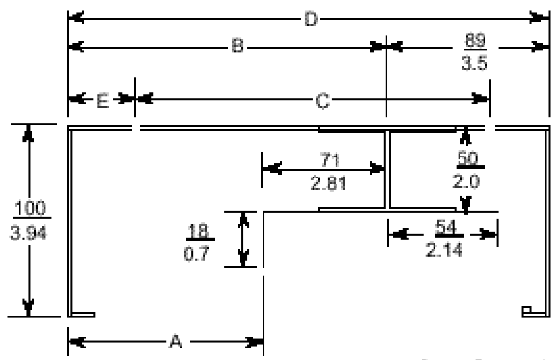
When Galvanically Isolated FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “inverted” position where field wiring enters the right channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the left channel of the FTA Mounting Channel.

CAUTION

Do not mount Galvanically Isolated FTAs and Standard FTAs on the same FTA Mounting Channel.

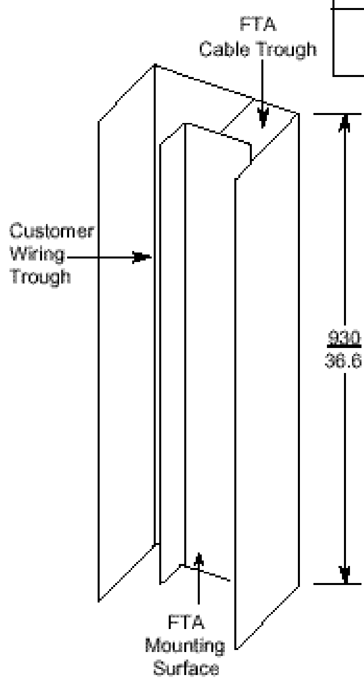
FTA Mounting Channel dimensions

Vertical FTA Mounting Channels are available in narrow and wide widths as shown in the following figure.



Cross Section View

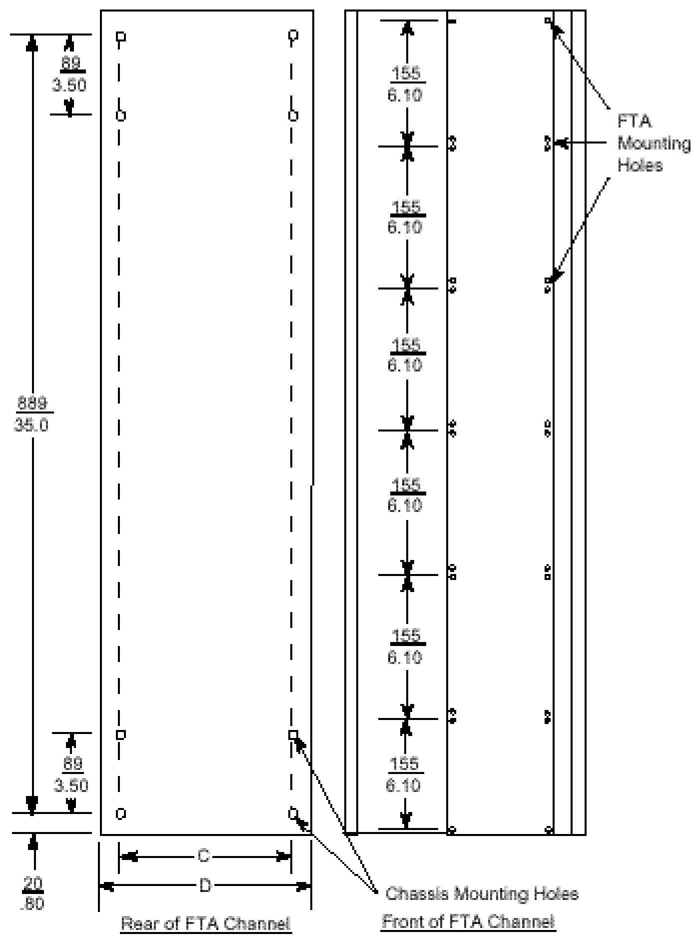
Channel Size	A	B	C	D	E
Wide	220 8.7	292 11.5	305 12.0	381 15.0	64 2.5
Narrow	94 3.7	165 6.5	178 7.0	254 10.0	64 2.5



Note: Dimensions are in millimeters/inches.

FTA installation hole locations

The following figure shows the locations of the FTA mounting holes on the FTA Mounting Channel and the holes used to install the FTA Mounting Channel.



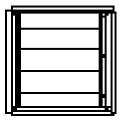
Note: See the previous figure for C and D dimensions.
Dimensions are in millimeters/inches.

IOP Cabinet Floor Planning

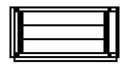
Floor template

The following figure is a cabinet floor template that will help you in planning your facility layout when installing IOP cabinets. The following notes pertain to the template in the following figure.

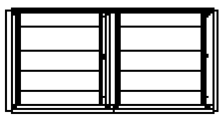
- Cabinet scale is 0.25 inch (6 millimeters) = 1 foot (0.3 meter).
- A dual access cabinet is approximately 30 inches (0.7 meter) by 30 inches (0.7 meter). The side and door panels add 1.5 inches (38 millimeters) to each cabinet dimension. When cabinets are complexed, 1.5 inches (38 millimeters) is added to the total complex dimensions.
- A single access cabinet is approximately 30 inches (0.7 meter) wide and 21 inches (0.5 meter) deep. The side panels and the single door panel add 0.75 inch (19 millimeters) to the cabinet depth and inches (38 millimeters) to the cabinet width. When cabinets are complexed, 0.75 inch (19 millimeters) is added to the complex depth and 1.5 inches (38 millimeters) is added to the total complex width.



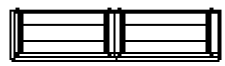
Single Dual Access Cabinet



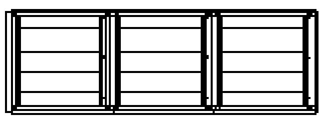
Single Single Access Cabinet



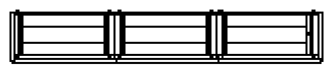
Dual Dual Access Cabinet Complex



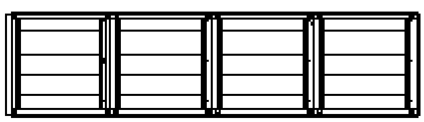
Dual Single Access Cabinet Complex



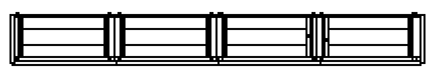
Triple Dual Access Cabinet Complex



Triple Single Access Cabinet Complex



Quad Dual Access Cabinet Complex



Quad Single Access Cabinet Complex

Appendix D

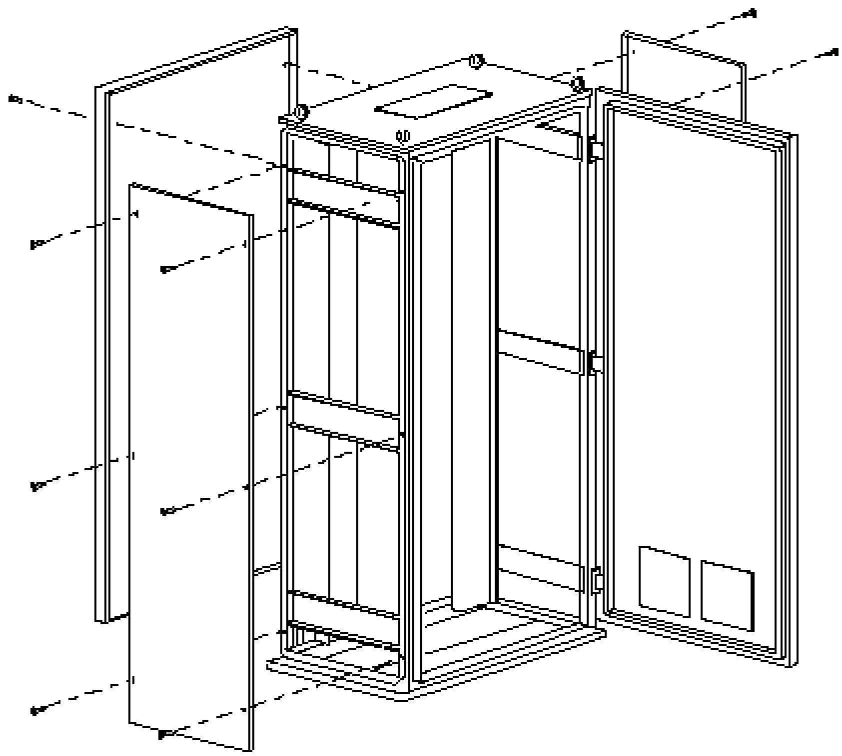
Model MU-C8SFR1/MU- C8DFR1 Cabinets

CE Compliant

The model MU-C8SFR1 and MU-C8DFR1 cabinets are CE Compliant. These cabinets are also referred to as Rittal cabinets because Rittal is the manufacturer.

Model MU-C8SFR1 Single-access cabinet

The single-access cabinet has one equipment entry point and that is in the front of the cabinet through a single door. The IOP card files, Power System, and the FTA Mounting Channels are installed inside the single-access door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-C8SFR1 single-access cabinet.

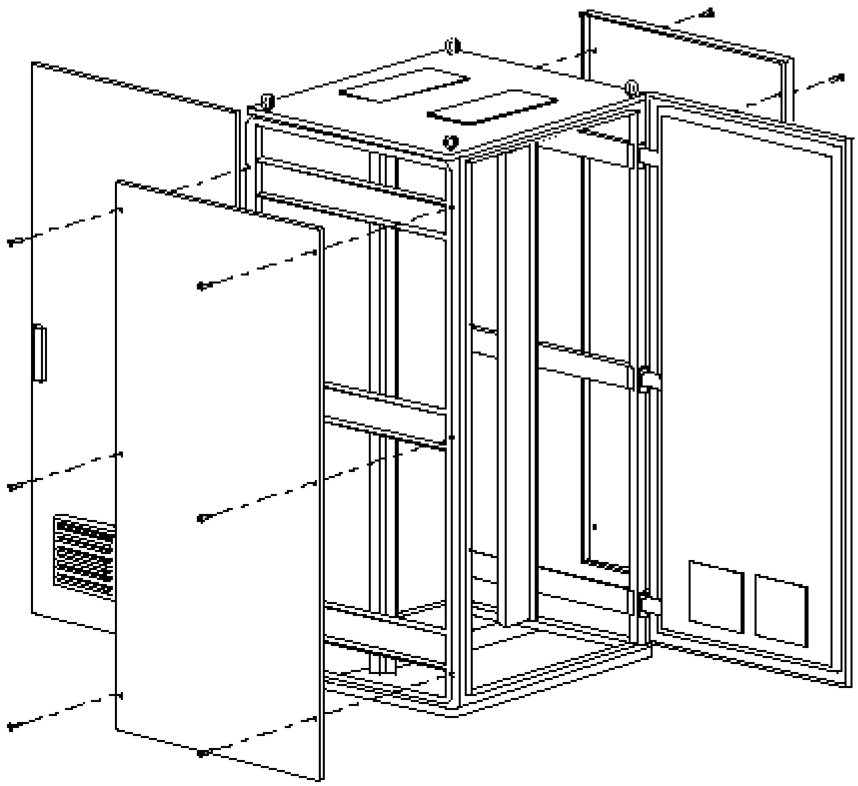


Model MU-C8SFR1 Cabinet

Dimension	Width	Depth	Height
Single Access	0.8 m/31.49 in.	0.5 m/19.68 in.	2 m/78.9 in.

Model MU-C8DFR1 Dual-access cabinet

The dual-access cabinet has two entry doors. The IOP card files and the Power System are mounted inside the front access door. The FTA Mounting Channels are normally installed inside the rear door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-C8DFR1 dual-access cabinet.



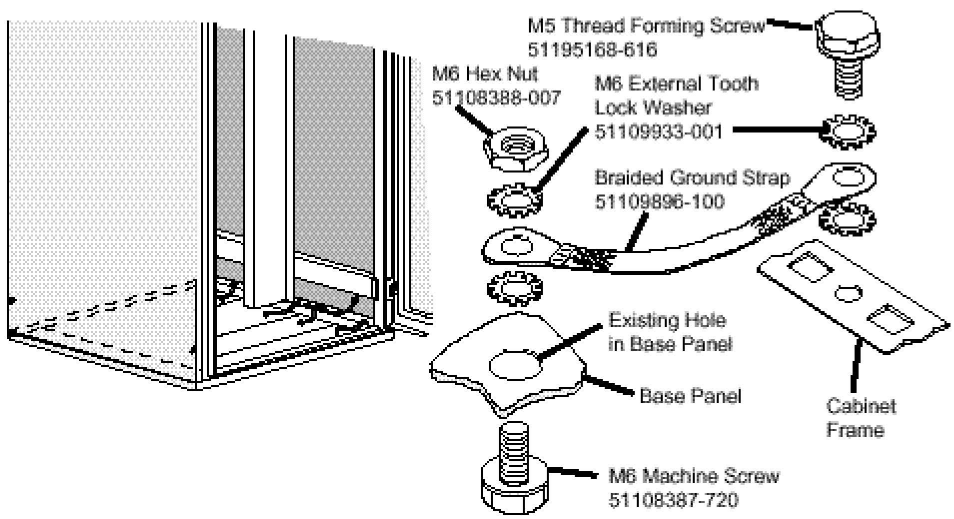
Model MU-C8DFR1 Cabinet

Dimensions	Width	Depth	Height
Dual Access	0.8 m/31.49 in.	0.8 m/31.49 in.	2 m/78.9 in.

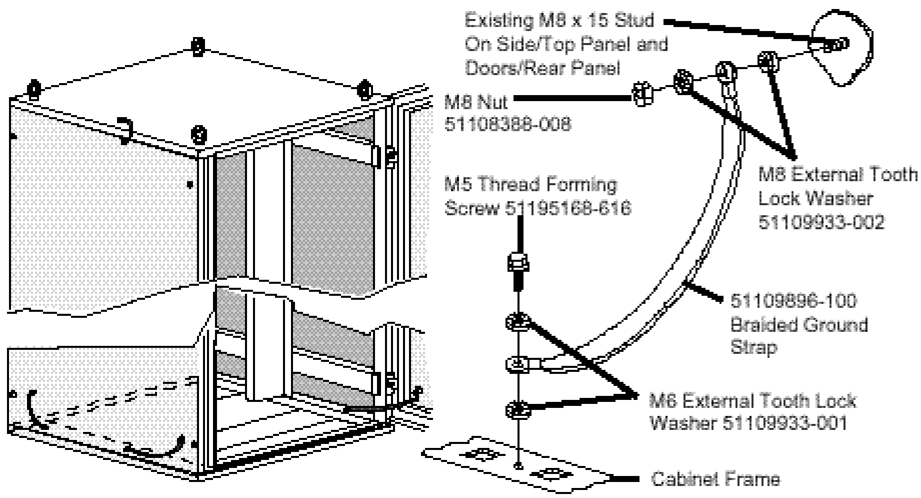
Cabinet grounding methods

CE Compliance versions of the cabinet are identified by the abundance of grounding straps inside the cabinet. All panels and doors are grounded to the cabinet frame by the straps. The following figures show the methods used to ground the cabinet panels and doors.

Cabinet Base Panel Grounding Method



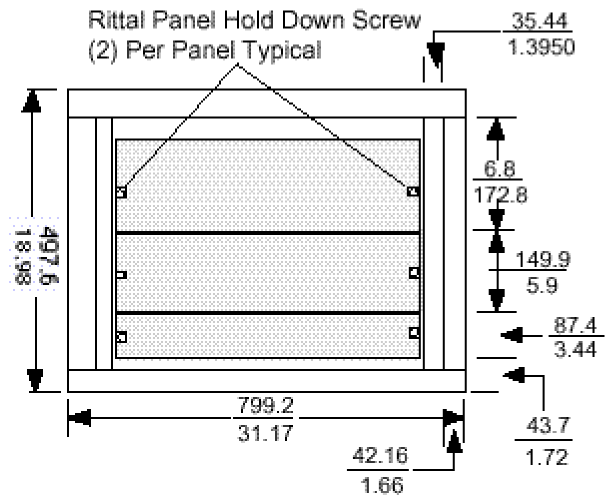
Cabinet Panel and Door Grounding Method



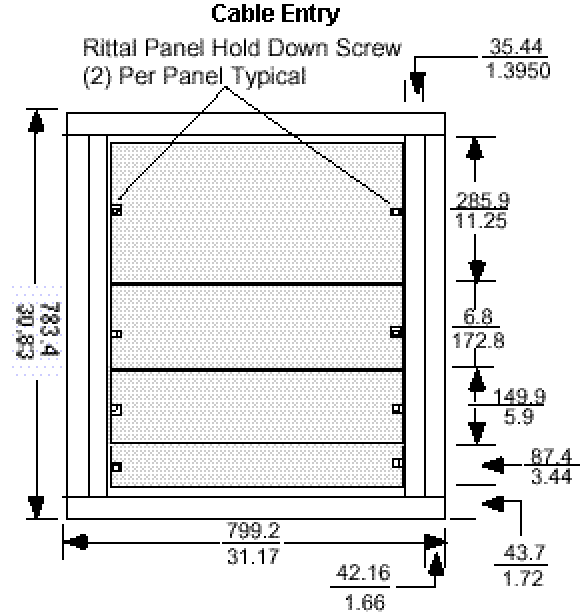
Top and bottom cabinet entry

Both cabinets are NEMA 1 rated and support top and bottom entry for process control wiring. Top entry requires removal of the top panel(s), and/or associated fan assemblies, before entry holes can be punched in the panel. Honeywell will prepunch the holes if specified when ordering the cabinet. The following figures are illustrations of the bottom cable entry slots for the single and dual cabinets, respectively.

Model MU-C8SFR1
Bottom Outline
Cable Entry



Model MU-C8DFR1
Bottom Outline
Cable Entry



Independent cabinet entry

The dual-access cabinet has two independent entry doors. A single access cabinet has only one entry side. Card files and the Power System, or FTA Mounting Channels can be installed in either side of the cabinet without being constrained by the equipment installed in the other side of the cabinet. The cabinet can be ordered with doors hinged on either the left or right side.

Cabinet complexing

A maximum of four cabinets can be complexed together without intervening side panels by a complexing kit, Honeywell part number 51109524-200 (single access cabinet) or 51109524-100 (dual access cabinet).

NEMA 12

NEMA 12 rated cabinets can be ordered from Honeywell.

Cabinet cooling

Cabinet cooling is accomplished by the use of one or more fan assemblies that are mounted over appropriate cutouts in the cabinet top. Use of a fan assembly is mandatory for a cabinet entry side containing card files or a Power System. Because of power dissipation, the cabinet configuration determines if a fan assembly is required for a cabinet entry side containing Field Termination Assemblies (FTAs). A fan assembly is mandatory when Galvanically Isolated FTAs are installed. Fan assemblies are available for voltages and frequencies noted below:

- MU-FAN501 Cabinet Fan Assembly (240 VAC, 50/60 HZ)
- MU-FAN601 Cabinet Fan Assembly (120 VAC, 50/60 HZ)
- MU/MC-FAN511 Cabinet Fan Assembly (240 VAC, 50/60 HZ) with alarm contact
- MU/MC-FAN611 Cabinet Fan Assembly (120 VAC, 50/60 HZ) with alarm contact

A blank plate is available to cover the hole(s) in the top of the cabinet in the event a fan assembly is not needed. The fan opening cabinet top cover plate is Honeywell part number 51304098-200.

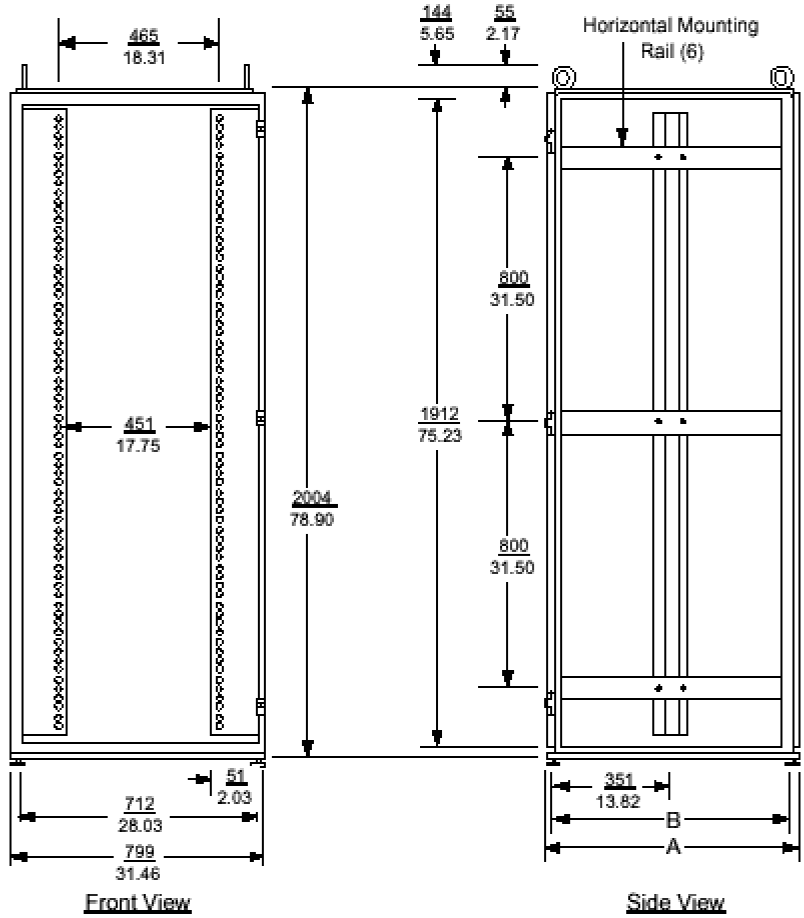
Mounting hardware for C200 (Process) Controller chassis

One bracket mounting plate model MU-PSBP01 (part number 51309593-100) and one Bracket Assembly model MU-PSBK01 (part number 51403454-100) are required to mount one 10-slot or 13-slot chassis in the Experion system. You can mount a second 10-slot or 13-slot chassis to the same bracket mounting plate with another bracket assembly. This means the bracket mounting plate accommodates either one or two bracket assemblies for mounting either one or two chassis.

Cabinet internal structure

As shown in the following figure, the cabinet is provided with an internal structure ("infrastructure") that is capable of accepting a 10-slot Process Controller chassis or a 13-slot one with cabinet modifications, card file assemblies, Power Systems, and FTA Mounting Channels. When installing FTAs, you must specify the FTA Mounting Channels as discussed in the following *FTA Mounting Channel Descriptions* section in this Appendix.

Model MU-C8SFR1/MU-C8DFR1 Cabinet Interior Dimensions



Cabinet	A	B
Dual Access	789 31.06	702 27.64
Single Access	489 19.25	402 15.83

Note: Dimensions are in millimeters/inches.

Equipment Configurations

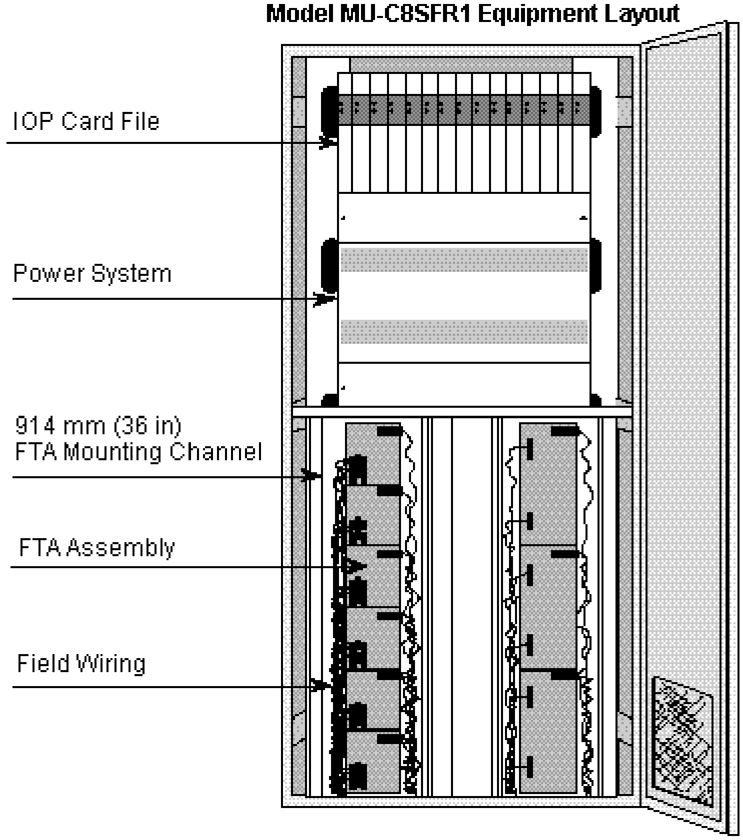
Cabinet equipment layout

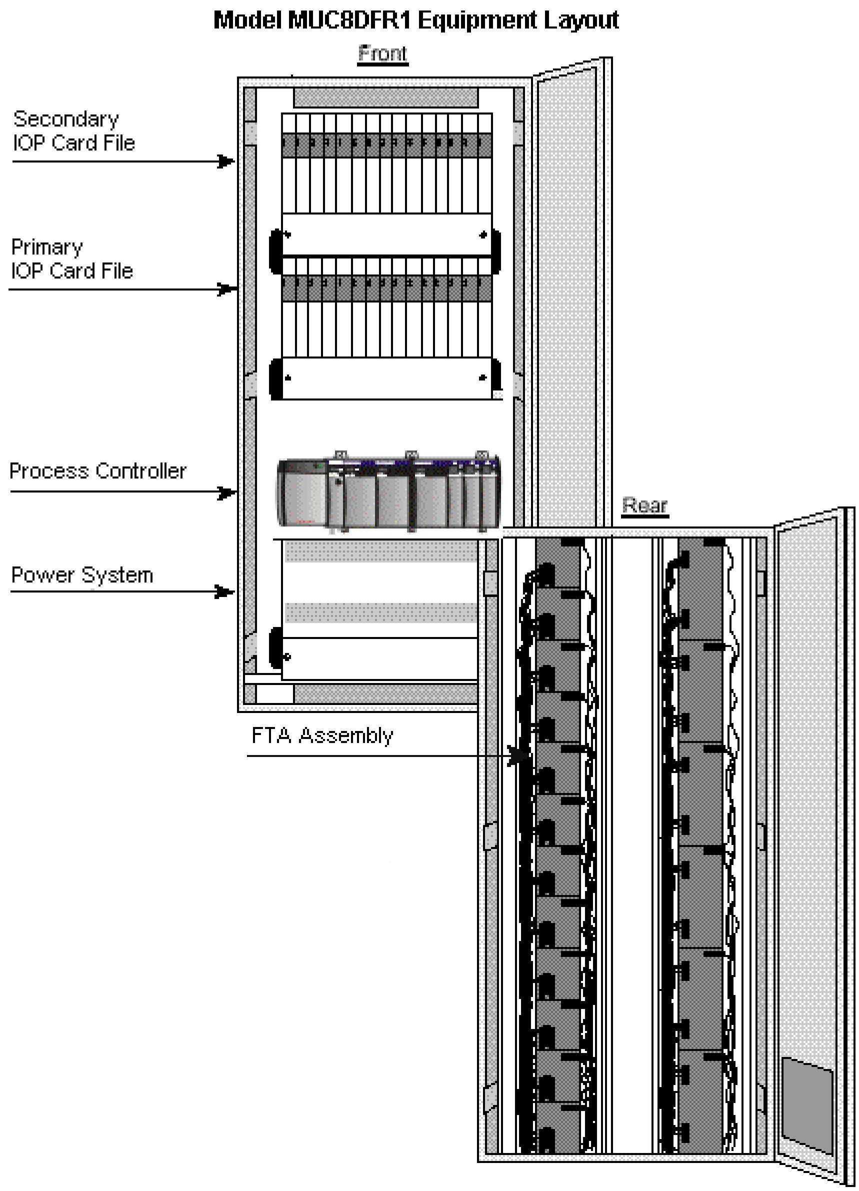
The Process Controller chassis, IOP card files, Power System, and FTA Mounting Channels install in the single- and dual-access cabinets as shown in following figures.

ATTENTION

- Be sure you mount the C200 (Process) Controller chassis immediately above the power system in the bottom of the cabinet to provide the best thermal dynamics within the cabinet.
- The maximum ambient temperature limit outside the cabinet is reduced from +50 degrees C (122 degrees F) to +40 degrees C (104 degrees F), when a model MU-C8SFR1 or MU-C8DFR1 cabinet **without** internal cabinet trim is used. Including trim or using another model cabinet (with or without internal trim) restores the limit to +50 degrees C (122 degrees F).

Model MU-C8SFR1 Equipment Layout




Model MUC8DFR1 Equipment Layout
Front
Secondary
IOP Card File
Primary
IOP Card File
Process Controller
Power System
Rear
FTA Assembly

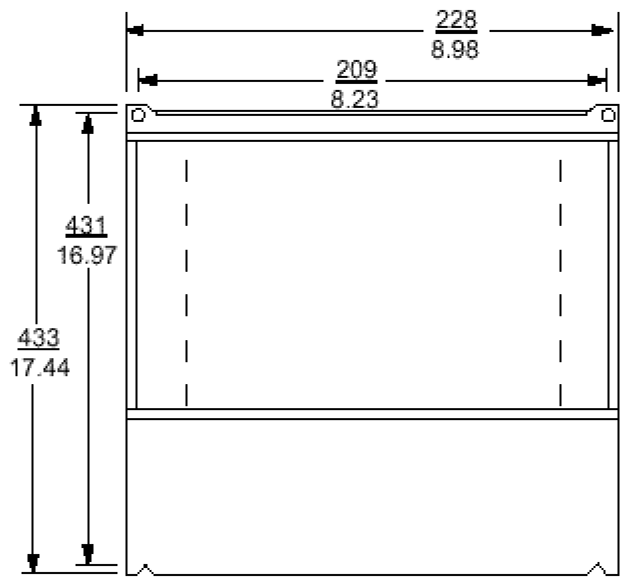
Equipment dimension references

The following figures show the mounting dimensions for 7-slot and 15-slot card files and the power system for reference. Please see the *Chassis-Mounting Dimensions* section in the Control Hardware Installation Guide in Knowledge builder for Process Controller mounting dimensions.

ATTENTION

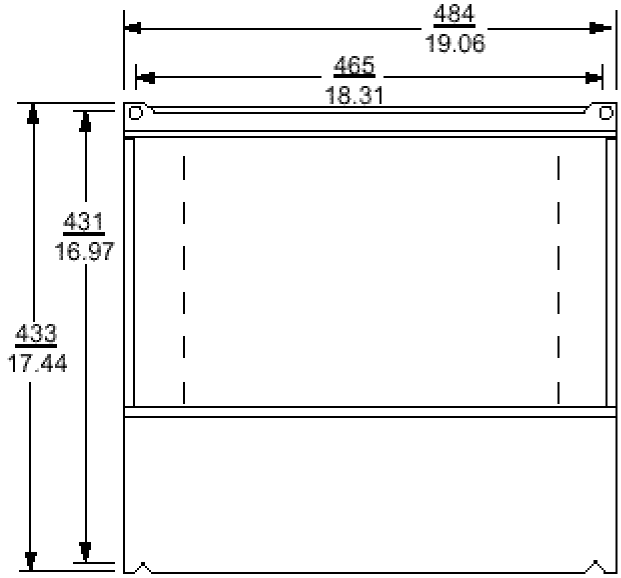
- A 10-slot Process Controller chassis can fit inside the IOP cabinet without modification. If you remove the trim panels from inside the cabinet, you can fit a 13-slot chassis inside the IOP cabinet. You can mount larger 17-slot chassis external to the IOP cabinet as long as the 10 meter (33 feet) “in-cabinet” I/O Link electrical length requirement is not exceeded.
- Do **not** mount more than two (2) Process Controller chassis in an IOP cabinet.

7-Slot Card File Mounting Dimensions



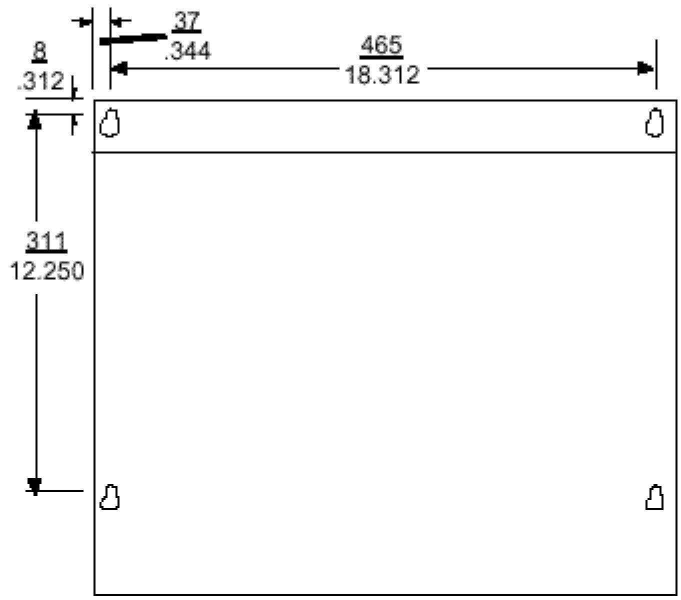
Note: Dimensions are in millimeters/inches.

15-Slot Card File Mounting Dimensions



Note: Dimensions are in millimeters/inches.

Power System Mounting Dimensions

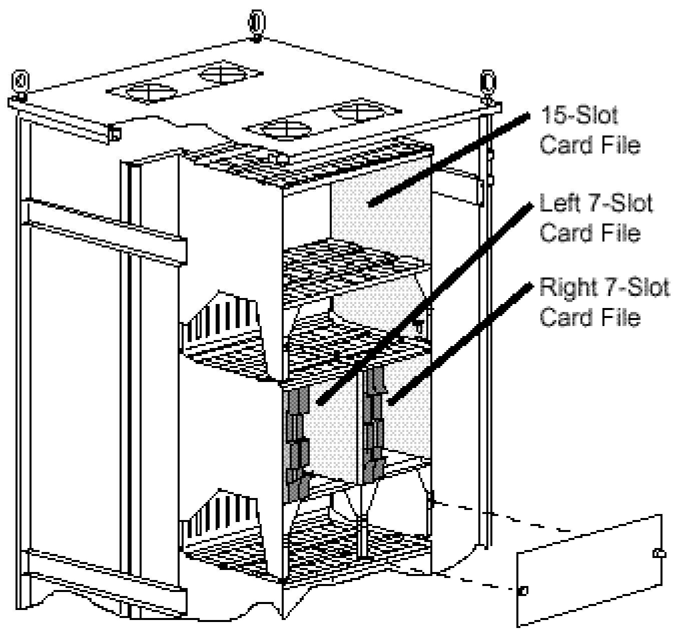


Note: Dimensions are in millimeters/inches.

7-Slot and 15-Slot card files installation

There are three types of card file assemblies, Left 7-Slot, Right 7-Slot, and 15-Slot. The Left and Right 7-Slot card files are the same size and are intended to be mounted adjacent to each other on the cabinet's 19-inch RETMA mounting infrastructure by using appropriate hardware. The 15-Slot card file mounts alone on the 19-inch RETMA mounting infrastructure. The following figure illustrates the installation of Left and Right 7-Slot and 15-Slot card files in a side-by-side configuration.

Typical 7-Slot and 15-Slot Card File Installation



FTA Mounting Channel Configurations

Vertical FTA Mounting Channel layout

ATTENTION

- It was previously a requirement that Galvanically Isolated, Intrinsically Safe (GI/IS) FTAs had to be mounted on horizontally oriented FTA Mounting Channels in an IOP cabinet. This is no longer a requirement due to 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-Galvanically Isolated) FTAs, and the wiring to them, be properly separated in the cabinet.

The vertical FTA Mounting Channel length, approximately 93 centimeters (36 inches) is approximately half the height of the cabinet. The FTA Mounting Channels can be mounted adjacent to each other in this vertical area. The FTA mounting configurations will allow:

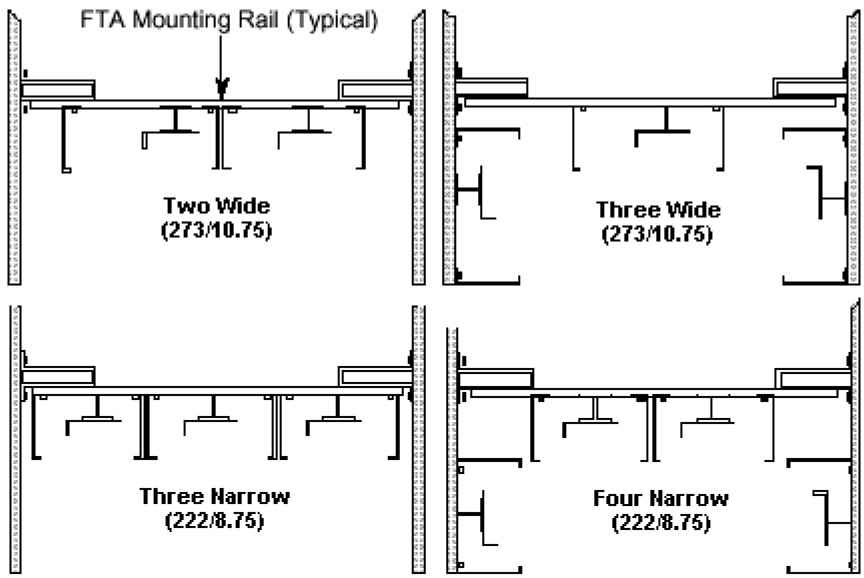
- up to four narrow channels or
- up to three wide channels.

The FTA Mounting Channels can be mounted adjacent to each other in the area below the Power System in a single-access cabinet as shown in the previous cabinet layout figures.

In the dual-access cabinet, one FTA Mounting Channel is normally installed above another, adjacently in pairs, as shown in the previous cabinet layout figures.

Normal Vertical FTA Mounting Channel orientation

When Standard type FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “normal” position where field wiring enters the left channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the right channel of the FTA Mounting Channel. The following figure shows the normal orientations for four typical vertical FTA Mounting Channel layouts in a cabinet.



Note: Space between adjacently mounted channels is typically 6 mm (0.25 in).
Dimensions are in millimeters/inches

Inverted Vertical FTA Mounting Channel orientation

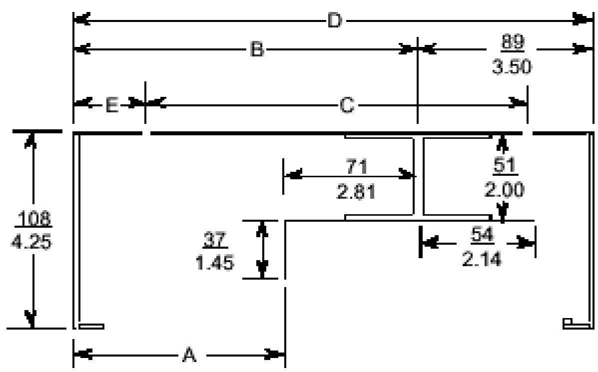
When Galvanically Isolated FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “inverted” position where field wiring enters the right channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the left channel of the FTA Mounting Channel.

CAUTION

Do not mount Galvanically Isolated FTAs and Standard FTAs on the same FTA Mounting Channel.

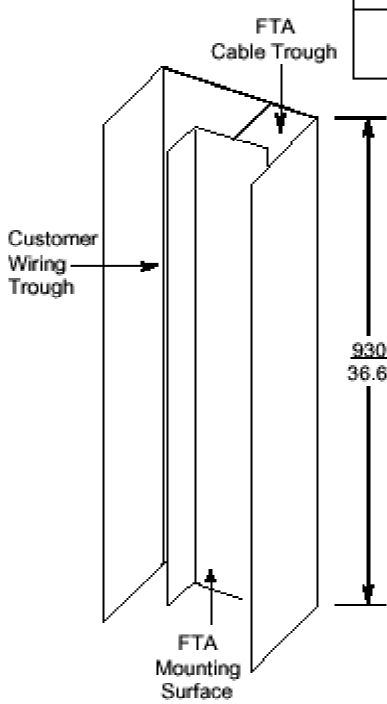
FTA Mounting Channel dimensions

Vertical FTA Mounting Channels are available in narrow and wide widths as shown in the following figure.



Cross Section View

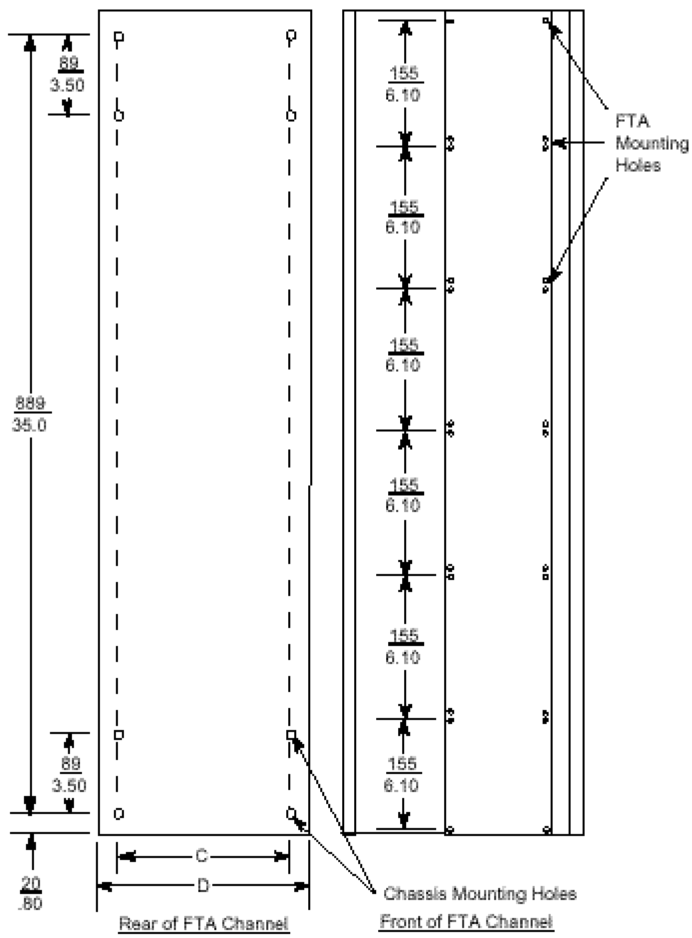
Channel Size	A	B	C	D	E
Wide	114 4.50	184 7.25	222 8.75	273 10.75	57 2.25
Narrow	64 2.50	133 5.25	172 6.75	222 8.75	32 1.25



Note: Dimensions are in millimeters/inches.

FTA installation hole locations

The following figure shows the locations of the FTA mounting holes on the FTA Mounting Channel and the holes used to install the FTA Mounting Channel.



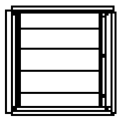
Note: See the previous figure for C and D dimensions.
Dimensions are in millimeters/inches.

IOP Cabinet Floor Planning

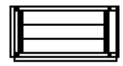
Floor template

The following figure is a cabinet floor template that will help you in planning your facility layout when installing IOP cabinets. The following notes pertain to the template in the following figure.

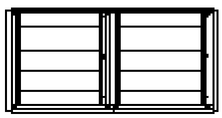
- Cabinet scale is 0.25 inch (6 millimeters) = 1 foot (0.3 meter).
- A dual access cabinet is approximately 30 inches (0.7 meter) by 30 inches (0.7 meter). The side and door panels add 1.5 inches (38 millimeters) to each cabinet dimension. When cabinets are complexed, 1.5 inches (38 millimeters) is added to the total complex dimensions.
- A single access cabinet is approximately 30 inches (0.7 meter) wide and 19 inches (0.5 meter) deep. The side panels and the single door panel add 0.75 inch (19 millimeters) to the cabinet depth and inches (38 millimeters) to the cabinet width. When cabinets are complexed, 0.75 inch (19 millimeters) is added to the complex depth and 1.5 inches (38 millimeters) is added to the total complex width.



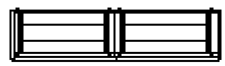
Single Dual Access Cabinet



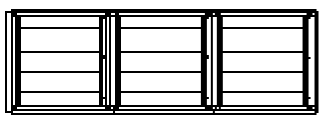
Single Single Access Cabinet



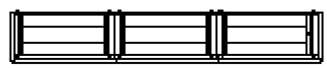
Dual Dual Access Cabinet Complex



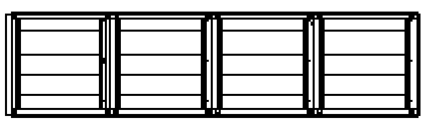
Dual Single Access Cabinet Complex



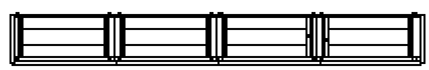
Triple Dual Access Cabinet Complex



Triple Single Access Cabinet Complex



Quad Dual Access Cabinet Complex



Quad Single Access Cabinet Complex

Appendix E

Power Draw for IOP

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 the “A” IOP and “B” IOP of a redundant pair to separate Power Systems.

A subsystem with redundant I/O may need additional Power Systems. The power calculation is made using the information provided in this Appendix. 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.

Power calculation procedure

The calculations are based on the power requirements of the components listed in the following 24 Vdc Power Usage table. The current requirements are based on the typical maximum, assuming all channels are in use. Use the following procedure to calculate the number of each type of IOP and associated FTA that an individual Power System must support.

Step	Action	Result
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 for the given type of IOP. For example, if a total of 256 High Level Analog Input (HLAI) IOP channels are needed, divide 256 channels by 16 channels per IOP to find that 16 HLAI IOPs and 16 FTAs are required.
2	Multiply the number of IOPs by the current requirement for the type of IOP.	Add the current requirement to the Total Module Current for the Power System. For example, 16 model MU-PAIH02 HLAI IOPs require 183 mA each, multiply 16 times 183 mA to find that 2928 mA or 2.928 A is the current requirement.

Step	Action	Result
3	Multiply the number of FTAs by the current requirement for the type of FTA.	Add the current requirement to the Total Module Current for the Power System. For example, 16 model MU-TAIH12/52 HLAI FTAs require 320 mA each, multiply 16 times 320 mA to find that 5120 mA or 5.120 A is the current requirement.
4	If redundant IOPs are required in the same Power System, double the IOP type count.	When the redundant IOPs reside in separate Power Systems, half the IOP power requirement is added to each Power System's Total Module Current power requirement (IOP A and IOP B). For example, 16 redundant HLAI channels, A and B, divide 16 channels by 16 channels per IOP times 2 to find that 2 IOPs are required.
5	To determine the Total Module Current, add together the total current for both the IOPs and their associated FTAs.	Sum of current requirements for IOPs and FTAs equals Total Module Current. For example, adding the results from the example current calculations in Steps 2 and 3 of this procedure yields 2928 mA plus 5120 mA equals 8048 mA or 8.048 A Total Module Current.

Component power usage

The following table lists the 24 Vdc power usage for IOP components.

ATTENTION

Be sure to include applicable power consumption data for the Process Controller chassis and its components. See the Chassis -Series A I/O Specification and Technical Data for details.

Component 24 Vdc Power Usage

Component	Model Number	Channels	Current (Ma)
IOP Card File	MU-IOFX02	N/A	0
Left 7-Slot Card File-Slots 1-7, non-CE Compliant	MU-HPFH01	N/A	0
Left 7-Slot IOP Card File-Slots 1-7, CE Compliant	MU-HPFI03	N/A	0
15-Slot Card File-Slots 1-15, non-CE Compliant	MU-HPFX02	N/A	0
15-Slot IOP Card File-Slots 1-15, CE Compliant	MU-HPFI23	N/A	0
Right 7-Slot Card File-Slots 9-15, non-CE Compliant	MU-HPFH11	N/A	0
Right 7-Slot IOP Card File-Slots 9-15, CE Compliant	MU-HPFI13	N/A	0
AO IOP Card	MU-PAOX02	8	100
AO IOP Card	MU-PAOX03	8	100
AO IOP Card	MU-PAOY22	16	432
AO HART IOP Card	MC-PHAO01	16	550
DI IOP Card	MU-PDIX02	32	90
DI IOP Card	MU-PDIY22	32	89

Component	Model Number	Channels	Current (Ma)
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
HLAI IOP Card	MU-PAIH02	16	183
HLAI IOP Card	MU-PAIH03	16	155
HLAIHART IOP Card	MC-PHAI01	16	225
LLAI IOP Card	MU-PAIL02	8	58
LLMux IOP Card	MU-PLAM02	16	70
PI IOP Card	MU-PPIX02	8	208
PI IOP Card	MU-PPIX02	8	208
RHMUX IOP Card (requires an IS or NI Power Adapter)	MU-PRHM01	32	100
STI IOP Card	MU-PSTX02	16	100
STIM IOP Card	MU-PSTX03	16	100
120 Vac/125 Vdc Relay DO FTA	MU-TDOR12/52	16	470
120 Vdc DI FTA	MU-TDIA12/52	32	192
120 Vdc DI FTA	MU-TDIA72	32	200
120/240 Vac Solid-State DO FTA	MU-TDOA13/53	16	160
24 Vdc DI FTA	MU-TDID12/52	32	408
24 Vdc DI FTA	MU-TDID72	32	410
24 Vdc DI FTA	MU-TDIY22/62	32	196

Component	Model Number	Channels	Current (Ma)
24 Vdc Isolated DO FTA	MU-TDOY22/62	32	004
24 Vdc Nonisolated DO FTA	MU-TDON12/52	16	0
24 Vdc Power Distribution Assembly	MU-TDPR02	12	200
240 Vac/125 Vac Relay DO FTA	MU-TDOR22/62	16	470
240 Vac/125 Vac Relay DO FTA	MU-TDOY23/63	16	228
240 Vdc DI FTA	MU-TDIA22/62	32	192
24-240 Vac Solid-State DO FTA	MU-TDOA12/52	16	160
31-200 Vdc Solid-State DO FTA	MU-TDOD22/62	16	160
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
5-200 Vdc Solid-State DO FTA	MU-TDOD23/63	16	160
AO FTA	MU-TAOX02	8	160
AO FTA	MU-TAOX12/52	8	171
AO FTA	MU-TAOY22/52	16	4
AO FTA - HART	MU-TAOY24/54	16	4

Component	Model Number	Channels	Current (Ma)
AO FTA	MU-TAOY23/53	16	4
AO FTA - HART	MU-TAOY25/55	16	4
AO HART FTA	MU-THAO11	16	4
HLAI FTA	MU-TAIH03	16	320
HLAI FTA - HART	MU-TAIH04	16	324
HLAI FTA	MU-TAIH13/53	16	320
HLAI FTA - HART	MU-TAIH14	16	324
HLAI FTA - HART	MU-TAIH15/54	16	324
HLAI FTA	MU-TAIH23	16	320
HLAI/STI FTA	MU-TAIH02	16	320
HLAI/STI FTA	MU-TAIH12/52	16	320
HLAI/STI FTA	MU-TAIH22/62	16	320
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—RTD FTA	MU-TAMR04	16	
LLMux—TC/Local CJR FTA	MU-TAMT02	16	185
LLMux—TC/Local CJR FTA	MU-TAMT03	16	185
LLMux—TC/Local CJR FTA	MU-TAMT04	16	
LLMux—TC/Remote CJR FTA	MU-TAMT12	16	185

Component	Model Number	Channels	Current (Ma)
LLMux—TC/Remote CJR FTA	MU-TAMT13	16	185
PI FTA	MU-TPIX12/52	8	136
RHMUX GI/IS Power Adapter (ISPA)	MU-GRPA01	32 (1)	300
RHMUX GI/NI Power Adapter (NIPA)	MU-TRPA01	32 (1)	575
RHMUX—TC/Local CJR FTA (ISPA or NIPA provides power to FTA)	MC-GRMT01	16	0
STI FTA	MU-TSTX03	16	320
STI FTA	MU-TSTX13/53	16	320
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
Galvanically Isolated AO FTA	MU-GAOX02/72	8	440
Galvanically Isolated AO FTA	MU-GAOX12/82	8	440
Galvanically Isolated AO HART FTA	MU-GHAO11	16	1252
Galvanically Isolated AO HART FTA	MU-GHAO21	16	1252
Galvanically Isolated HLAI FTA	MU-GAIH12/82	16	1200
Galvanically Isolated HLAI FTA	MU-GAIH22/92	16	1200
Galvanically Isolated HLAI/STI FTA	MU-GAIH13/83	16	1200

Component	Model Number	Channels	Current (Ma)
Galvanically Isolated HLAI/STI FTA	MU-GAIH14/84	16	1200
Galvanic Isolation Power Distribution Assembly	MU-GPRD02	N/A	160
Combiner Panel	MU-GLFD02	N/A	0
Marshalling Panel	MU-GMAR02	N/A	0
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
(1) 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.			

Single Power System Calculation Example

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

Components	Total IOP/Module Current	Total FTA Current
High Level Analog Input (HLAI) IOPs, non-redundant (256 channels divided by 16 channels/IOP equals 16 IOPs times 183 mA equals 2928 mA or 2.928 A) (16 FTAs times 320 mA equals 5120 mA or 5.120 A)	2.928 A	5.120 A
High Level Analog Input (HLAI) IOPs, redundant A & B (16 channels times 2 equals 32 channels divided by 16 channels/IOP equals 2 IOPs times 183 mA equals 366 mA or 0.366 A) (1 FTA times 320 mA equals 320 mA or 0.320 A)	0.366 A	0.320 A
Analog Output (AO) IOPs, non-redundant (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (8 FTAs times 171 mA equals 1368 mA or 1.368 A)	1.500 A	1.368 A
Analog Output (AO) IOPs, redundant A & B (16 channels times 2 equals 32 channels divided by 8 channels/IOP equals 4 IOPs times 100 mA equals 400 mA or 0.400 A) (2 FTAs times 171 mA equals 342 mA or 0.342 A)	0.400 A	0.342 A
Subtotals	5.194 A	7.150 A
Total Power System Current equals 5.194 plus 7.150 equals 12.344 A		

Dual Power System Calculation Examples

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

Components	Total IOP/Module Current	Total FTA Current
Power System 1		
High Level Analog Input (HLAI) IOPs, non-redundant (80 channels divided by 16 channels/IOP equals 5 IOPs times 183 mA equals 915 mA or 0.915 A) (5 FTAs times 320 mA equals 1600 mA or 1.600 A)	0.915 A	1.600 A
High Level Analog Input (HLAI) IOPs, redundant A (240 channels divided by 16 channels/IOP equals 15 IOPs times 183 mA equals 2740 mA or 2.740 A) (15 FTA times 320 mA equals 4800 mA or 4.800 A)	2.740 A	4.800 A
Analog Output (AO) IOPs, non-redundant (40 channels divided by 8 channels/IOP equals 5 IOPs times 100 mA equals 500 mA or 0.500 A) (5 FTAs times 171 mA equals 855 mA or 0.855 A)	0.500 A	0.855 A
Analog Output (AO) IOPs, redundant A (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (15 FTAs times 171 mA equals 2565 mA or 2.565 A)	1.500 A	2.565 A
Subtotals	5.655 A	9.820 A
Total Power System 1 Current equals 5.655 plus 9.820 equals 15.475 A		
Power System 2		
High Level Analog Input (HLAI IOPs, redundant B (240 channels divided by 16 channels/IOP equals 15 IOPs times 183 mA equals 2740 mA or 2.740 A) (15 FTA times 320 mA equals 4800 mA or 4.800 A)	2.740 A	4.800 A
Analog Output (AO) IOPs, redundant B (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (15 FTAs times 171 mA equals 2565 mA or 2.565 A)	1.500 A	2.565 A
Subtotals	4.240 A	7.365 A
Total Power System 2 Current equals 4.240 plus 7.365 equals 11.605 A		

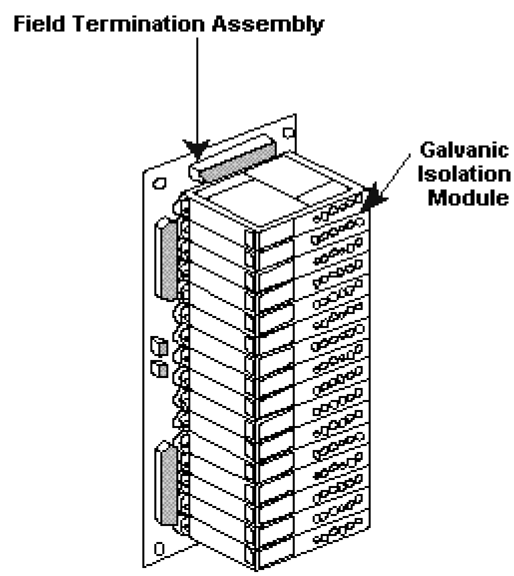
Appendix F

Galvanically Isolated FTA Planning

Galvanically Isolated FTAs are used for connecting input and output signals to field devices in Division 1 (Zone 0 and Zone 1) hazardous areas. These FTAs are available that accept plug-in Galvanic Isolation Modules. The FTAs are compatible with the IOPs that support the companion standard FTAs.

Galvanic Isolation Module

Field signal connections are made at the plug-in Galvanic Isolation Module on the FTA. In general, each module provides a terminal connector for one field device connection. The exception is the Galvanic Isolation Module on the Digital Input FTA. This Galvanic Isolation Module provides terminal connectors for two field devices. The following figure shows a typical Galvanically Isolated FTA with Galvanic Isolation Modules installed.



Usage advantages

The isolating nature of the intrinsically safe connection removes the necessity to install a potential-equalizing conductor where it is called for in any certification. The resultant simplification and reduction in cost of the installation is a considerable advantage, and makes the use of the Galvanic Isolators the preferred method over conventional shunt-diode safety barriers for this type of installation. There are many occasions when the lack of information about the precise site conditions is solved by using the isolators to minimize installation and security problems.

CE Compliance

Some Galvanically Isolated Field Termination Assemblies and their supporting assemblies, such as a Combiner Panel, are CE Compliant, while others are not CE Compliant. The CE Compliant and non-CE Compliant models with their part numbers are listed in the FTA models section. Generally, CE Compliant Galvanically Isolated FTAs are identified by the tab number of the part number that ends in "25" or "75". They do not have a unique model number. The CE Compliant FTAs feature filtered connectors that interface with the CE Compliant model MU-KFTSxx IOP to FTA cable(s).

Standby Manual devices and FTA connections

The following table lists the FTAs that support Standby Manual device connections as well as a description of the Standby Manual device along with model and part number references.

ATTENTION

The Galvanically Isolated Analog Output FTA for HART connection (MU-GHAO11) does not support Standby Manual device connection.

If FTA is. . .	You can connect Standby Manual device to. . .	Standby Manual Device Description	Model Number	CE-Compliant Part Number
Analog Output model	A unique third 50-pin connector.	Analog Output Standby Manual Device w/case, cable	MC-SMAC02	51401277-250
24 Vdc Digital Output model	One of the two 50-pin connectors for redundant IOPs.	Digital Output Standby Manual Device w/case, cable	MC-SMDC02	51304526-150
		Digital Output Standby Manual Device with cable	MC-SMDX02	51304527-150

Operation limits

The ambient temperature limits of the Galvanic Isolation Modules are -20 to +60 degrees Celsius (-4 to +140 degrees Fahrenheit) operating range and -40 to +80 degrees Celsius (-40 to +176 degrees Fahrenheit) storage range. The humidity limits are 5 to 95 percent relative humidity.

GI FTA Power

FTA power requirements

The power requirement for the FTAs is a nominal 24 Vdc. Because of the large additional amount of power the Galvanically Isolated FTAs require, power to the FTA is not provided directly from the Power System through the associated IOP, as it is for Standard type FTAs, but instead through a Power Distribution Assembly.

The following table lists the power requirements at 24 Vdc for the given types of Galvanically Isolated FTAs. The requirements assume that all inputs/outputs are active.

FTA Type	Power Requirement (Amperes)
High Level Analog Input/Smart Transmitter Interface	
MU-GAIH12/82	1.28
MU-GAIH13/83	1.28
MU-GAIH14/84	1.20
MU-GAIH22/92	1.20
Analog Output	
MU-GAOX02/12/72/82	0.45
MU-GHAO11	1.252
MU-GHAO21	1.252
24 Vdc Digital Input	
MU-GDID12/82	0.72
MU-GDID13/83	0.56
24 Vdc Digital Output	
MU-GDOD12/82	1.10
MU-GDOL12/82	1.10

Power Distribution Assembly

The model MU-GPRD02 Galvanic Isolation Power Distribution Assembly provides individually fused 24 Vdc power for the Galvanically Isolated FTAs.

The dc power is supplied to the Galvanic Isolation Power Distribution Assembly by the same type of 6-pin connector cable, model MU-KDPRxx (the suffix “xx” in the model number represents the length of the cable in meters), used to supply power to the card files from the IOP's Power System when the assembly is located in the same cabinet or cabinet complex.

If the Galvanic Isolation Power Distribution Assembly is located external to the cabinet or cabinet complex and CE Compliance is a requirement, model MU-KSPRxx cables must be used. The 2-conductor cable provides only 24 Vdc power.

A single-source or dual-source (redundant) of power can be supplied because the Power Distribution Assembly has two input power connectors.

Eight 2-pin power connectors

The Power Distribution Assembly has eight 2-pin connectors to which 2-wire power cables can be connected to supply the 24 Vdc power to the power connectors on the Galvanically Isolated FTAs.

Model MU-KGPRxx cables

Two power cable lengths can be ordered by model number. Model MU-KGPR05 is a 5-meter cable and model MU-KGPR10 is a 10-meter cable. Other lengths are available, but the cable must be ordered by part number. Standard lengths are 0.5, 0.75, 1, 1.25, 2, 3, 4, 5 (MU-KGPR05), and 10 (MU-KGPR10) meters (20, 30, 40, 50, 80, 120, 160, 195, and 395 inches). Order by Honeywell part number 51109620-xxx, where “xxx” represents the length of the cable in inches.

Same size as A-size FTA

The Power Distribution Assembly has the same mounting dimensions as an A-size FTA.

Cabling to Power Distribution Assemblies

Model MU-KDPRxx (the suffix "xx" in the model number represents the length of the cable in meters) power cables connect the 6-pin power connectors on the Power System with 6-pin connectors on the Power Distribution Assembly. Cable redundancy is provided by two power cables connected to each Power Distribution Assembly.

The cables can be daisy-chained to up to four Power Distribution Assemblies, provided the current through the series of MU-KDPRxx cables to the most distant Power Distribution Assembly from the Power System does not exceed 12 amperes of 24 Vdc power. The 12-ampere limitation assumes that one of the redundant cables has failed and broke the power loop.

Power Distribution Cable length restrictions

The allowable total length of the model MU-KDPRxx cables is also determined by the current through them. The length in meters cannot exceed 33 divided by the amount of current in amperes in the series of cables. This allows a 0.5 volt drop for the series of cables. Once again, assume that one of the redundant cables has failed when calculating the length.

Cabling to FTAs

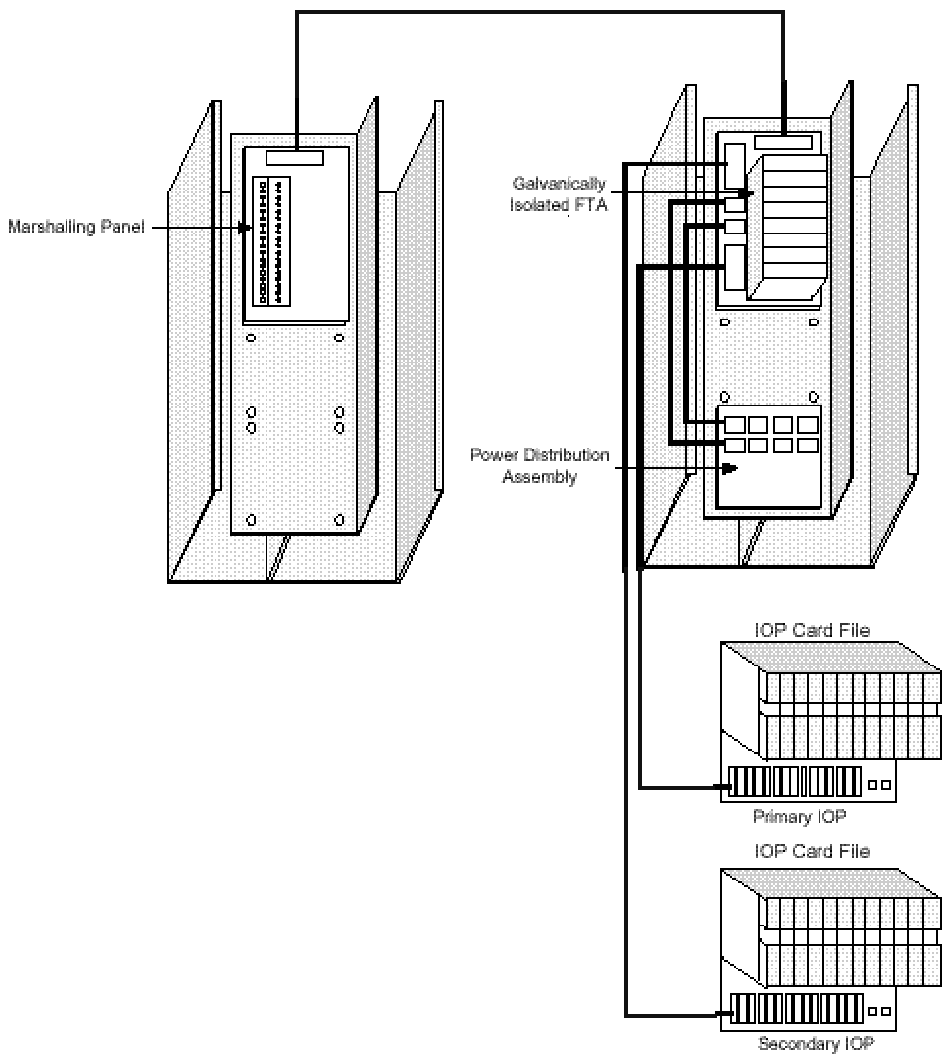
The Power Distribution Assembly has eight 2-pin connectors that supply 24 Vdc power to the FTAs through model MU-KGPRxx (the suffix "xx" in the model number represents the length of the cable in inches) cables. The cable is not shielded and must not exit the cabinet, unless in conduit, for a CE Compliance application. Each FTA must have two cables connected to it to provide a redundant source of power. The cabling must not be daisy-chained to the FTAs.

FTA Cable length restrictions

The allowable total length of the model MU-KGPRxx cables is also determined by the current through them. The length in meters cannot exceed 13 divided by the amount of current in amperes in the series of cables. In any case, the total length cannot exceed 10 meters. This allows a 0.5 volt drop for the series of cables. When calculating the length, assume that one of the redundant cables has failed, and the other cable(s) is carrying all the current.

Typical cabinet configuration

A typical cabinet side might have 12 FTAs and 3 Power Distribution Assemblies, and a 12-inch unused length of FTA Mounting Channel. The following figure is an illustration of the connections between the Galvanically Isolated FTA, its associated IOP, and the Marshalling Panel.



Marshalling Panel mounting

The model MU-GMAR52 Marshalling Panel can be mounted on either a horizontally or vertically oriented FTA Mounting Channel. No Galvanically Isolated FTAs can be mounted on the same FTA Mounting Channel.

Additional Power System

If an additional Power System is required in the cabinet to power the Galvanically Isolated FTAs, it can be installed on the same side of the cabinet as the FTA Mounting Channels. The Power System should be installed at the top of the cabinet if the FTA's field wiring entry is at the bottom of the cabinet so the field wires are not routed near the Power System. If the field wiring entry is at the top of the cabinet, install the Power System at the bottom of the cabinet.

Avoid using a non-IOP power source

Avoid providing 24 Vdc power to the Galvanically Isolated FTAs from a separate power system that is "disassociated" from the IOP Power System. A "disassociated" power system is one that is part of a larger system. Try to use power systems that are local to the loads that they serve.

Use surplus power for the FTAs

If redundant IOPs are both powered from one Power System, use whatever surplus power there is in the system to power the Galvanically Isolated FTAs. Add another Power System, if necessary. If redundant IOPs are each powered by their own Power System, use surplus power from both systems to power the FTAs. If more power is needed for the FTAs, use power from an additional Power System.

Vertical FTA Mounting Channel cabling assignment

All power cables must be routed in the left channel of a vertical FTA Mounting Channel. The field wires to the Galvanically Isolated FTAs must always be routed in the right channel of a vertical FTA Mounting Channel. No other wires, other than field wires to Galvanically Isolated FTAs, can be routed in the right channel of the vertical FTA Mounting Channel.

Field wiring restrictions

Field wires terminating on Galvanically Isolated FTAs must be routed at least 2 inches (50 millimeters) away from any other wires or electrical components, or a nonconductive material or grounded metal barrier must be provided for separation.

Field wiring routing

If the field wires leaving the Galvanically Isolated FTAs are dressed downward toward the bottom of the cabinet, the Power Distribution Assembly(s) must be installed above the FTAs. As a result, the field wires will not pass close to a Power Distribution Assembly. If the field wires are routed upward toward the top of the cabinet, the Power Distribution Assembly(s) must be installed below the FTAs.

High Level Analog Input (HLAI) FTAs

Model MU-GAIH12/MU-GAIH82 FTAs

The model MU-GAIH12 and MU-GAIH82 High Level Analog Input (HLAI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters only.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A non-redundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• The acceptable input signal is from a 4-20 mA 2-wire or 3-wire transmitter. It is not expected that any self-powered transmitters will be the source. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.

Function	Description
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.28 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. • This represents 30.7 watts of power. • The power dissipation is 25.0 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH13/MU-GAIH83 FTAs

The model MU-GAIH13 and MU-GAIH83 High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters, as well as HART and “smart” transmitters whose digital communication signals are superimposed on a standard 4-20 mA signal. The HART and smart transmitters can be calibrated, interrogated, or tested from the system, or from a hand-held communicator connected to the hazardous-side connector terminals on the Galvanic Isolation Module or connected across points on the FTA board.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A non-redundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• Each Galvanic Isolation Module on the HLAI/STI FTA provides a floating dc source for energizing conventional 2-wire or 3-wire 4-20 mA transmitters or the HART and smart transmitters, such as the Honeywell model ST3000 Smart Transmitter, whose digital communications signal is superimposed on a 4-20 mA signal. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.
Smart Transmitter communication	Terminals 3 and 4 on the Galvanic Isolation Module are internally connected to the two field terminals and can be used to communicate with a smart transmitter through its hand-held communicator.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.28 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 30.7 watts of power. • The power dissipation is 25.0 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH14/MU-GAIH84 FTAs

The model MU-GAIH14 and MU-GAIH84 High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTAs accommodate up to 16 high level dc signals. The model MU-GAIH14/MU-GAIH84 FTA is similar to the model MU-GAIH13/MU-GAIH83 FTA, except for its safety specifications and the available field terminal voltage is higher. This permits longer field wiring.

The FTA provides floating dc power to energize 2-wire or 3-wire, 4-20 mA transmitters in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters, as well as HART and "smart" transmitters whose digital communication signals are superimposed on a standard 4-20 mA signal. The HART and smart transmitters can be calibrated, interrogated, or tested from the system, or from a hand-held communicator connected to the hazardous-side connector terminals on the Galvanic Isolation Module or connected across points on the FTA board.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A non-redundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• Each Galvanic Isolation Module on the HLAI/STI FTA provides a floating dc source for energizing conventional 2-wire or 3-wire 4-20 mA transmitters or the HART and smart transmitters, such as the Honeywell model ST3000 Smart Transmitter, whose digital communications signal is superimposed on a 4-20 mA signal. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.
Smart Transmitter communication	Terminals 3 and 4 on the Galvanic Isolation Module are internally connected to the two field terminals and can be used to communicate with a smart transmitter through its hand-held communicator.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.2 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 28.8 watts of power. • The power dissipation is 20.8 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH22/MU-GAIH92 FTAs

The model MU-GAIH22 and MU-GAIH92 High Level Analog Input (HLAI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP.

The model MU-GAIH22 and MU-GAIH92 FTAs is similar to the model MU-GAIH14 and MU-GAIH84 FTAs, except the 4-20 mA output signal from the Galvanic Isolation Module can be routed to an auxiliary receiver through an auxiliary connector before it is sent to the range spool on the FTA to generate the 1-5 Vdc input to the IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters and HART transmitters, whose digital communication signals are superimposed on a standard 4-20 mA signal. The HART transmitter used in conjunction with the MU-GAIH22 FTA can be calibrated, interrogated, or tested from the system, or from a hand-held communicator connected to the hazardous-side connector terminals on the Galvanic Isolation Module or connected across points on the FTA board.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A non-redundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• The acceptable input signal is from a 4-20 mA 2-wire or 3-wire transmitter. It is not expected that any self-powered transmitters will be the source. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. Because it is the same 4-20 mA signal that the range spool is exposed to, the recording or monitoring system connected to the screw terminals of the Marshalling Panel must provide a low impedance of 250 ohms, or less.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.2 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 28.8 watts of power. • The power dissipation is 20.8 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

12Vdc Digital Input FTAs

Model MU-GDID12/MU-GDID82 FTAs

The model MU-GDID12 and MU-GDID82 24 Vdc Digital Input (DI) FTAs accommodate up to 32 switch or proximity detector inputs from a hazardous area, isolate the signal, and presents them to the FTA's associated 24 Vdc Digital Input FTA in the safe area. The phase of the input signals is selectable, which allows the alarm condition to be chosen for either state of the sensor. This is accomplished with independent switches on the top of the Galvanic Isolation Modules. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Line fault detection	Individual line-fault detection is provided that signals a contact change in the event the field wires are shorted or open. Switches are provided on the Galvanic Isolation Module to optionally defeat the line-fault detection on an individual input basis. The Galvanic Isolation Module signals a change of state to the IOP if the field wires are open or shorted. An open wire is defined as an input current of less than 100 µA, and a shorted wire is defined as an input current of greater than 6.5 mA.

ATTENTION

To prevent false triggering of the line-fault detection feature, proximity sensors must be used. If switch inputs are used, they must be fitted with series and shunt resistors so that an open switch provides 22 k-ohms resistance and a closed switch provides 620 ohms resistance. If this feature is not wanted, it can be disabled by placing two switches on the top of the Galvanic Isolation Module, one for each input, in the “off” position.

Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, redundant Digital Input IOPs are not supported. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.

Function	Description
Field wiring input signals	The input signal specifications and assumptions are as follows: • Input from a contact or proximity switch. • A sensed current of less than 2 k-ohms resistance is interpreted as a closure. • The hysteresis is nominally 650 ohms. • The voltage applied to the sensor is 7.7 to 9.0 Vdc for 1 k-ohms resistance.
Auxiliary connector output	• Duplicate floating dry contacts that track the action of the signals presented to the IOP are provided by the auxiliary connector. There are two contacts in each module, isolated from the system, but not isolated from each other (three wires per isolator). • By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the length of the cable in meters), the signals can be connected to the model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • Two amber indicators on each Galvanic Isolation Module, one for each input, illuminates when a “closed” signal is sent to the IOP. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 0.72 amperes at 24 Vdc with all inputs in use. This represents 17.3 watts of power. • The power dissipation is 16 watts with all inputs active.

Function	Description
Isolation and safety	• Isolation is 250 Vac between each input, each auxiliary set of contacts, and the IOP. • The safety description for each Galvanic Isolation Module input is: – 10.5 volts maximum – 800 ohms – 14 milliamps maximum

Model MU-GDID13/MU-GDID83 FTAs

The model MU-GDID13 and MU-GDID83 24 Vdc Digital Input (DI) FTAs accommodate up to 32 switch or proximity detector inputs from a hazardous area, isolate the signal, and presents them to the FTA's associated 24 Vdc Digital Input FTA in the safe area. The FTA is similar to the model MU-GDID12/MU-GDID82 FTA, except the phase of the Galvanic Isolation Module's input to output signals are not selectable on the module, and the module's signal outputs are solid-state, instead of contacts. Also, the FTA has no auxiliary output connector. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Signal Connectors	Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, redundant Digital Input IOPs are not supported.
Field wiring input signals	The input signal specifications and assumptions are as follows: • Input from a contact or proximity switch. • A sensed current of less than 2 k-ohms resistance is interpreted as a closure. • The hysteresis is nominally 650 ohms. • The voltage applied to the sensor is 7.7 to 9.0 Vdc for 1 k-ohms resistance.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • Two amber indicators on each Galvanic Isolation Module, one for each input, illuminates when a "closed" signal is sent to the IOP. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 0.56 amperes at 24 Vdc with all inputs in use. This represents 13.4 watts of power. • The power dissipation is 14.4 watts with all inputs active.

Function	Description
Isolation and safety	• Isolation is 250 Vac between each input, each auxiliary set of contacts, and the IOP. • The safety description for each Galvanic Isolation Module input is: – 10.5 volts maximum – 800 ohms – 14 milliamps maximum

Analog Output FTAs

Model MU-GAOX02/72 and MU-GAOX12/82 FTAs

The non-redundant model, MU-GAOX02 and MU-GAOX72, and the redundant model, MU-GAOX12 and MU-GAOX82, Analog Output (AO) FTAs isolate up to eight 4-20 mA signals that can drive current-to-pressure (I/P) transducers, position actuators, or any load of 750 ohms or less, from an associated Analog Output IOP. The two models are identical in performance, with the redundant model capable of being controlled from redundant IOPs. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Fault-line detection	In the event of an open or short circuit in the field wiring, the resistance sensed at the input to the Galvanic Isolation Module will be a high value. This permits the readback feature of the associated 4-20 mA Analog Output IOP to detect the open or shorted field circuit and report a soft failure to the user.
Signal connectors	• Two 50-pin connectors on the redundant model of the FTA provide the interfaces to one or two IOPs. • One 50-pin connector accepts signals from an Analog Output Standby Manual Device, permitting removal and replacement of an IOP during normal operation of the FTA.
Field wiring output signals	The FTA provides, nominally, 4-20 mA for control of field devices that are Galvanically Isolated from all other circuits. The load resistance can be no greater than 750 ohms. The signal output’s dynamic impedance is greater than 1 megohm.
Calibration terminals	Four screw terminals are provided on the FTA, two pairs for calibrating the primary and secondary IOPs. A touch pad is provided that initiates the calibration procedure in primary or secondary IOP.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.

Function	Description
Current consumption	• Both models of the FTA consume 0.42 amperes at 24 Vdc with a 20 mA signal on all outputs. This represents 10.5 watts of power. • The power dissipation for the FTA is 9.6 watts with all outputs providing 20 mA of current.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MC-GHAO11 and MC-GHAO21 FTAs

The redundant model MC-GHAO11 and MC-GHAO21 Analog Output (AO) FTAs isolate up to sixteen 4-20 mA signals that can drive current-to-pressure (I/P) transducers, position actuators, or any load of 870 ohms or less, from an associated Analog Output IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Fault-line detection	In the event of an open or short circuit in the field wiring, the resistance sensed at the input to the Galvanic Isolation Module will be a high value. This permits the readback feature of the associated 4-20 mA Analog Output IOP to detect the open or shorted field circuit and report a soft failure to the user.
Signal connectors	• Two 50-pin connectors on the redundant model of the FTA provide the interfaces to one or two IOPs. • A 20-pin connector that provides the interface to an external HART multiplexer. • The two 2-pin power connectors that provide the interfaces to the GI/IS Power Distribution Panel.
Field wiring output signals	The FTA provides, nominally, 4-20 mA for control of field devices that are Galvanically Isolated from all other circuits. The load resistance can be no greater than 870 ohms. The signal output's dynamic impedance is greater than 1 megohm.
Calibration terminals	Four screw terminals are provided on the FTA, two pairs for calibrating the primary and secondary IOPs. A touch pad is provided that initiates the calibration procedure in primary or secondary IOP.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• Both models of the FTA consume 928 mA at 24 Vdc with a 20 mA signal on all outputs. • The power dissipation for the FTA is 21.6 watts with all outputs providing 20 mA of current.

Function	Description
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 28 volts maximum – 240 ohms – 116 milliamps maximum – Um= 250 Vrms AC or DC.

12Vdc Digital Output FTAs

Model MU-GDOD12/MU-GDOD82 FTAs

The model MU-GDOD12 and MU-GDOD82 24 Vdc Digital Output (DO) FTA can drive up to 16 suitably certified, intrinsically safe loads in a hazardous area. The loads can be a solenoid or alarm, as well as a nonenergy storing "simple apparatus," such as a Light Emitting Diode (LED). The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, Digital Output IOP redundancy is not supported. • One 50-pin auxiliary connector accepts signals from an emergency shutdown system.
Field wiring output signals	Each output is a voltage source that provides a maximum output voltage of 25.5 Vdc through 232 ohms. The minimum output voltage varies from 22 volts at zero current to 10 volts at 50 milliamps.
Auxiliary connector	• The auxiliary connector provides an input for control signals from an emergency shutdown system that is user-supplied. The shutdown system must provide potential-free floating sets of contacts. When one of the contacts is closed, a corresponding FTA output is disabled (deenergized), regardless of the output state command from the IOP. • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals.. • There is no dedicated Standby Manual Device connector on the FTA. An IOP connector interface is used by the Digital Output Standby Manual device to control the output of the FTA.

Function	Description
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • An amber indicator on the Galvanic Isolation Module illuminates when the module's output is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• At 25 Vdc and with all outputs active into a 350 ohm load (typical for a solenoid value), the FTA consumes 1.10 amperes. • The power dissipation is 18.7 watts with all outputs active.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 25.5 volts maximum – 232 ohms – 110 milliamps maximum

Model MU-GDOL12/MU-GDO82 FTAs

The model MU-GDOL12 and MU-GDOL82 24 Vdc Digital Output (DO) FTA can drive up to 16 suitably certified, intrinsically safe loads in a hazardous area. The loads can be a solenoid or alarm, as well as a nonenergy storing “simple apparatus,” such as a Light Emitting Diode (LED).

The FTA is similar to the MU-GDOD12/MU-GDOD82 FTA, except it does not have the capability to accept output override signals from a shut-down device through an auxiliary connector. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Line fault detection	• Each input channel has line fault detection circuitry that causes a contact closure that is present at an auxiliary connector.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, Digital Output IOP redundancy is not supported. • A 50-pin connector provides contact closure line fault signals from each of the 16 channels.
Field wiring output signals	Each output is a voltage source that provides a maximum output voltage of 25.5 Vdc through 232 ohms. The minimum output voltage varies from 22 volts at zero current to 10 volts at 50 milliamps.

Function	Description
Auxiliary connector	• The auxiliary connector provides Line Fault Detection signals that are represented by a solid-state signal for each of the FTA's 16 channels. Upon detection of a line fault, the Galvanic Isolation Module deenergizes a solid-state switch that has its emitter connected to logic ground. The collector is the output to the auxiliary connector and is not terminated in the module or on the FTA assembly. The solid-state switch has the following characteristics: – Maximum off-state voltage = 35 Vdc – Maximum on-state voltage = 2 Vdc – Maximum off-state leakage current = 10 µA – Maximum on-state current = 50 mA • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to the model MU-GLFD02 Combiner Panel where the signals are combined with 16 other LFD signals from another FTA. The combined 32 signals are available as inputs to redundant Digital Input IOPs, model MU-PDIX02. • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals. • There is no dedicated Standby Manual Device connector on the FTA. An IOP connector interface is used by the Digital Output Standby Manual device to control the output of the FTA.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • An amber indicator on the Galvanic Isolation Module illuminates when the module's output is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module. • A red indicator on the Galvanic Isolation Module illuminates when a line fault is detected.

Function	Description
Current consumption	• At 25 Vdc and with all outputs active into a 350 ohm load (typical for a solenoid value), the FTA consumes 1.10 amperes. • The power dissipation is 18.7 watts with all outputs active.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 25.5 volts maximum – 170 ohms – 150 milliamps maximum

Combiner Panel

Model MU-GLFD02

The model MU-GLFD02 Combiner Panel is similar in shape and appearance to an "A" size FTA and contains four 50-pin phone-type connectors and a single green LED indicator.

The purpose of the panel is to combine the Line Fault Detection (LFD) outputs (16) of two Digital Output FTAs and present the signals (32) to redundant Digital Input IOPs for integration. The following table summarizes some typical Combiner Panel functions.

Function	Description
Signal connectors	• Two connectors on the panel connect to the auxiliary connector on two Digital Output FTAs that have line fault detection capability. Presently, these are the MU-GDOL12/MU-GDOL82 FTAs. The standard IOP to FTA cable is used to provide the connections. • The combined 32 LFD outputs are available at two output connectors. One output connector connects to IOP A and the other connector connects to its redundant partner, IOP B. The standard IOP to FTA cable is used to provide the connections.
Indicators	• The green LED indicator is illuminated when IOP A is active.

Marshalling Panel

Model MU-GMAR52

The model MU-GMAR52 Marshalling Panel is similar in shape and appearance to a "B" size FTA. It has 38 screw terminal connections. There is only one version of the Marshalling Panel. The Marshalling Panel has one 50-pin connector that receives or sends signals to the safe side of the FTA to which it is connected.

The Marshalling Panel was developed primarily to provide user-accessibility to the signals from the auxiliary connectors on the Galvanically Isolated FTAs, but it can also be used as a general purpose marshalling panel in the IOP subsystem.

ATTENTION

Although the Marshalling Panel is used with the FTAs, the signals present are **not** intrinsically safe or inherently Galvanically Isolated. Therefore, the signals on the Marshalling Panel cannot be exposed to a Division 1, Zone 0 or Zone 1 environment.

Bus bar

Because the Marshalling Panel does not have a built-in shield bus, providing termination for a large number of shield wires requires the use of a horizontal or vertical bus bar. The horizontal or vertical bus bar is connected to the local Master Reference Ground (Safety Ground for CE Compliance).

Mounting

The model MU-GMAR52 Marshalling Panel can be mounted on a vertically oriented FTA Mounting Channel. No Galvanically Isolated or Standard (non-Galvanically Isolated) FTAs can also be mounted on the same FTA Mounting Channel. Cabling to the Marshalling Panel must be routed in the right channel and to the right in a vertical FTA Mounting Channel.

Configurations

The screw terminals connection of the Marshalling Panel can assume six configurations, depending upon the model of FTA to which its 50-pin connector is connected through a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters). The configurations are described in the following table for the given type of FTA.

Configuration	Description
High Level Analog Input FTAs	
Use	When used with High Level Analog Input (HLAI) FTA or High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTA, the Marshalling Panel provides either 1 to 5 volt or 4 to 20 mA PV signals.
1 to 5 V signals	The 1 to 5 volt signals are the same signals that the HLAI or STI IOP receives.
4-20 mA signals	The 4 to 20 mA signals must be returned to the FTA to produce the 1 to 5 volt signal across a spool resistor that the IOP requires.
Recording or monitoring devices	The signals are intended to be connected to a recording or monitoring device that the user provides.
1-5 Vdc FTAs	• The following FTAs provide 1 to 5 volt signals: – Model MU-GAIH12/82 HLAI FTA – Model MU-GAIH13/83 HLAI/STI FTA – Model MU-GAIH14/84 HLAI/STI FTA • The subsystem must have an input impedance of 1 megohm, or greater, to avoid loading down the signals and introducing errors into the IOP
4-20 mA FTA	• The following FTA provides 4 to 20 mA signals: – Model MU-GAIH22/92 HLAI FTA • The subsystem must have an input impedance of 250 ohms or less.
Cable routing	The signal wires must be separated from other wires or cables that might induce noise onto the signals. It is suggested that you use a properly grounded, shielded, twisted-pair cable to carry the signals to the recording or monitoring device.
Digital Input FTAs	
Model MU-GDID12/82	Provides potential free sets of contacts that are isolated from the input to the IOP to which the FTA is connected are available.

Configuration	Description
Relay contact interface	Each Digital Input Galvanic Isolation Module mounted on the FTA has two double-pole on/off reed relays. One set of the reed relay contacts is connected to the IOP, the second set of relay contacts is connected to the Marshalling Panel. The contact rating is 10 W, 0.5 A at 35 Vdc.
Application.	The typical applications for the sets of contacts are inputs to sequence of events recorders, monitoring systems, and shutdown systems.
Digital Output FTAs	
Model MU-GDOD12/82	The Digital Output configuration provides control by contacts or transistors to individually deenergize each Galvanic Isolation Module digital output. For example, an “on” output command from the IOP for a channel can be “overwritten” by a control signal from the Marshalling Panel that forces the output signal “off.” The override signal cannot force the output signal “on.”
Application.	• The inputs can be control signals from an emergency shutdown subsystem that is user-supplied. • To disable a particular channel, a designated pair of terminals are shorted together.
Model MU-GDOL12/82	The Digital Output configuration for the model MU-GDOL12/82 FTA is an interface that represents input channel line fault detection from the FTA. Line Fault Detection (LFD) circuitry in each Galvanic Isolation Module controls a solid-state switch output at the FTA’s auxiliary connector. Upon detection of a line fault, the Galvanic Isolation Module deenergizes the solid-state switch that has its emitter connected to logic ground.

Appendix G

Honeywell Services

Honeywell support

Honeywell's **TotalPlant** Services provide you with professional services to meet your needs now, and throughout the life cycle of your automation investment. **TotalPlant** Services are an additional resource to your plant. They deliver technological know-how and industry-specific expertise to help you meet key business goals and compete more effectively. To learn more about Honeywell services, contact your Honeywell Account Manager.

TotalPlant services

TotalPlant Services represent a continuum of consulting, planning, implementation, and support services as described below:

- **Consulting Services** — Honeywell's Consulting Services work with you to define current needs and future requirements. We draw upon our industry-specific expertise to identify solutions that effectively meet your goals; we create a plan for implementing your automation vision.
- **Training** — Honeywell provides the most effective advanced automation training available.
- **Project Services** — Honeywell's Project Services provide full, single-source support for automation projects of any size. These services assure you of a high-quality, professional implementation, and allow you to enjoy the benefits of your automation technology much sooner. Project services encompass:
  - requirements definition
  - design
  - implementation
  - installation
  - start-up
- **Integration Services** — Honeywell's Integration Services address your integration needs at all levels of the plant. At the process level, we help you incorporate smart subsystems (such as lab analyzers or gas chromatographs) into your control system architecture. At the plant level, we apply our extensive resources and experience to provide complete integration solutions.

- **Network Services** — Honeywell's comprehensive Network Services include design, installation, and support for all standard industrial local area networks and their attached devices. Our goal is to provide you with the highest up-time attainable; we do that through proactive consulting and maintenance techniques.
- **Application and Advanced Control Services** — Honeywell's Application Services are designed to meet the specific requirements of your industry. These services provide the advanced control and production management direction, implementation, and support required to optimize your process, while increasing your profits.
- **Environmental Safety and Specialty Services** — As awareness of environmental and safety issues has grown, so has the number of government regulations. Honeywell's Environmental Safety and Specialty Services help you to comply with requirements quickly; doing so completely and in a cost-effective manner.
- **Availability and Optimization Services** — Honeywell's Availability and Optimization Services can increase system and equipment up-time, while improving productivity and reducing support costs. Services include:
  - ***Hardware Support Services*** to keep your system, instrumentation, and equipment in optimal running condition.
  - The ***Asset Management Program*** which offers you an attractive alternative to owning and managing spare parts.
  - The ***System Enhancement and Support Program*** which can improve your productivity and system availability with expert assistance, automatic software updates, automatic documentation management, and an electronic bulletin board.
  - ***The Site-Support Specialist*** which applies the resources of an experienced service professional to the challenge of implementing your automation technology in a quick and proper manner.
  - ***Validation Services*** lowering your cost of complying with regulatory requirements of pharmaceutical manufacturing.

Experion training

Please visit the Honeywell Automation College web site http://www.automationcollege.com/ for a list of current courses and available training options.

Appendix H

Configuration Rules for Fieldbus Interface Module (FIM) Topology

The following table lists rules to consider when including Series A FIMs in your control hardware configuration.

Rule Number	Description
1	FIMs may reside in a Controller chassis, within the power constraints of the chassis.
2	FIMs may reside in a FIM only chassis. The FIM-only chassis may reside on a Supervisory ControlNet or Fault Tolerant Ethernet (FTE) network or an I/O ControlNet network.
3	All of the FIMs connected to a C200 Controller must reside either on the Supervisory network or on the I/O network, but not split between the two. Different C200 Controllers in the same Cluster may use either of these configurations simultaneously. For example, one C200 Controller uses FIMs on the Supervisory network and another one uses FIMs on its I/O network.
4	FIMs are not supported on any Experion Cluster (in any location) using a Supervisory Ethernet network through the TC-CEN011 (obsolete) or TC-CEN021 Ethernet module in a C200 Controller.
5	For each FIM or redundant FIM pair included in the Experion Cluster, two fewer IOMs are supported from a C200 Controller. Each C200 Controller supports a maximum of 21 non-redundant FIMS or 12 redundant FIM pairs. Each FIM must be counted as 2 IOMs against each Controller that it supports. It can be expressed using the following formula. 2 x number of FiMs + number of IOMs is less than or equal to 64 per Controller.
6	The maximum number of physical FIMs per Server is 100 or 50 redundant FIM pairs.
7	The maximum number of independent H1 links supported per C200 Controller is 42 when using non-redundant FIMs or 24 when using redundant FIMs.
8	The maximum number of independent H1 links supported per Server is 200 for non-redundant FIMs or 100 redundant FIM pairs.

Rule Number	Description
9	The maximum number of fieldbus devices configurable per link is 16. This is enforced. This is usually limited by consideration for scale of loss by H1 communication bandwidth, maximum spur length degradation with large number of devices, maximum number of FIM link portVCRs, link power available, and possibly by intrinsic safety (I.S.) limits. For example, 10 devices, each publishing two values, would consume 10 x 2 x 3 +2 = 62 of 64 FIM VCRs.
10	The recommended maximum number of single variable publications per second on a H1 link is 16. The maximum percentage of publications permitted in the schedule is 60%, guaranteeing time for alerts and client-server communications.
11	The macrocycle is the longest cyclic period on the link. It may have a maximum of 4 subschedules. For example, a 2000 millisecond macrocycle could have subschedule periods of 1000ms, 500ms, 250ms. (Subschedule periods must be exactly divisible into the macrocycle period.)
12	The maximum number of **agents per link is 50**. This corresponds to the number of “wires” drawn between Experion blocks and fieldbus blocks in either direction. Include the invisible back-calculation wire for each control output in the count. This means that control output wires count as 2 wires. This would represent, for example, 25 control loops (AI, AO in fieldbus devices, PID in Experion) or 50 wired monitoring points (AI in fieldbus devices, application block in Experion). Other constraints will likely be encountered first.

Rule Number	Description
13	The maximum **number of VCRs** (Virtual Communications Relationships) supported by **each FIM** on each link port is **64**. One VCR is used internally and a second VCR is used to support alerts from all devices, leaving **62**. Additionally, for each device, a VCR is used for management communications and a second for function block application process (FBAP) communications (Hence, **2 per device**). Further, **every publication** connection from the FIM and subscription connection to the FIM **requires one** VCR at the FIM. (The FIM only establishes publication or subscription VCRs if a "wire" is drawn in the Control Builder CM chart between an Experion block and an fieldbus device-resident block. Note that for every control output wire drawn from a Experion control block to an fieldbus control or output block, an **invisible back-calculation wire is created**. This is published and must be included in the count. This means that control output wires count as 2 wires. Devices in the visitor address range do <u>not</u> require any VCRs. To summarize, the number of VCRs required for each link is: Number of VCRs = 2 + 2 x number of Devices_on_link + number of Wires_Devices_to_CPM + 2 x number of Wires_CPM_to_Devices Number of VCRs per link less than or equal to 64 per link. <u>Example 1</u>: AI in transmitter, PID in C200 controller, AO in valve: The transmitter's AI publishes to the FIM. The FIM publishes the PID's output to the AO's input and the AO publishes its BKCAL_OUT back to the FIM. There are a total of 9 VCRs in the FIM (the 1 for the internal use and the 1 for alerts plus 1 for each of the 2 device management connections and alert connection plus the 2 subscriptions and 1 publication). <u>Example 2</u>: AI and PID in transmitter, AO in valve: The transmitter's AI publishes to the AO but the FIM does not subscribe because it is not wired to a Controller function block input. The valve's AO publishes its BKCAL_OUT back to the PID in the transmitter but the FIM does not subscribe because it is not wired to a Controller function block input. There are a total of 6 VCRs in the FIM (the 1 for the internal use and the 1 for alerts plus 1 for each of the 2 device management connections and alert connection but no FIM subscriptions or publications.) <u>Example 3</u>: 16 transmitters that do <u>not</u> publish their OUTs would require 2 + 16 x 2 (=34) FIM VCRs. <u>Example 4</u>: 16 transmitters that <u>do</u> publish their OUTs to PS blocks would require 2 + 16 x 3 (=50) FIM VCRs.

Rule Number	Description
14	The maximum **number of VCRs** (Virtual Communications Relationships) supported by **each fieldbus Device** is specified by that device's manufacturer. One VCR is used for the management application process, a second is used for the Function Block Application Process; a third is used to generate alarms and alerts. Additionally, one VCR is used for each subscription and for each publication. Keep in mind the "invisible" back-calculation publication back to the CPM or other link-resident device for each control output sent to a fieldbus control or output block. Number of VCRs = 3 + number of Wires_to_this_device + number of Wires_from_this_device (including back-calculation connections whether visible or not) Number of VCRs less than or equal to maximum specified by each device's manufacturer.
15	The maximum number of fieldbus **devices** supported **per C200 Controller** is **672** (21 FIMs per controller x 2 links per FIM x16 Devices per link) for a non-redundant FIM solution, and **384** (12 redundant-FIMs per Controller pairs X 2 links per FIM X 16 Devices per link) for a redundant FIM solution. Other likely limiting considerations include scale of loss, H1 communication bandwidth, and maximum number of FIM link port VCRs, mentioned previously.
16	The maximum number of fieldbus **devices** supported **per Server** is **3200** (100 FIMs per Server x 2 Links per FIM x 16 Devices per link) for non-redundant FIM configuration and **1600** (50 redundant-FIMs per Server x 2 Links per FIM x 16 Devices per link) for a redundant-FIM configuration.
17	The **maximum number of blocks per FIM is 250**. This includes resource blocks (RB), transducer blocks (XB), and function blocks. (Example, 16 devices per link, on each of 2 links, each device with a resource block, one transducer block, and an average of five function blocks, would take 16 x 2 x (1+1+5) = 224 blocks. 8 devices per link, each with an average of 13 function blocks, a RB and one XB would take 8 x 2 x (13+1+1) = 240 blocks.)
18	The **maximum number of unique block types per FIM is 100**. This requires, that at the 250 block limit, a maximum of 60% of the blocks be non-unique (250-100)/250. For example, 5 ST3000 Smart Transmitters of the same revision level would require 20 blocks (5 x (RB+XB+AI+PID)) but would only define 4 unique blocks (its RB, XB, AI, and PID).
19	A given **FIM** can connect to a maximum number of **5 C200 Controllers** (using peer-to-peer connections). (In the future, it is planned that FIMs will be able to connect to other FIMs as peers to support controller-less bridging.)

Rule Number	Description
20	A given **C200 Controller** can connect to a maximum number of **21 non-redundant FIMs or 12 redundant FIMs** (using peer-to-peer connections).
21	**Non-redundant FIMs may be co-resident in a chassis with I/O** modules, keeping in mind the above noted capacity displacement of **two (2) I/O units** for each FIM for the **64 I/O limit**, and **3 I/O Units** for the **24 I/O per CNI** limit.
22	The ISA SP50.02 standard and the Fieldbus Foundation specify rules for maximum wire and spur lengths based on cable type. Although the rules have some complexity, there are simplified guidelines that apply in most instances.
23	The FIM is **not** intended for use with the **5 ms CEE** execution application because CEE execution generally exceeds fieldbus sampling and transport rates.
24	The FIM is **not** intended for use with any CEE that executes more frequently than the fieldbus device sampling and transport rate and CDA transport rate.
25	A FIM can communicate to a single or to **multiple Controllers** using CDA services.
26	FIM connections are limited to a **single "hop**" from one network node to another node on the same ControlNet or FTE network. For example, a FIM connection in a Remote Mixed Chassis can hop over an I/O ControlNet to a Controller Chassis, but cannot then hop over the Supervisory ControlNet to another C200. (Experion function blocks can be used as a method to communicate fieldbus values across multiple networks, if needed.)
27	The series E CNI modules (TC-CCN014, TC/TK-CCR014) or series D CNI modules (TC-CCN013, TC/TK-CCR013, obsolete) must be used in conjunction with the FIM.
Redundant FIM Configuration Rules	
28	Redundant Chassis Pairs must be configured identically - same size chassis, same Redundancy compliant module types located in the same slots in each chassis, and one Redundancy Module per chassis connected with a RM Fiber cable. This rule applies to Controller Redundant chassis with FIMs, as well as Redundant FIM-only chassis.
29	Quantity of FIMs per chassis is subject to available slots and power. CNI(s) and RMs must be considered. A remote I/O chassis, for example, will support a CNI, RM and up to 6 FIMs. A C200 Controller chassis will support a CNI, C200, and RM and up to 4 FIMs and up to two more CNIs or up to 3 FIMs and an additional IOLIM within power constraints.
30	FIM-only redundant chassis CNI modules will follow the same ControlNet MACID address assignment rules as those applied to Controller RCP chassis.

Rule Number	Description
31	A Redundant FIM-only chassis can support only one CNI module that is connected to either the Supervisory ControlNet or to a Remote I/O ControlNet segment under a C200 Controller chassis.
32	Redundant FIMs must use the new redundant compliant Fieldbus RTP – model number TC-FSU01.
33	Maximum of 50 redundant (or 100 physical FIMs) per Server.
34	Maximum of 12 Redundant FIMs per C200 Controller.
35	Each FIM or Redundant-FIM Pair consumes 2 I/O Units (equivalent to 2 IOM/IOPs) as applied to the 64 I/O Unit limit.
36	Redundant FIMs must reside in FIM-only chassis when configured to be remote from the Controller chassis, and count as 4 I/O Units per pair against the 24 I/O Unit/downlink CNI limit. This means that only 6 redundant FIMs may reside on any single I/O ControlNet segment.
Mixed Redundant and Non-Redundant FIM Configuration Rules	
37	When mixing redundant and non-redundant FIMs, all FIMs connecting to a C200 Controller must be configured either in the Redundant Controller chassis (for the Redundant-FIMs), or on a downlink I/O ControlNet segment.
38	Cannot mix Redundant and non-Redundant FIMs in the same chassis.
39	The number of FIMs per downlink CNI must be calculated using **3 I/O Units** for each non-redundant FIM and **4 I/O Units** for each Redundant-FIM with a maximum of **24 I/O Units** maximum allocated for each downlink CNI.
40	The following table describes the allowable combinations of redundant and non-redundant FIMs per C200 Controller.

The following table lists rules to consider when including Series C FIMs (FIM4s) in your control hardware configuration.

Rule Number	Description
1	The Series C FIM (or FIM4) is a standalone module that will be present directly on the L1 FTE network through the Control Firewall (CF9) Module.
2	The C200 Controller does not support the FIM4.

Rule Number	Description
3	Each C300 Controller can support FIM4s (redundant or non-redundant up to the maximums allowed per controller and per server) connected to the L1 FTE Network.
4	The use of FIM4s by a controller will reduce the allowed I/O used by that controller based upon the IO Unit loading limits.
5	The recommended maximum number of **single-variable publications per second** on an H1 link is **16**. The maximum **percentage of publications** permitted in the schedule is **50%,** guaranteeing time for alerts and client-server communications. (Each Pub requires a Compel Data (CD) to kick it off + the Analog pub time. The two consume about 28ms. So 28ms x 16 = 448ms. When housekeeping functions like token passing and time distributions are included, the total is ~ 50% of bandwidth.
6	The macrocycle is the longest cyclic period on the link. It may have a maximum of **4 sub-schedules**. For example, a 2000ms macrocycle could have sub-schedule periods of 1000ms, 500ms, and 250ms. (Sub-schedule periods must be exactly divisible into the macrocycle period.
7	A given FIM4 can connect to a maximum number of 5 C300 controllers (using peer-to-peer connections).
8	**FF H1 Wiring rules:** The ISA SP50.02 standard and the Fieldbus Foundation specify rules for maximum wire and spur lengths based on cable type. Although the rules have some complexity, there are simplified guidelines that apply in most instances.
9	The FIM4 is **not** intended for use with any CEE that executes more frequently than the fieldbus device sampling and transport rate and Control Data Access (CDA) transport rate.
10	A FIM4 can communicate to a single or to **multiple controllers** using CDA services.
11	FIMs may be used in systems that also contain Experion Console Station-TPS (ES-T) nodes, but the number of Console Stations in such a mixed system cannot exceed 10.
Redundant FIM Configuration Rules	
12	Redundant FIM4 Pairs require a redundant IOTA. A non-redundant IOTA cannot be used for FIM4 redundancy.

Table 14 Allowable Redundant and Non-Redundant FIM Combinations per C200 Controller

Redundant FIMs	Non-Red FIMs	Active (Primaries)	Total Physical FIMs	Total I/O Units to be divided into 24/CNI	Downlink CNIs required
0	21	21	21	63	3
1	20	21	22	64	3
2	19	21	23	65	3
3	18	21	24	66	3
4	16	20	24	64	3
5	14	19	24	62	3
6	12	18	24	60	3
7	10	17	24	58	3
8	8	16	24	56	3
9	6	15	24	54	3
10	4	14	24	52	3
11	2	13	24	47	2
12	0	12	24	48	2

FIM Performance Limits

The FIM is a complex device interfacing the high-speed Experion internal networks to the 31.25 Kbps fieldbus H1 links. It uses an advanced caching scheme to maintain quick response to reasonably fresh values and maintains communications with the multiple fieldbus devices as time permits in the prioritized scheme of the Link Schedule based on fieldbus specification requirements. This table describes limits of performance through the FIM.

The FIM cache (one for both links) holds 800 items. An item can be:

- A simple parameter,
- A structured parameter,

- An arrayed parameter.

Quality of service is based on priorities. Priorities of service are (highest to lowest):

- Incoming H1 Subscriptions and outgoing H1 Publications, per Link Active Schedule (LAS),
- H1 Alerts,
- H1 Writes,
- New H1 reads (and re-written parameters),
- H1 Re-reads to refresh the cache.

ATTENTION

The FIM does not support the C200 Controller 5ms CEE environment.

FIM Performance Limits	Per FIM		Per Link		Per Device	
Note1: Assumes ≥50% of link schedule is usable for client-server messaging. Applies to entire table.	**Burst**	**Sustained**	**Burst**	**Sustained**	**Burst**	**Sustained**
H1 Link Publication Rate (parameters/second, pps)	---	32	---	16	---	16
Client-Server Store Rate (pps) [excludes publications from Experion function blocks] **Note2**: This assumes that the fieldbus device supports AlterEventConditionMonitoring, the ability to suppress Update Events. Otherwise reduce by factor of 2.	40	10 See Note2	20	5 See Note2	4	1 See Note2
Max number of slow history points. **Note3:** All parameters must be in one view list per device or published.	---	40	---	20 See Note3	---	20 See Note3

FIM Performance Limits	Per FIM		Per Link		Per Device	
Note1: Assumes ≥50% of link schedule is usable for client-server messaging. Applies to entire table.	**Burst**	**Sustained**	**Burst**	**Sustained**	**Burst**	**Sustained**
Max number of read-activities per second. (A read-activity includes any or all of a block view list parameters or a single non-viewed parameter.) [Includes all users such as slow history, SCM connections to non-published parameters, Excel or OPC reads of non-published parameters, etc.]	10	10	5	5	2	2
Maximum number of parameters read per second. [Includes all users such as CM connections to non-output parameters (e.g. tuning constants or limits), SCM connections to non-published parameters, Excel or OPC reads of non-published parameters, etc.] **Note4:** Assumes all parameters read are in view lists and the average number of parameters read and used per view is 8	80 See Note4	80 See Note4	40 See Note4	40 See Note4	16 See Note4	16 See Note4
Maximum Alert Rate per second. (Alarm and Return-to-Normal reports) **Note5**: Assumes bursts are up to one minute apart.	50 See Note5	2	50 See Note5	2	2 See Note5	1
Maximum Number of Devices **Note6**: These numbers may be further limited by other restrictions noted in this document	32 See Note6		16 See Note6		---	

FIM Display-related Performance Limits

The following table gives performance guidelines for the display of "tabs" on the fieldbus Block Detail Display Form, which obtains its data through the FIM and H1 links:

Fieldbus Block Detail Display Form Performance (per "tab", ≤ 40 parameters)				
Performance Distribution	***Call-up rate, sec*** *(100% Contained in View Lists)*	***Call-up rate, sec*** *(0% Contained in View Lists)*	***Refresh rate, sec*** *(100% Contained in View Lists)*	***Refresh rate, sec*** *(0% Contained in View Lists)*
80% (average)	2	8	2	10
10% (slow)	4	16	5	16
10% (worst)	8	20	10	20

Assumptions:

- At least 50% of the link schedule must be available and usable for client-server transactions.
- No more than 40 non-viewed-contained parameters appear on a display tab at once.
- No more than one new tab is called up for devices on the same link within 10 seconds of each other.
- No more than four tabs are being refreshed from device on the same link simultaneously.
- The 80%-10%-10% specification is intended to allow that, in consideration of the many factors that influence link throughput, over the long-term (say, 1000 call-ups), 80% or more will meet or exceed the "average" number, 90% (additional 10%) or more will meet or exceed the "slow" spec, and 100% (additional 10%) or more will meet or exceed the "worst" spec.

Series C FIM TCP Connections

The Series C FIM supports the following types and numbers of TCP/IP connections.

Use of Connections	Number of Connections
CDA Display Access	32 responder connections
CDA Peer Access for C300 or ACE	32 responder connections AND 30 initiator connections[1]
CTool Access for module firmware download and diagnostics	8 responder connections[2]
Total TCP/IP Connections	103
[1]Although 32 responder & 30 initiator connections are reserved, the FIM4 only supports Peer-Peer connections with 5 other Nodes (C300 or ACEs). [2]Although 8 connections are reserved, only 1 copy per cluster of CTools is allowed to be run at a time.	

Redundant FIM – Performance Requirements

Initial Synchronization Time

Initial synchronization is throttled on the device boundary. Only one device is permitted to send its sync data at a time. Initial sync time can be estimated based on the following formula:

$$\mathbf{T_{initial\ sync} = N_{Devices} * 1s + 3s}$$

The formula above assumes that it takes one second per device plus 1 second for each link plus one second for FIM-global sync data transfer. In case of fully loaded FIM with both links having maximum number of 16 devices, initial sync time is around **40 seconds**.

Failure detection time

The following table lists failure detection times for various Series A FIM related failures.

Failure condition	Maximum Detection time
Chassis power failure	20ms
ICP backplane failure	100ms

Uplink CNI failure	100ms
Dual ControlNet failure	100ms
FIM motherboard electronics failure	100ms
FIM daughterboard failure	200ms
RTP connection failure	50ms
RM failure	100ms

The following table lists failure detection times for various Series C FIM related failures.

Failure condition	Maximum Detection time
Module power failure	20ms
IOTA backplane failure	100ms
Dual FTE failure	100ms
FIM4 motherboard electronics failure	100ms
FIM4 daughterboard failure	200ms

Display connections (ControlNet or FTE)

Display access connections are configured for 500ms RPI with timeout multiplier of 8 resulting in overall fail-over time of **4 seconds**.

Control connections (ControlNet or FTE)

Control or peer-to-peer connections are configured for 100ms RPI with timeout multiplier of 4 resulting in overall fail-over time of **400ms**.

Fieldbus client-server connections

Client-server connections are closed and re-open during fail-over. Time to complete this activity linearly depends on the number of devices on H1 network and available non-scheduled bandwidth. Assuming at least 50% of bandwidth availability, it takes about 100ms to re-open connection to one device. Empirical observation suggests that overall time to re-open connection to N devices can be computed based on the following formula:

Reopen Time = 200 ms + (Num Devices * 150ms)

- FIM link with 10 devices takes about 1.7 seconds to reform all client-server connections.
- **FIM link with maximum allowed 16 devices takes about 2.6 seconds** to re-form all client-server connections.

ATTENTION

This time depends on device responsiveness in addition to number of devices. Slow devices would result in increased fail-over time.

C200 or C300 Controller is shielded from connection re-establishment process on H1 for up to 10 seconds. During this time, C200 or C300 Controller blocks continue to act on old data received from H1 before fail-over occurred. If 10 seconds was not enough to re-establish a connection and retrieve fresh data, C200 or C300 Controller may shed control.

Fieldbus publication fail-over time

New primary opens its publication connections as soon as it is notified of a role change. It starts publishing fresh data on H1 network only after first CDA publication is received. CDA publication rate is 200ms. Resulting worst-case delay is thus a sum of failure detection time, worst-case publication connection open time and time to first data from CDA. **Resulting worst-case delay is in the order of 400ms**.

TIP

Given that fastest H1 publication rate supported by Experion is 250ms, subscribing H1 devices will miss at most one publication. A **Stale Count** configuration of two should be sufficient to mask this communication glitch.

Fieldbus subscription fail-over time

Both primary and secondary FIMs subscribe to data published by fieldbus devices. C200 or C300 Controller subscribing to fieldbus data receives fresh data as soon as Control

Data Access (CDA) connection is formed to new primary FIM module. Worst-case delay in receiving subscribed input data is in the order of one macrocycle. In other words, C200 or C300 Controller may receive one macrocycle-old input data as a result of fail-over.

Back-initialization data is a special class of subscribed input data. Delay on receiving fresh back-initialization data is significantly longer since FIM constructs PS back-initialization structure from subscribed FF back-initialization data plus scaling data retrieved by reading FF views. Reading of scaling data depends on establishing client-server connection to a device and reading a view. Combined time of all these activities depends on the number of devices similarly to connection re-open time. Empirical formula for worst-case delay is:

Back-init Data Delay = 300ms + (Num Devices * 300 ms)

A 10-device link may cause up to 3.3-second delay in fresh back-initialization data. H1 link with 16 devices may cause up to 5.1-second delay.

ATTENTION

The back-initialization data is not used in control algorithm calculations. Its only purpose is to provide initial setpoint value. Delay is receiving fresh back-initialization data is therefore not critical and does not affect control.

Fieldbus alert fail-over time

Both primary and secondary FIMs subscribe to Fieldbus alerts in parallel. Fail-over has no impact on alert processing.

Impact of FIM cache on fail-over time

Secondary FIM does not have any data in its cache since cache is populated based on client interest in fieldbus data. During fail-over, clients establish connections to new primary and thus re-create a cache. There is a one-time delay associated with this activity during fail-over since every client request results in a round-trip request to device to obtain fresh data.

The same formula that has been used to calculate back-initialization delay can be used here to estimate display glitch caused by fail-over. The formula provides meaningful average. VIEW_3 data used in control will typically be available in cache even before client display connection is made and therefore will have no visible delay. VIEW_4 data would typically have a calculated delay. Non-view data will be delayed further consistently with first time display call-up time.

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