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.

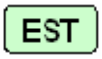
- If planning a new network, you need to consider issues such as the network architecture to use.
- If planning to use an existing network, you will have to determine how to integrate the networks as seamlessly as possible. If the existing network has a system administrator, they should help with the 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.

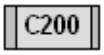
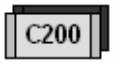
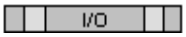
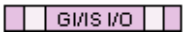
Identifying topology diagram symbols

About the symbols

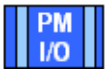
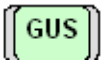
The symbols listed in the following table are used to simplify the node and component references to reduce the size and enhance the readability of the topology diagrams included in this document.

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
	Application Control Environment (TPS) used with TPS Systems and connected to the TPN (LCN) Network
	Experion Console Station (TPS) used with TPS Systems and connected to the TPN (LCN) Network
Experion Level 3/Level 4 Application Components	
	Experion Application Server
	PHD Server
	Experion eServer
	Experion Desktop Workstation
Miscellaneous Computer-Based Components	
	Windows 2003 Domain Server
	Windows 2000 Domain Server
	Third-Party OPC Server
	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

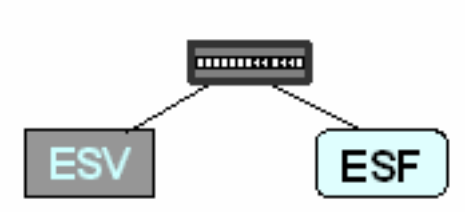


Figure 1 Experion Cluster Type 1

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

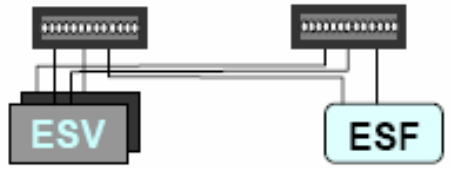


Figure 2 Experion Cluster Type 2

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

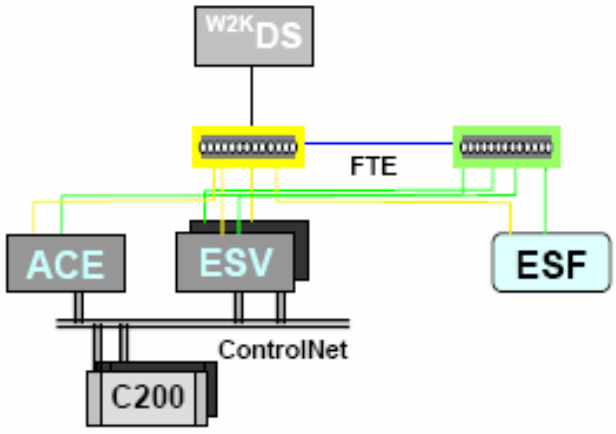


Figure 3 Experion Cluster Type 3

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

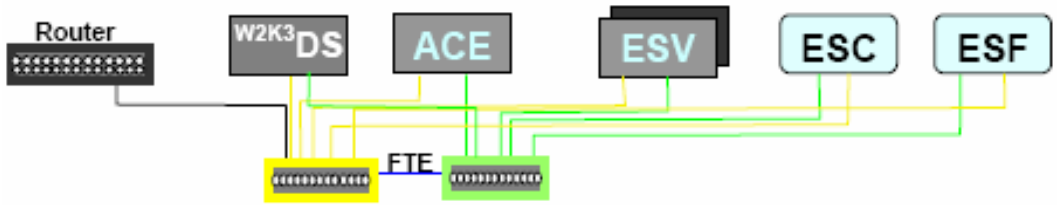


Figure 4 Experion Cluster Type 4

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

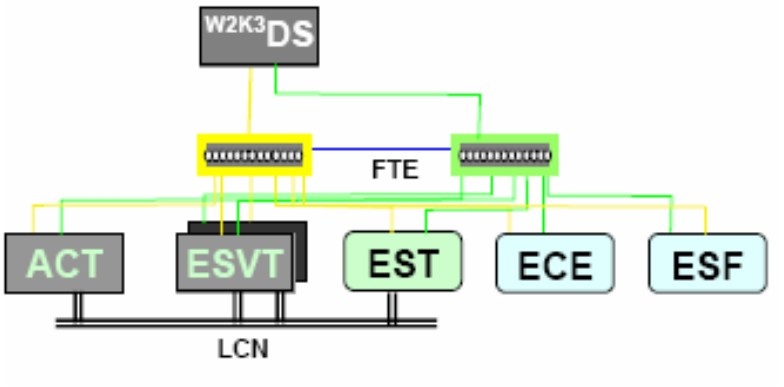


Figure 5 Experion Cluster Type 5

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.

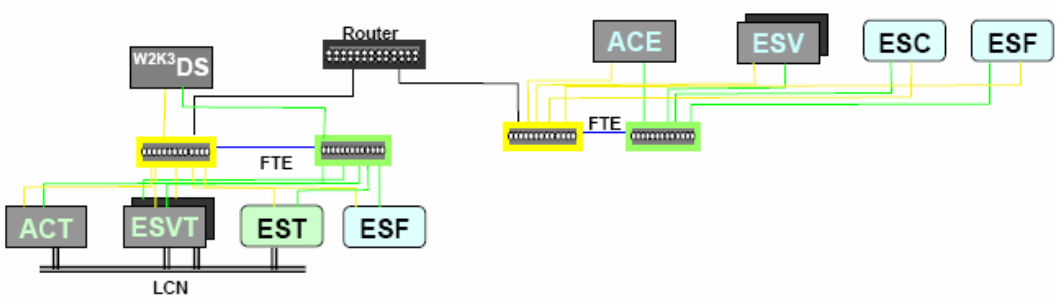


Figure 6 Router Connected Topology

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.

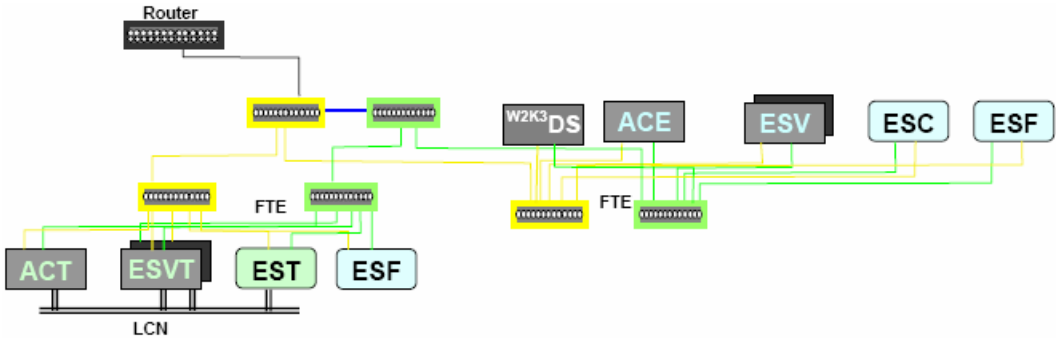


Figure 7 Common FTE Community Connected Topology

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.

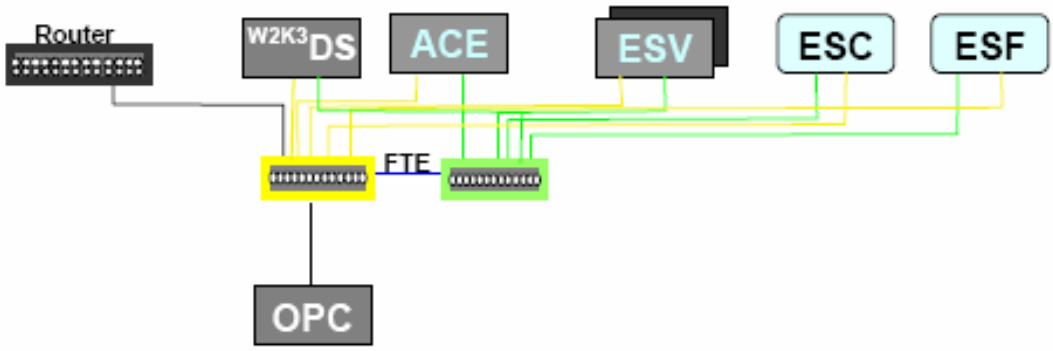


Figure 8 Level 2 OPC Server Topology

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.

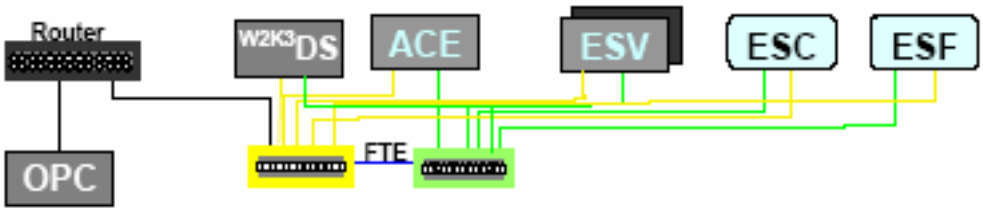


Figure 9 Level 3 OPC Server Topology

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.

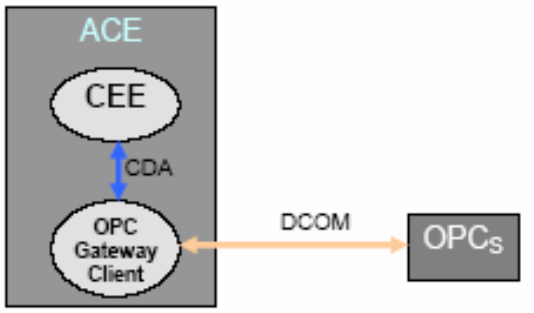


Figure 10 Resident OPC Gateway Client

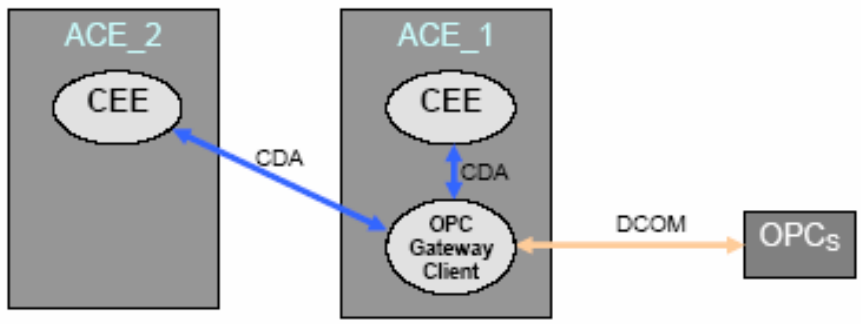


Figure 11 Non-resident OPC Gateway Client

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.

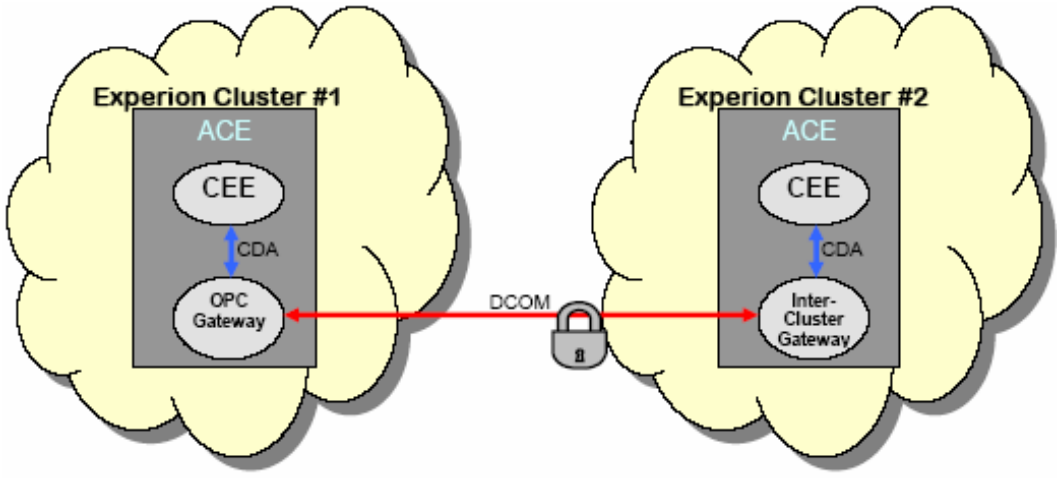


Figure 12 Simple Experion Inter-Cluster Gateway

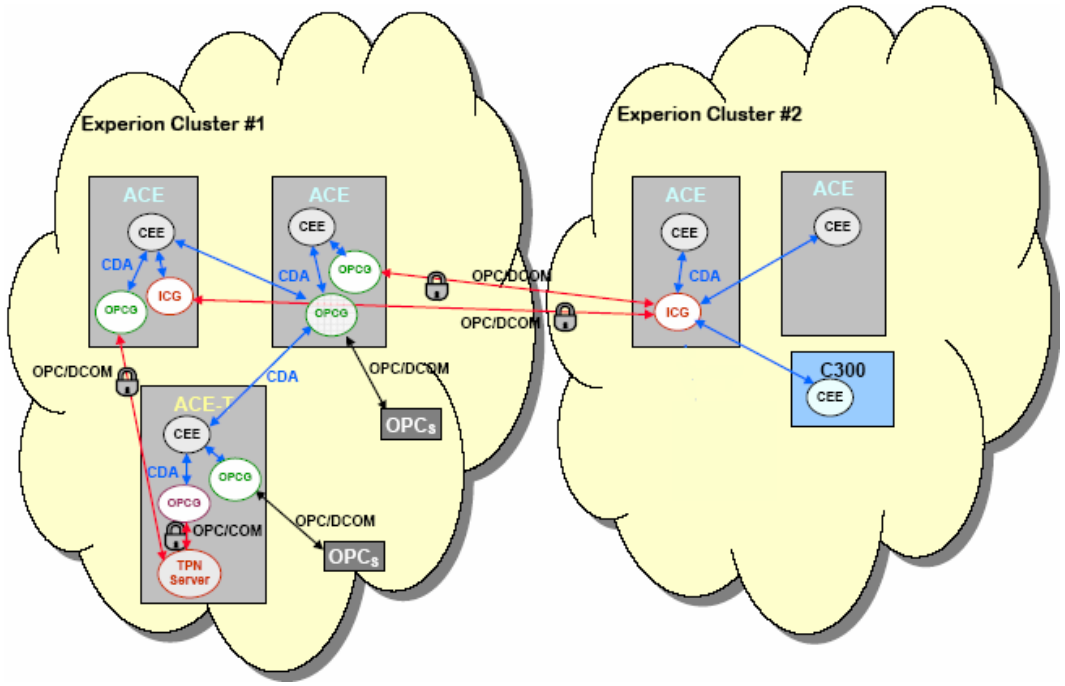


Figure 13 Complex Experion Inter-Cluster Gateway and OPC Gateway

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.

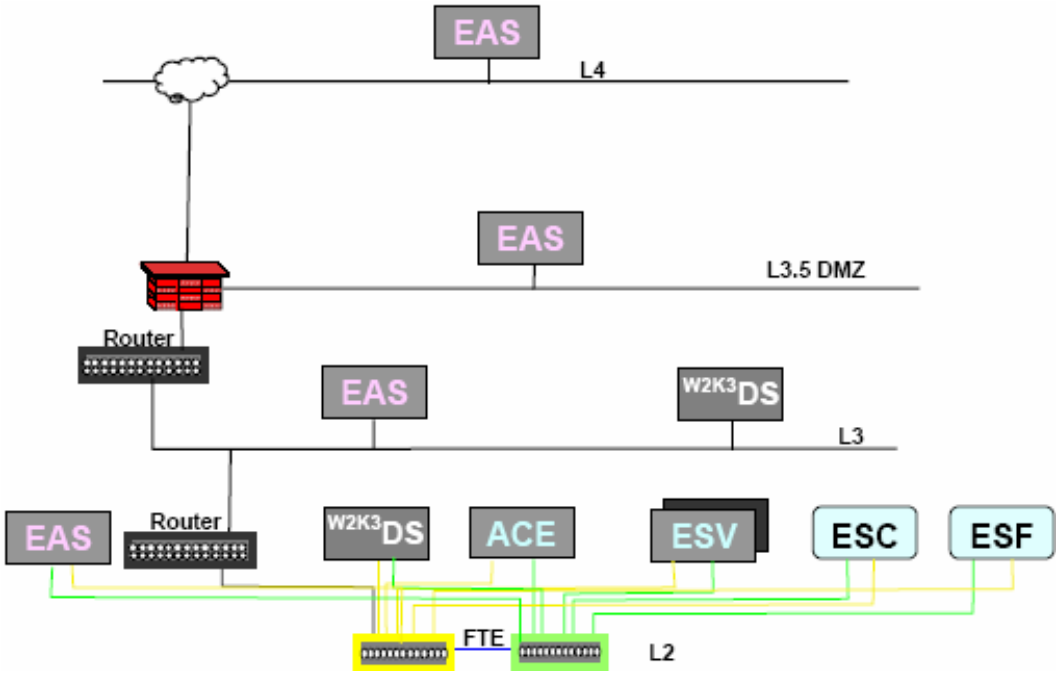


Figure 14 EAS topology

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.

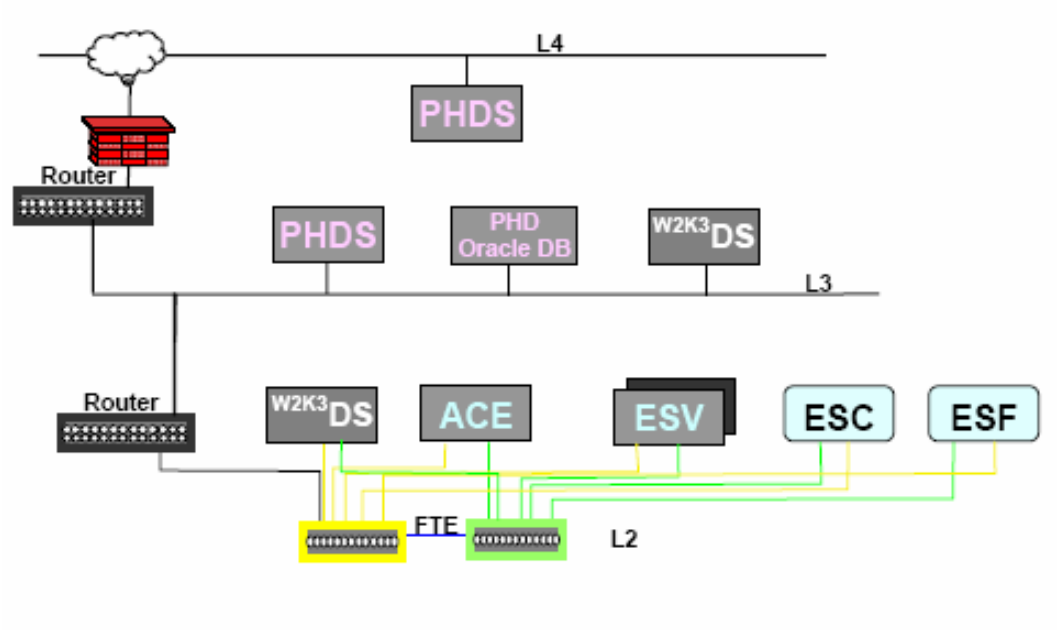


Figure 15 Basic PHD Integration Topology

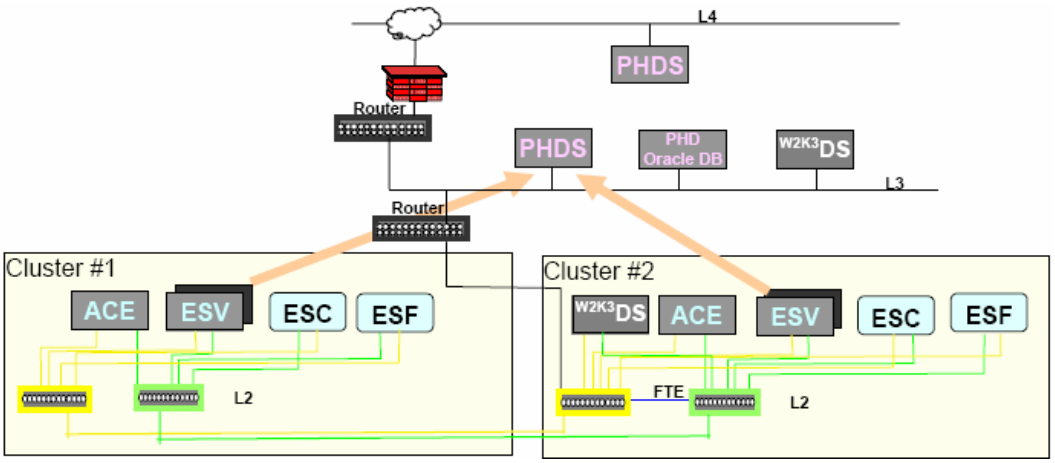


Figure 16 Multi-Cluster PHD Integration Topology

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.

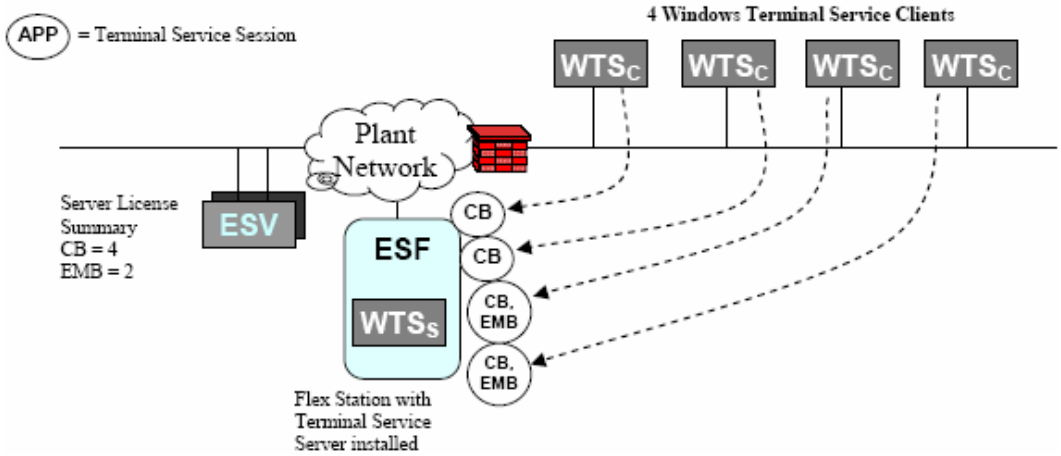


Figure 17 Terminal Server Topology

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.

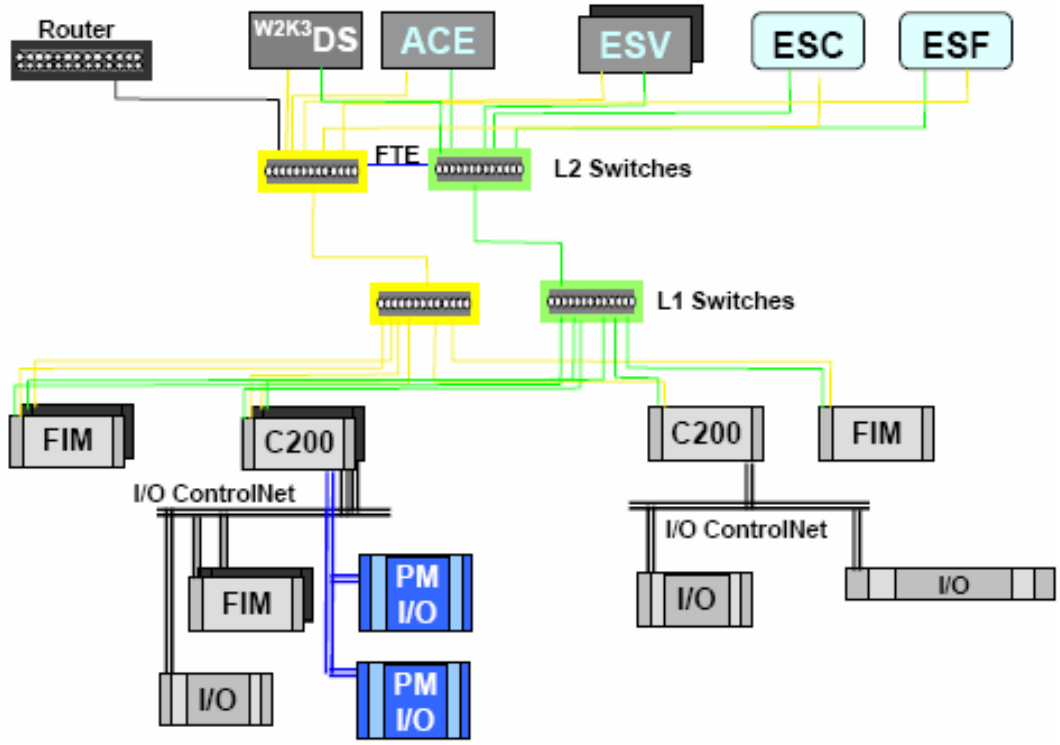


Figure 18 Basic C200 FTE Topology

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.

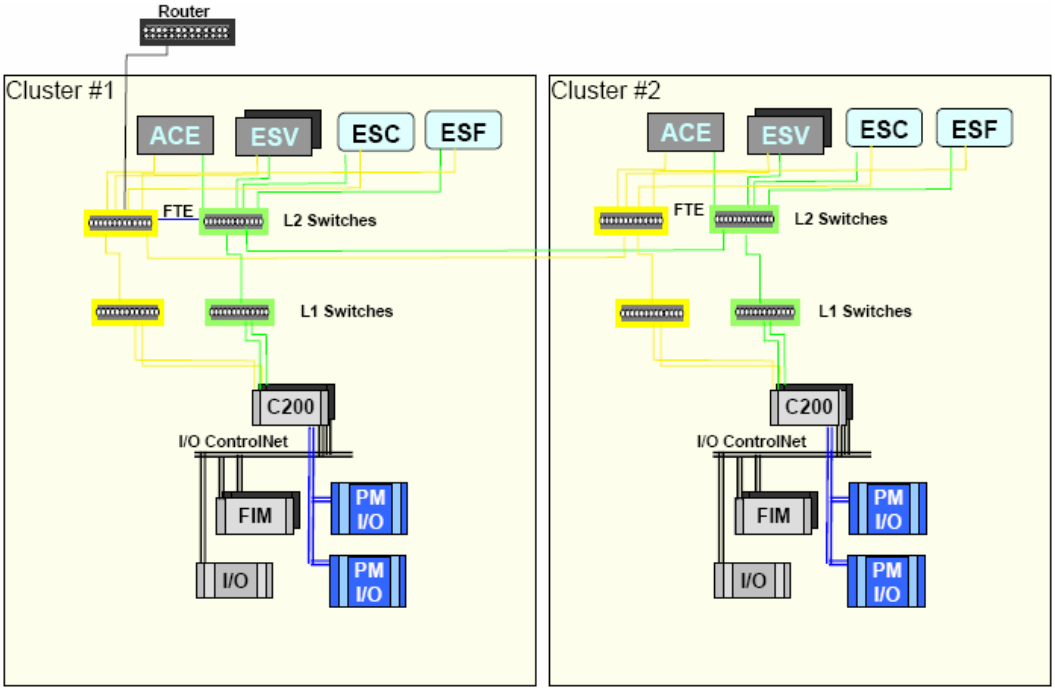


Figure 19 Multiple Experion Cluster C200 FTE Topology

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.

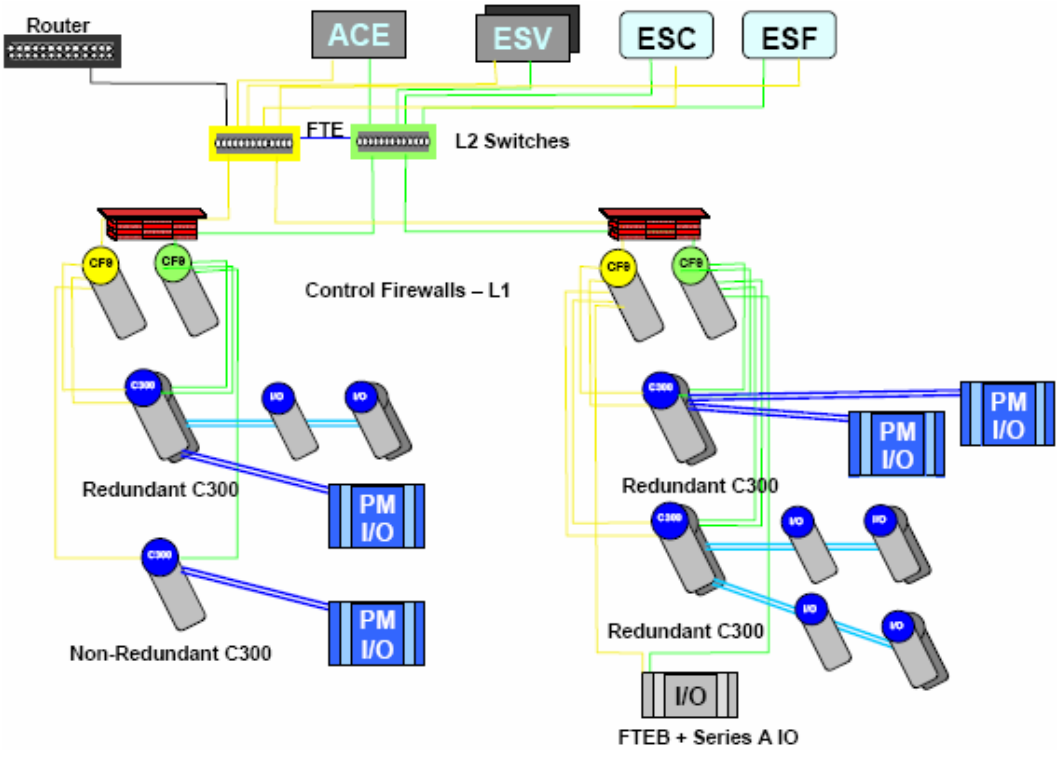


Figure 20 Basic C300 FTE Topology

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.

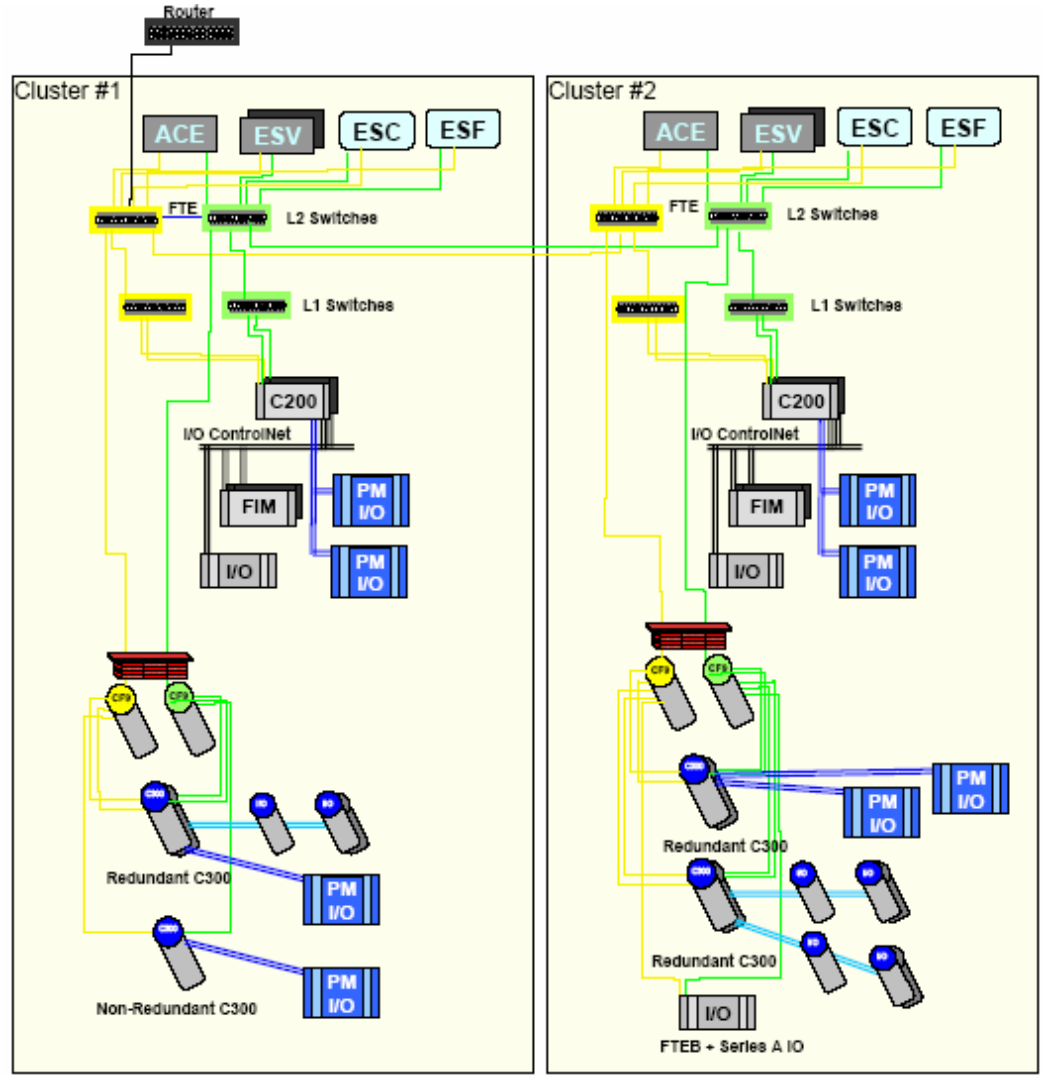


Figure 21 Multiple Experion Cluster with Mixed C300 and C200 FTE Topology

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.

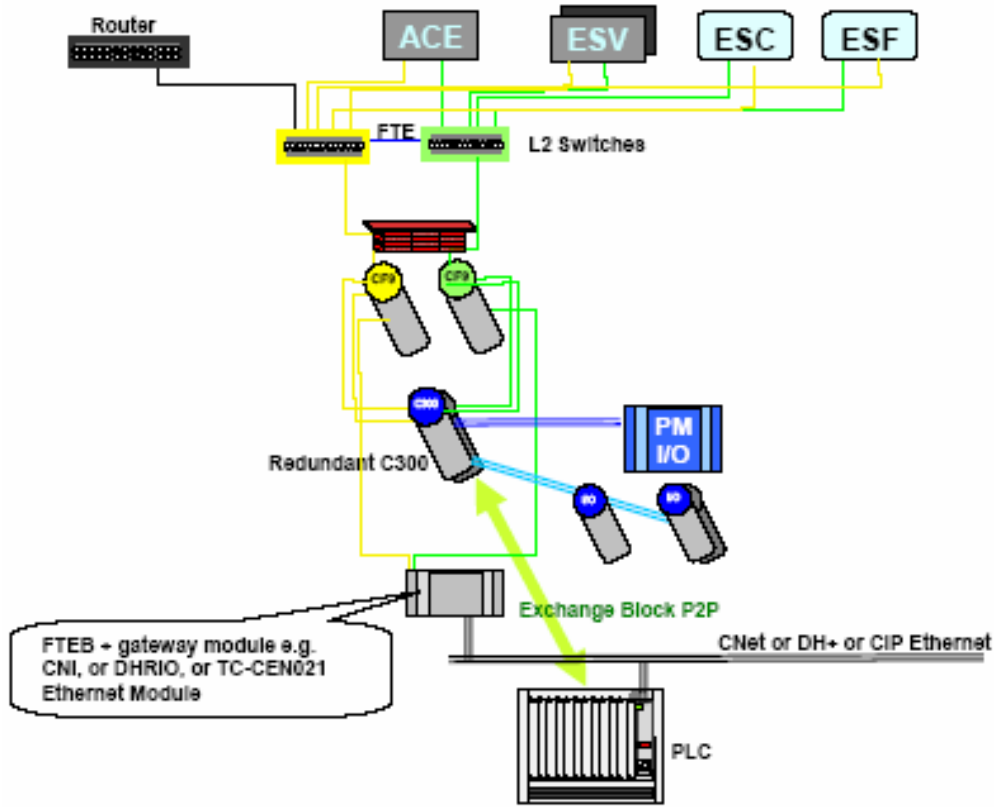


Figure 22 Typical C300 and PLC Interoperable Topology.

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.

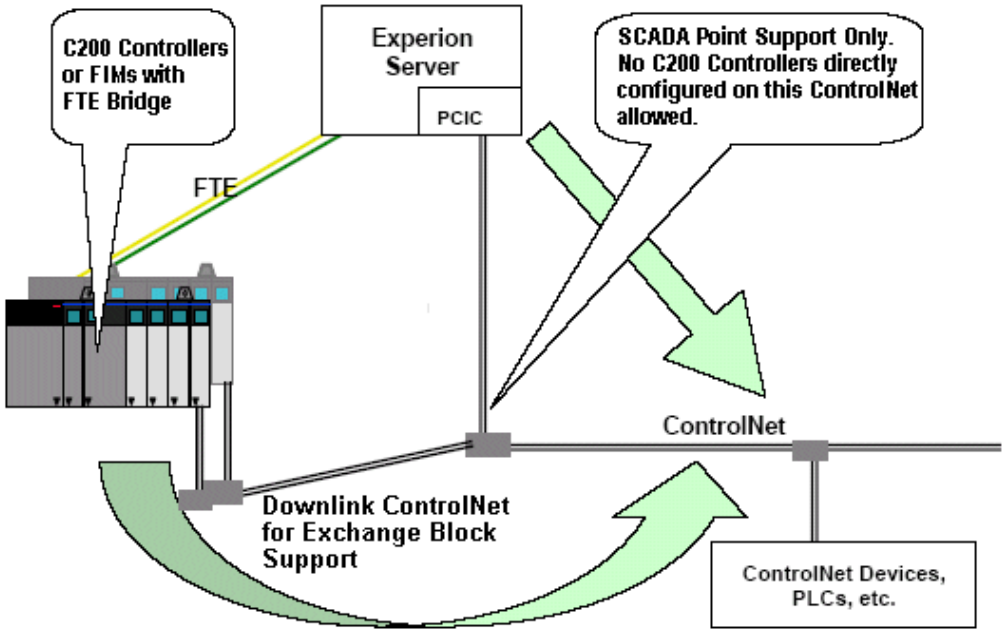


Figure 23 Possible C200 with FTE and ControlNet for Third-Party ControlNet Devices Topology

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.

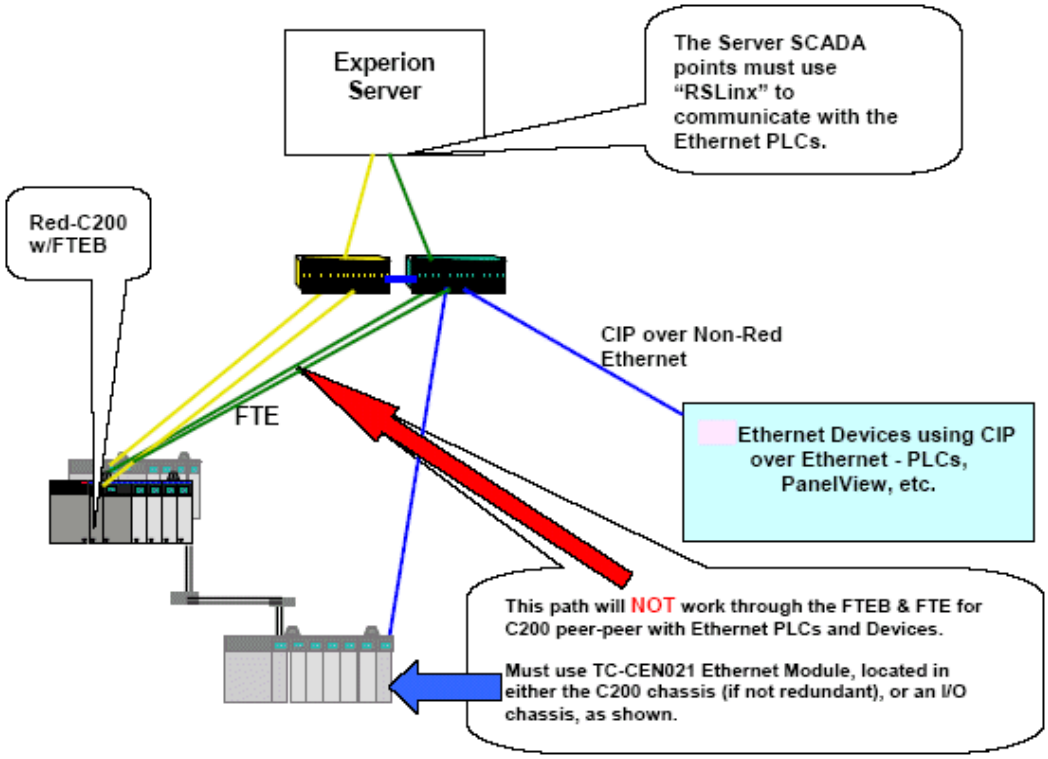


Figure 24 Possible C200 using FTE with ControlNet for Rockwell Ethernet Third-Party Devices Topology

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.

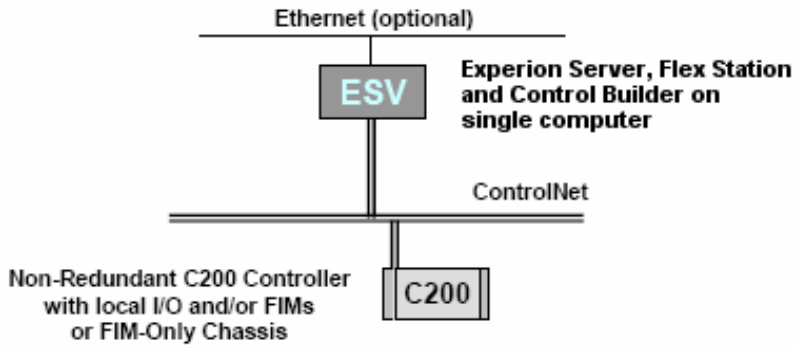


Figure 25 Small ControlNet Topology

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.

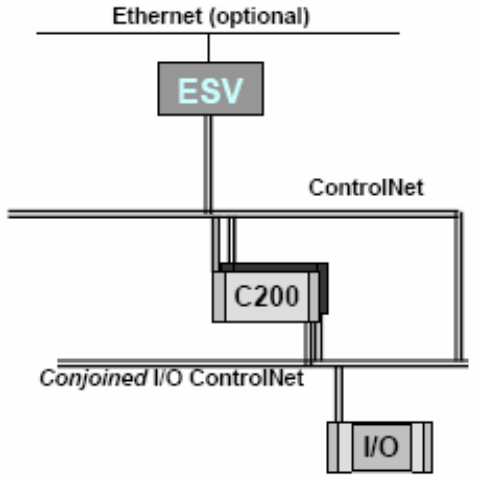


Figure 26 Conjoined Redundant C200 ControlNet Topology

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.

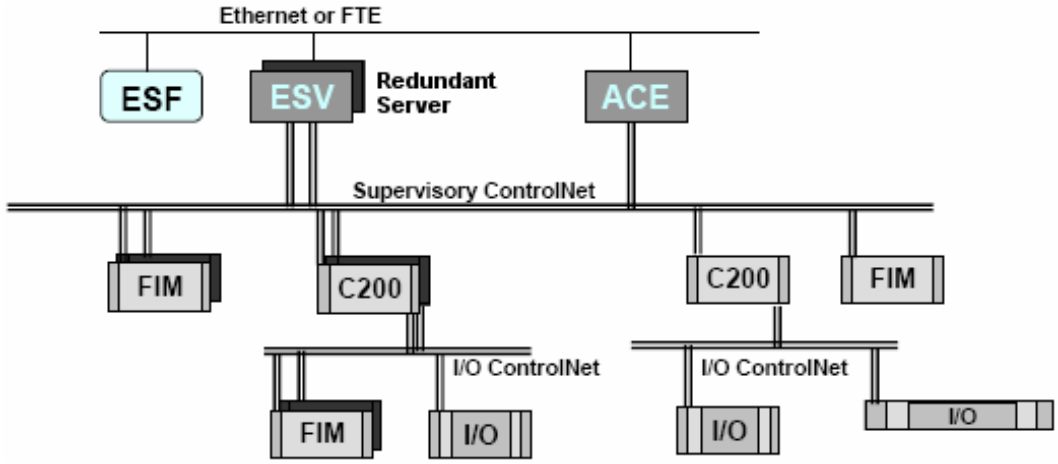


Figure 27 Basic ControlNet Topology

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.

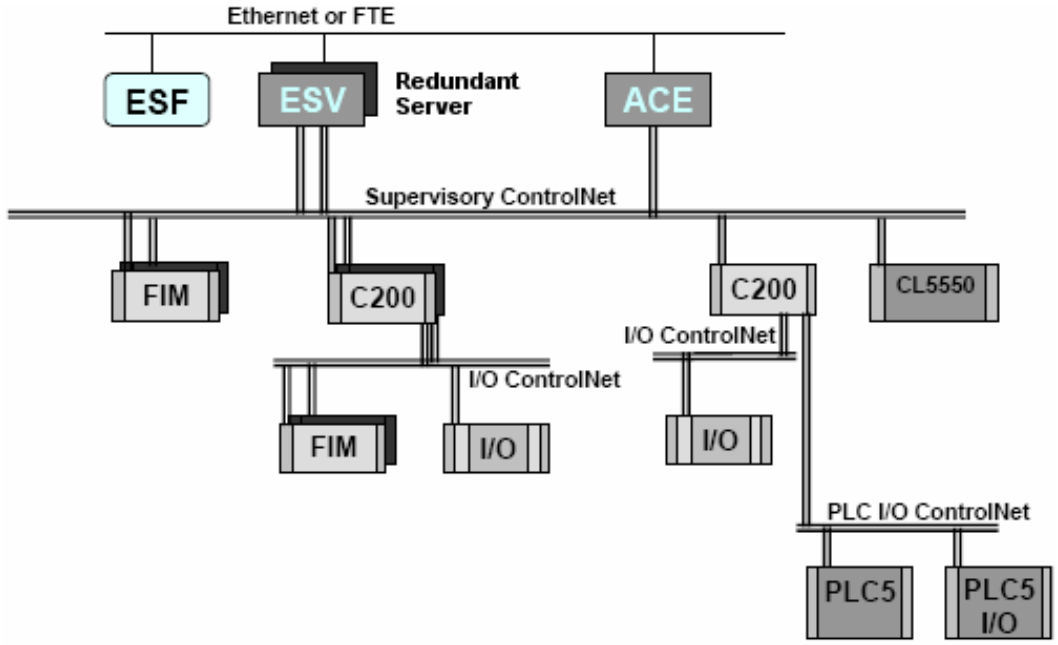


Figure 28 Experion Server Integrated with PLCs Topology

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.

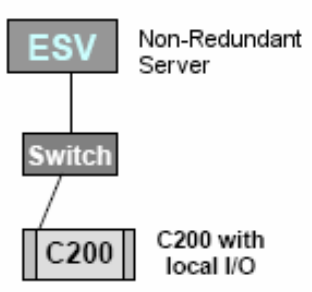


Figure 29 Small Supervisory CIP Ethernet Topology

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.

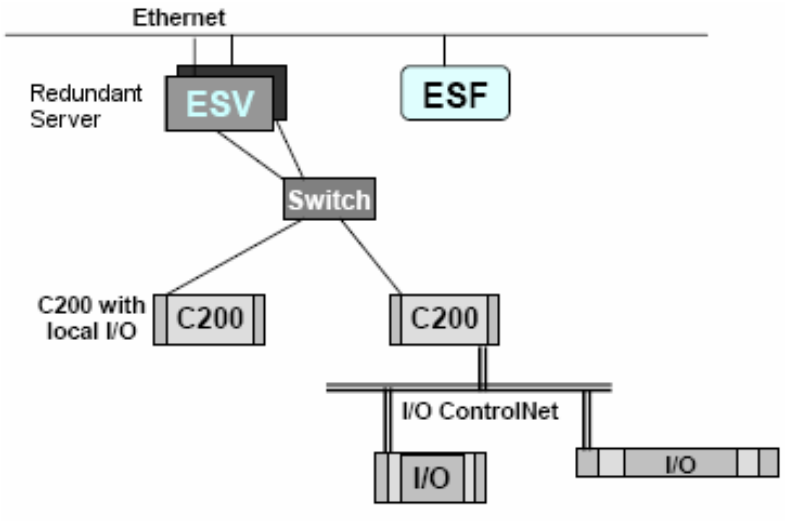


Figure 30 Basic Supervisory CIP Ethernet Topology

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

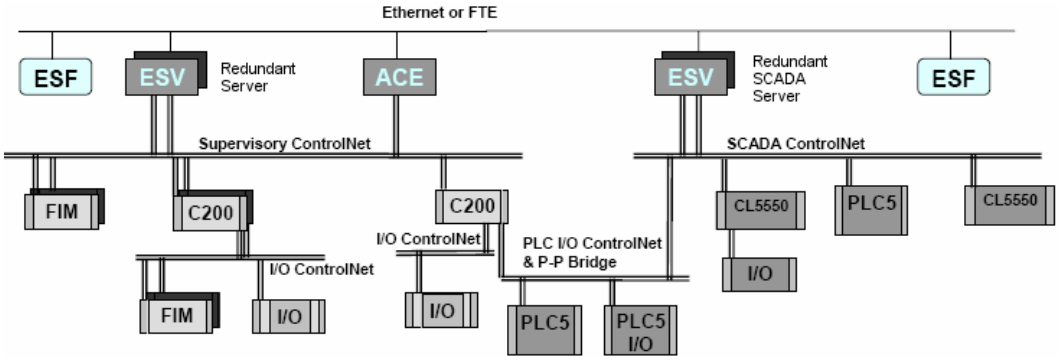


Figure 31 Integrated SCADA topology

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.

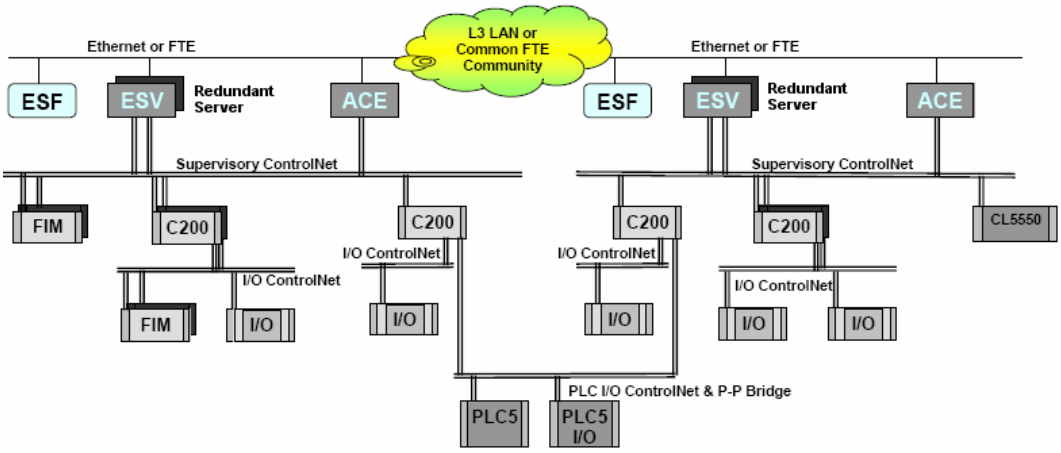


Figure 32 Multiple ControlNet server DSA topology

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.

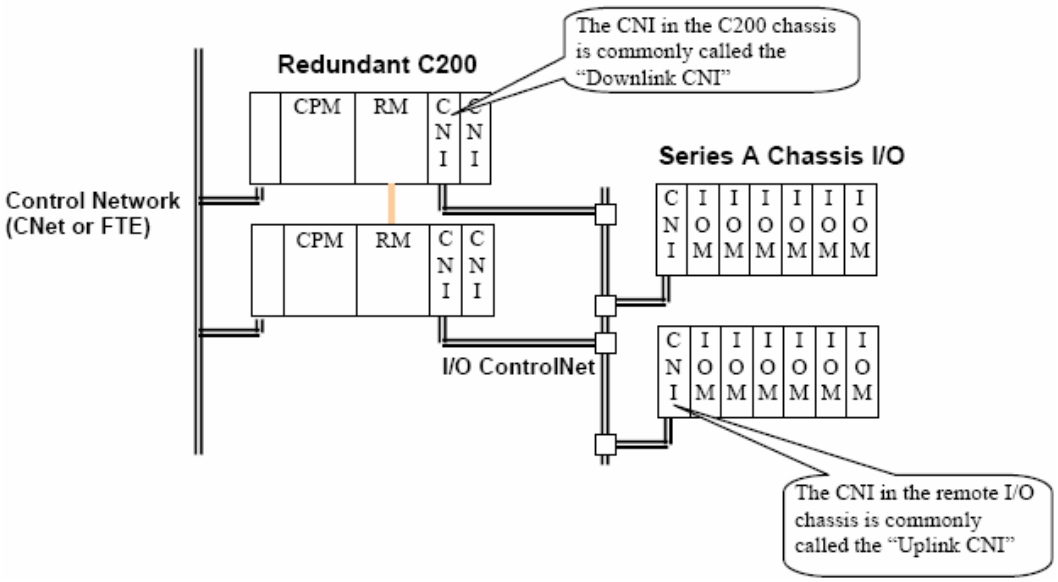


Figure 33 Basic Series A Chassis I/O Topology

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.

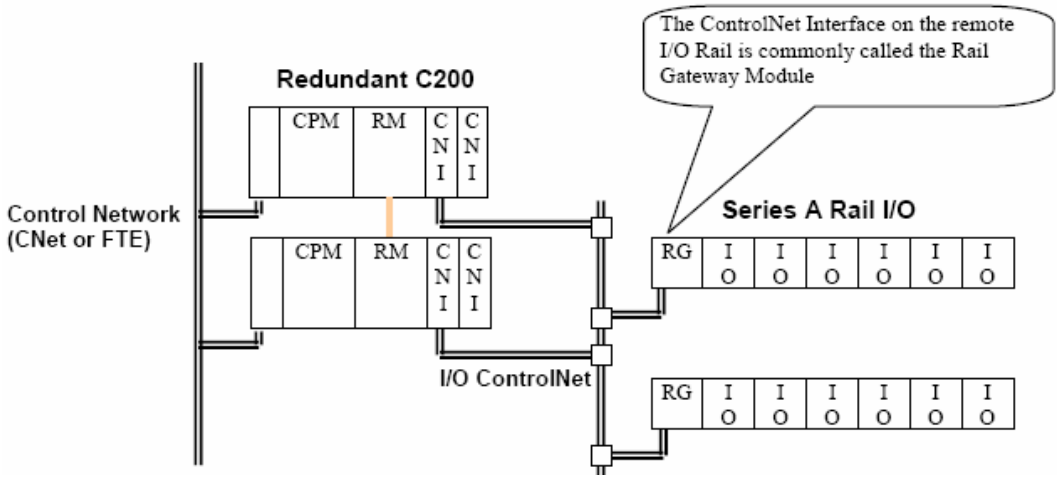
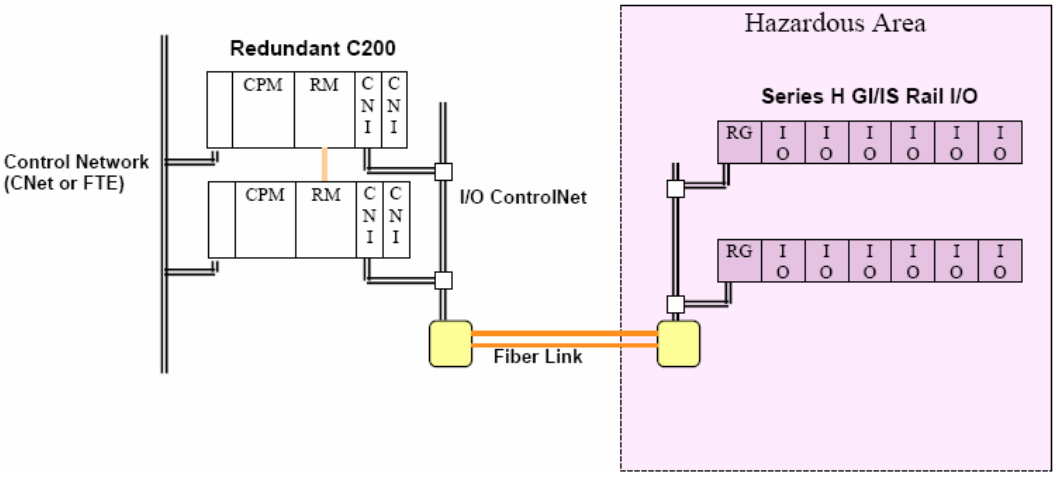


Figure 34 Basic Series A Rail I/O Topology

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.

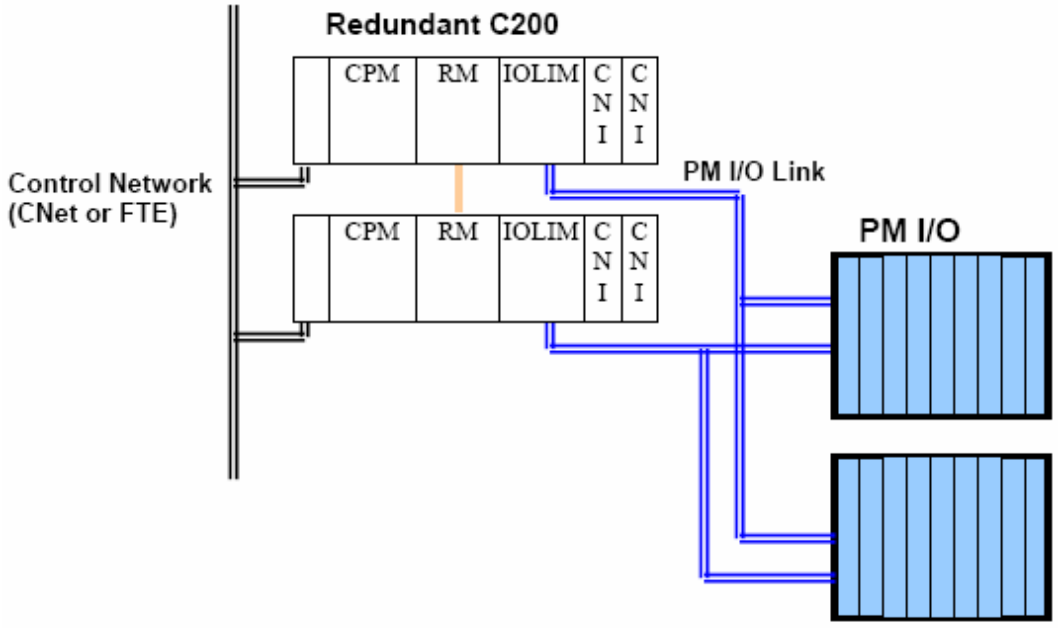


Figure 35 Basic PM I/O with C200 and IOLIM Topology

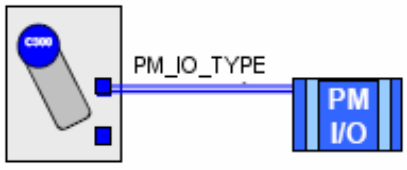
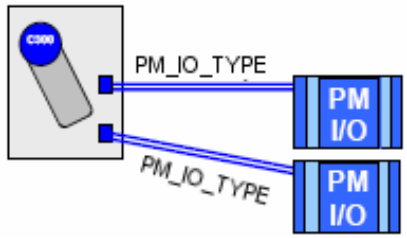
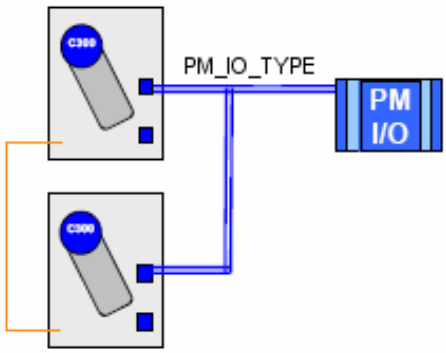
Configuration Rules (LIM)

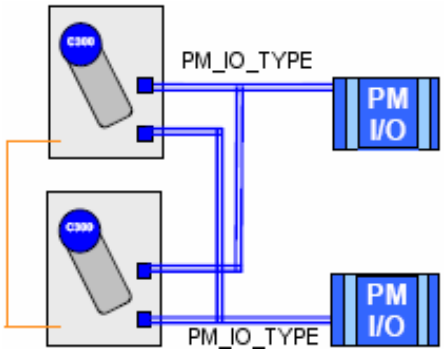
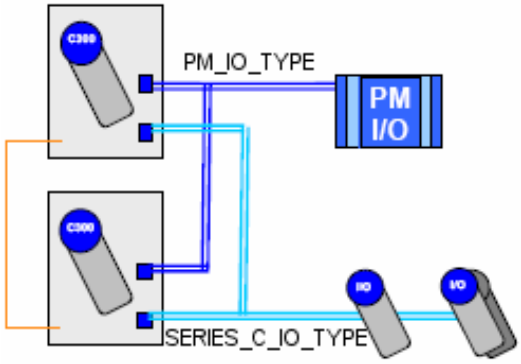
Reference	Description
CR_LIM.0	The IOLIM must reside in the same chassis as the C200 Controller. Both redundant and non-redundant chassis are supported.
CR_LIM.1	A redundant controller chassis using PM I/O must contain at least a supervisory ControlNet Interface module (CNI) (for ControlNet) or FTE Bridge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

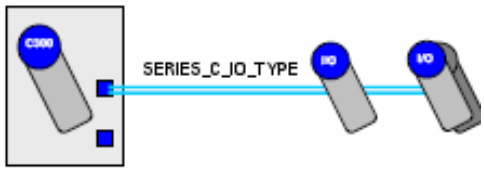
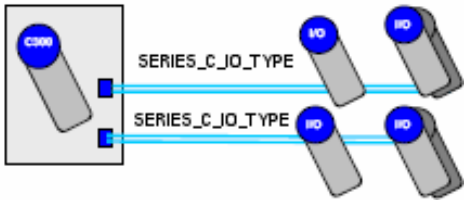
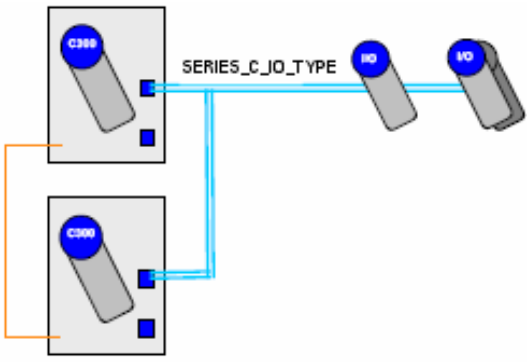
IOP Type	Description	Channels
HLAI	Analog Input – High Level	16
HLAIHART	Analog Input – High Level, HART Capable	16
LLAI	Analog Input – Low Level	8
LLMUX	Analog Input – Low Level Multiplexer	32
RHMUX	Remote Hardened Multiplexer	32
STI-MV	Smart Transmitter Interface - MV	16
AO8	Analog Output 8	8
AO16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

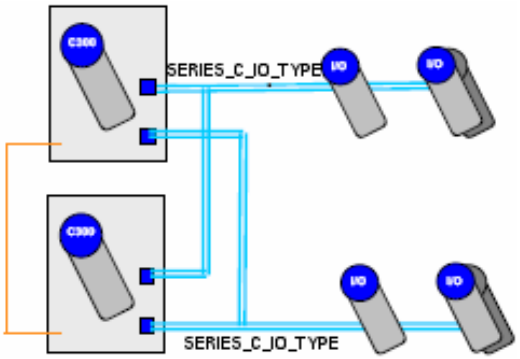
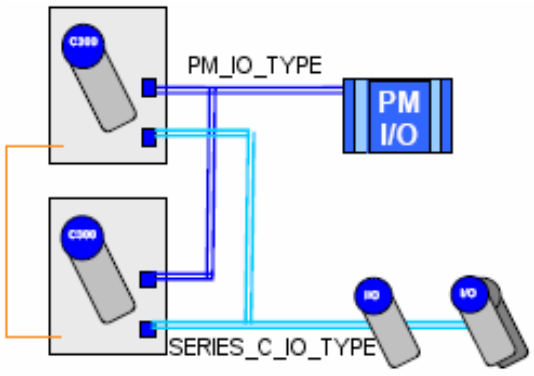
IOP Type	Description	Channels
DI	Digital Input	32
DI24	Digital Input 24 Vdc	32
DISOE	Digital Input Sequence of Events	32
DO16	Digital Output 16	16
DO32	Digital Output 32	32

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.

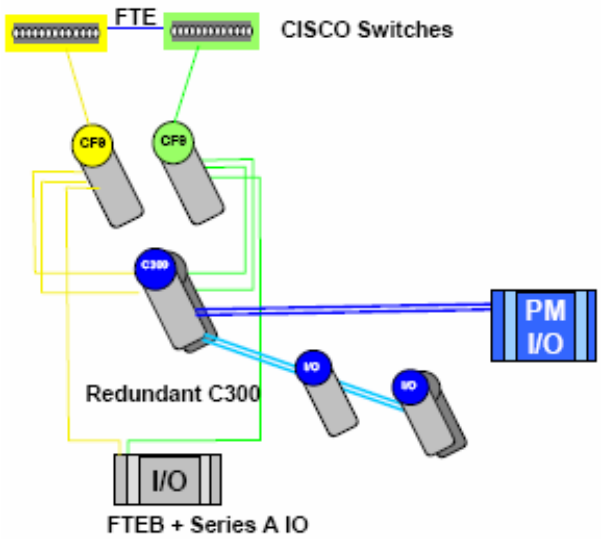


Figure 36 Basic C300 with Series A Chassis I/O Topology

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.

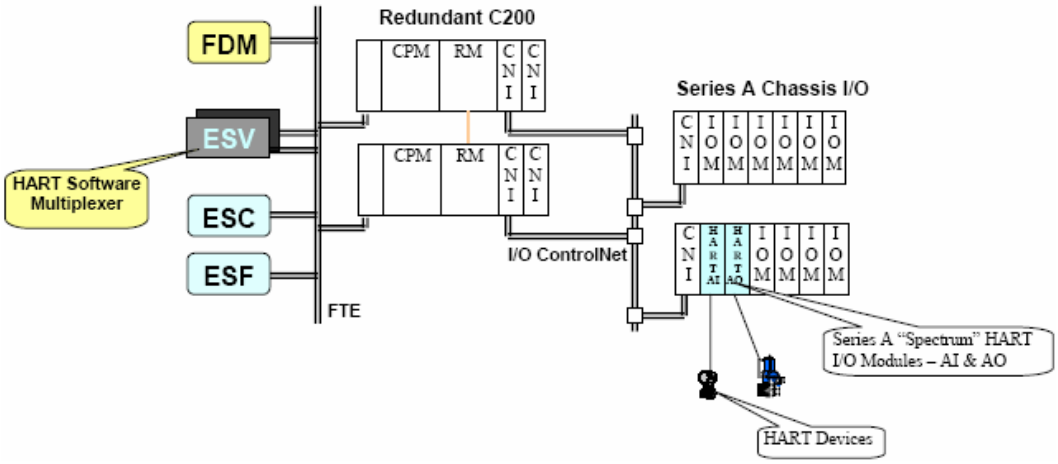


Figure 37 Series A *Spectrum* HART I/O Topology

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.

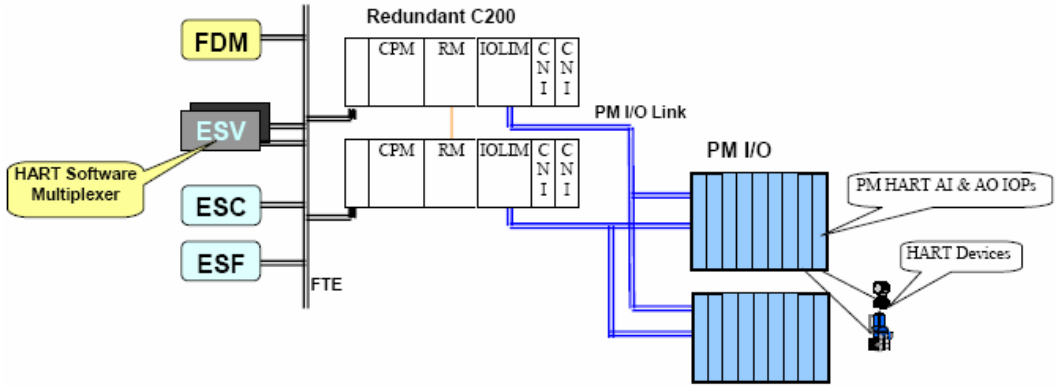


Figure 38 HART PM I/O Topology

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.

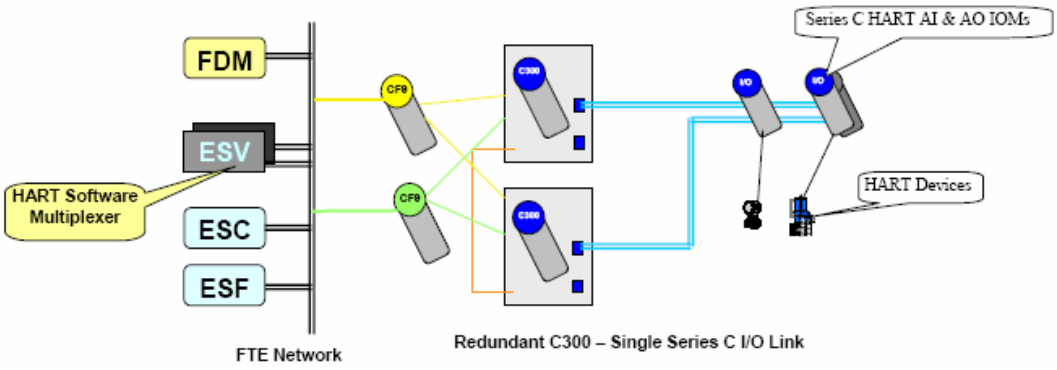


Figure 39 HART Series C I/O Topology

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.

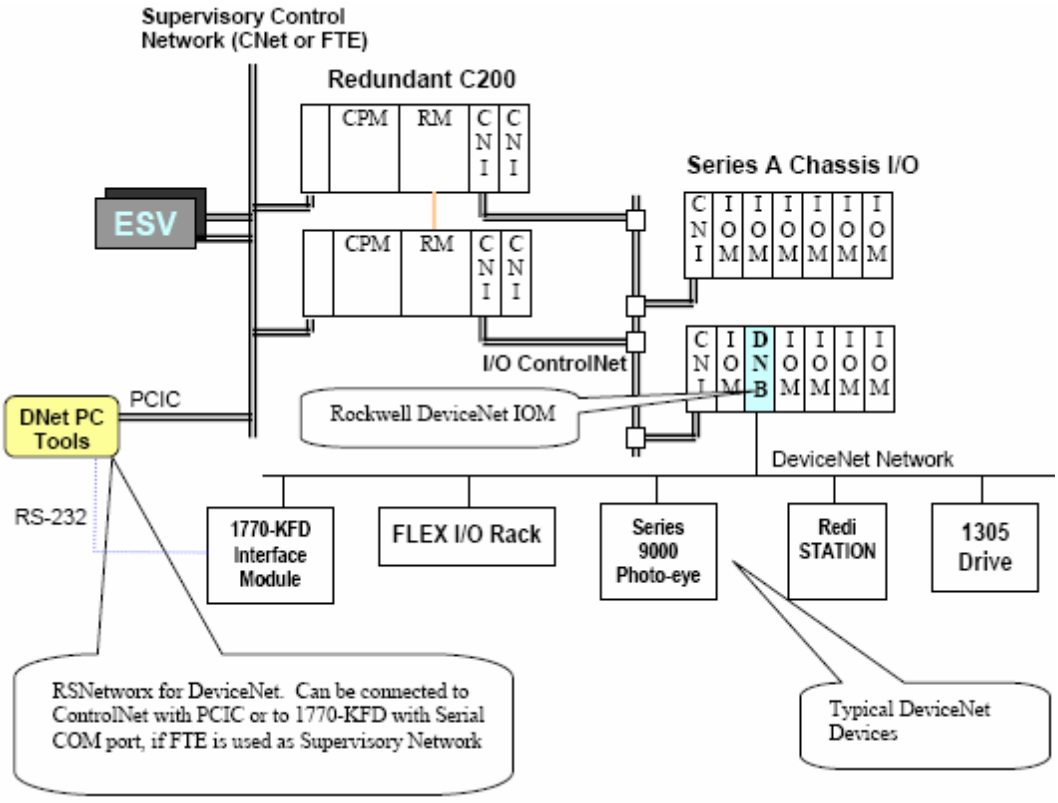
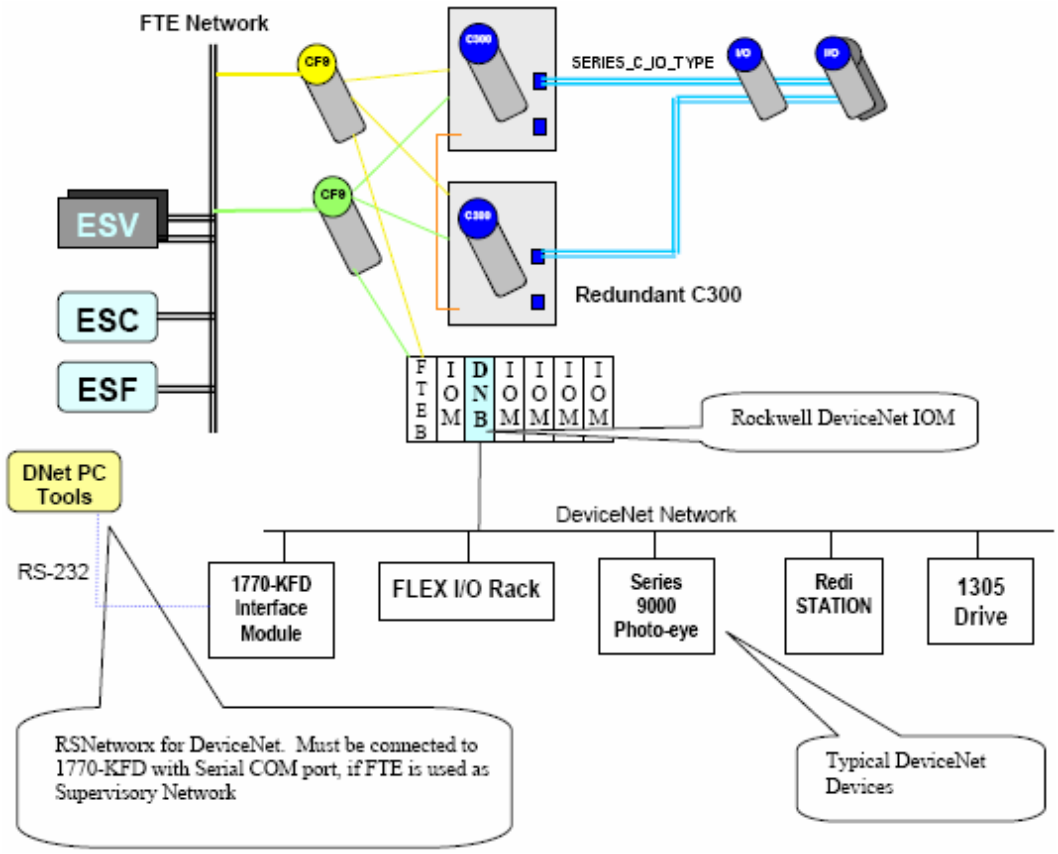


Figure 40 C200 DeviceNet I/O Topology

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.

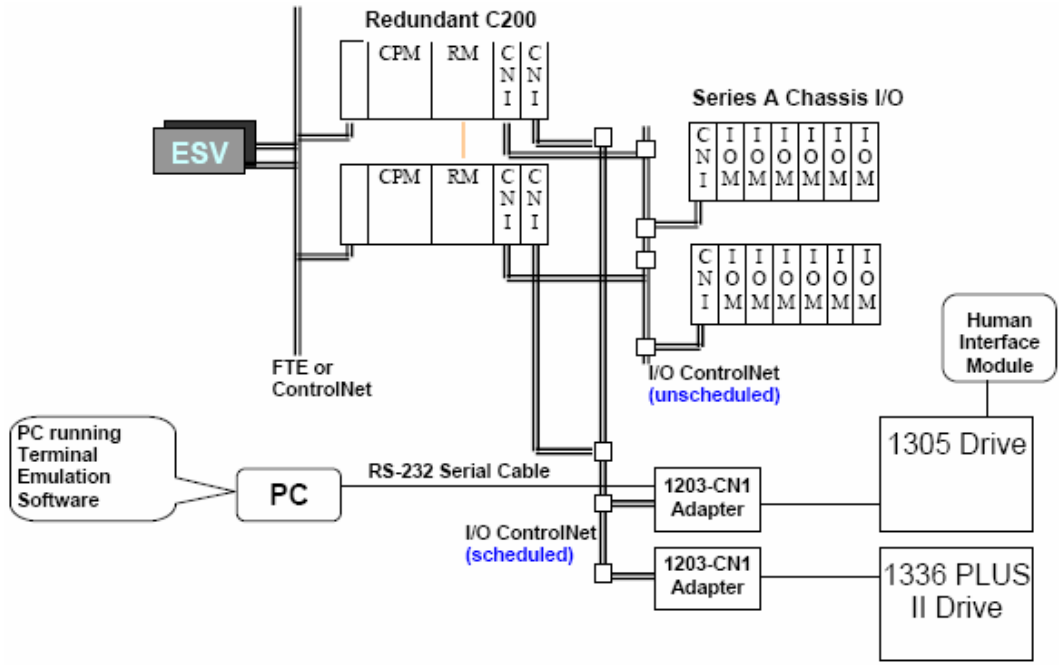
<table>
<tr><th>Reference</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">CR_DNT.1</td><td colspan="3">The communication update interval between the DeviceNet Interface and the DNET_IM block is not configurable, but is dependant upon the Base Execution Rate of the CEE in which the block 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.

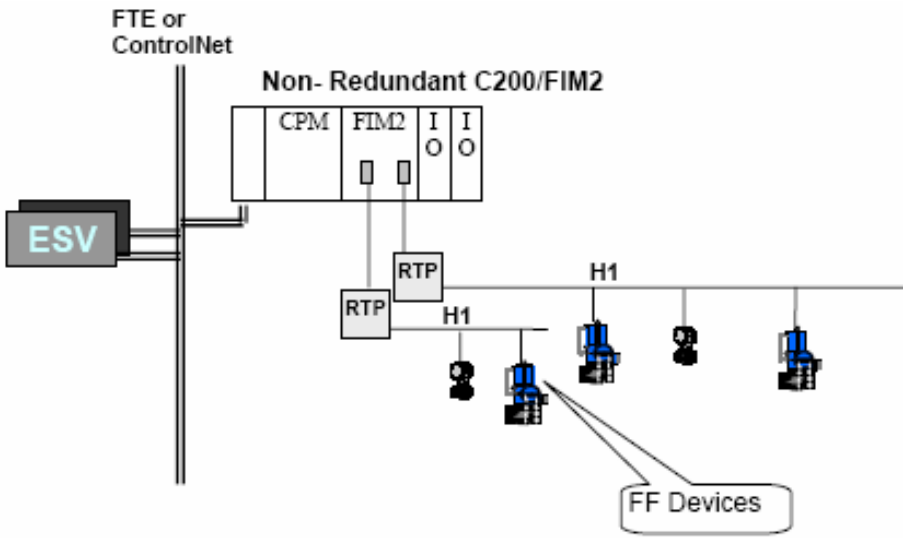


Figure 41 Non-Redundant Series A FIM topology

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.

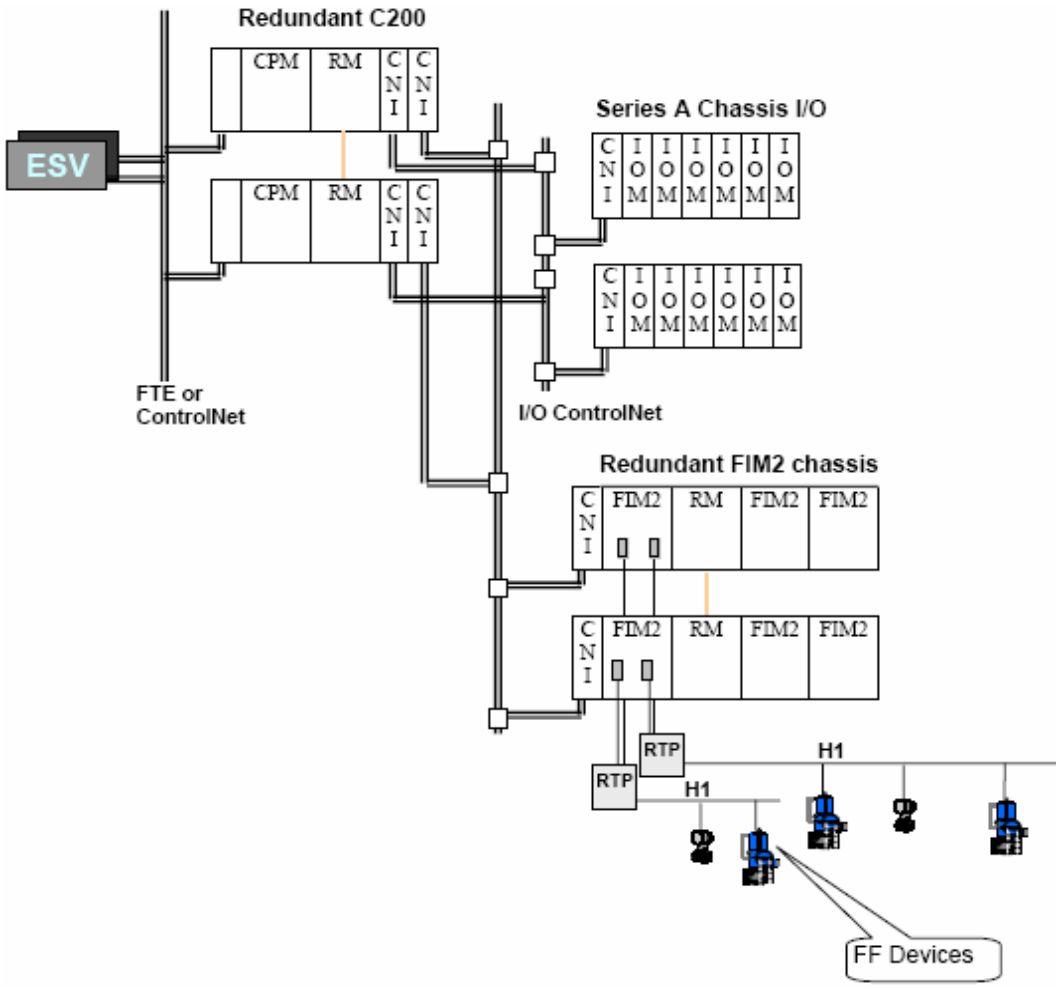


Figure 42 Redundant Series A FIM topology

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.

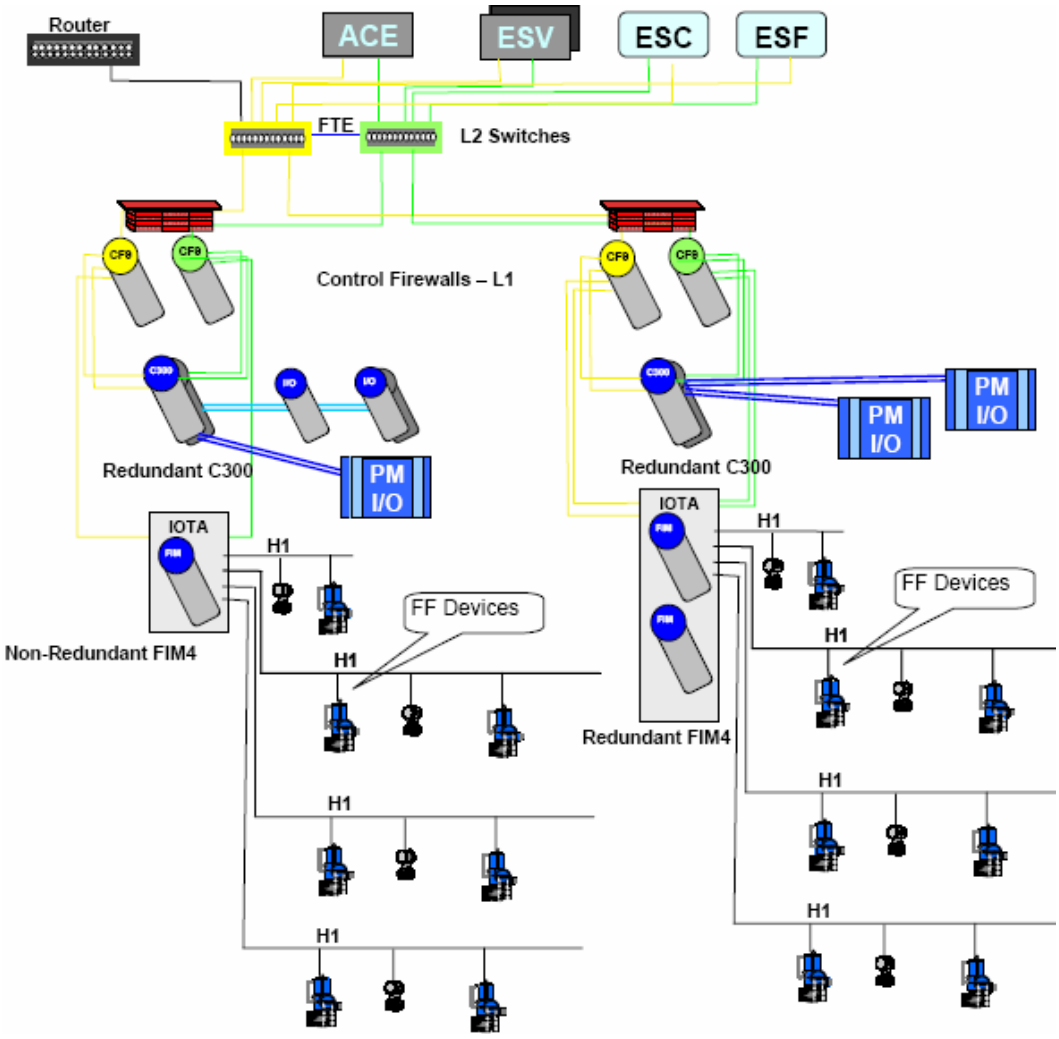


Figure 43 Basic Series C FIM topology

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.

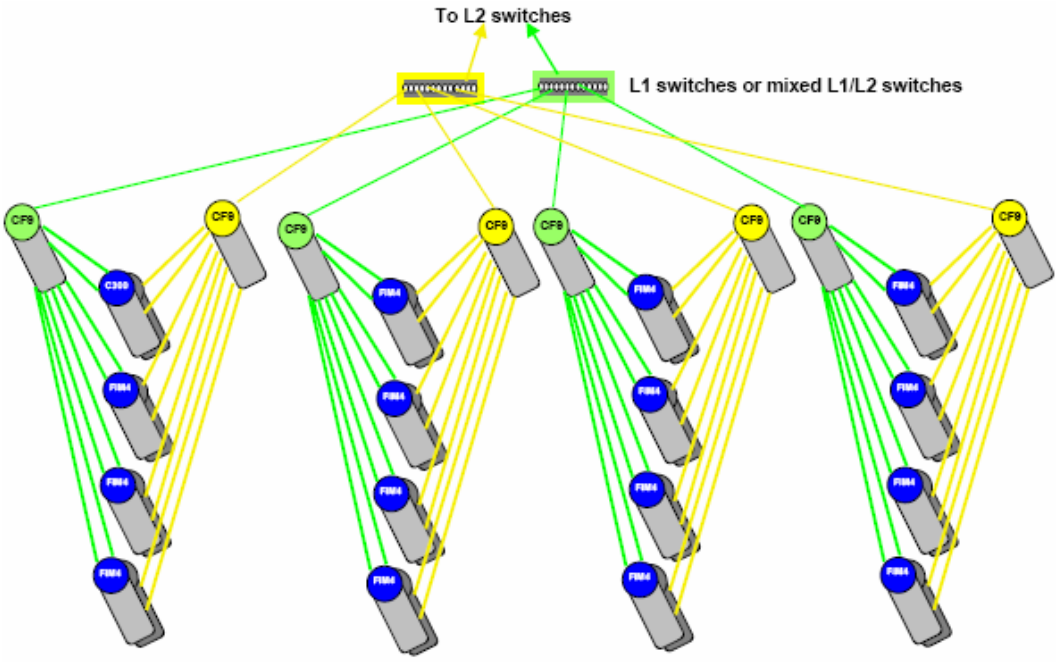


Figure 44 Maximum C300, Series C FIM and Control Firewall topology

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.

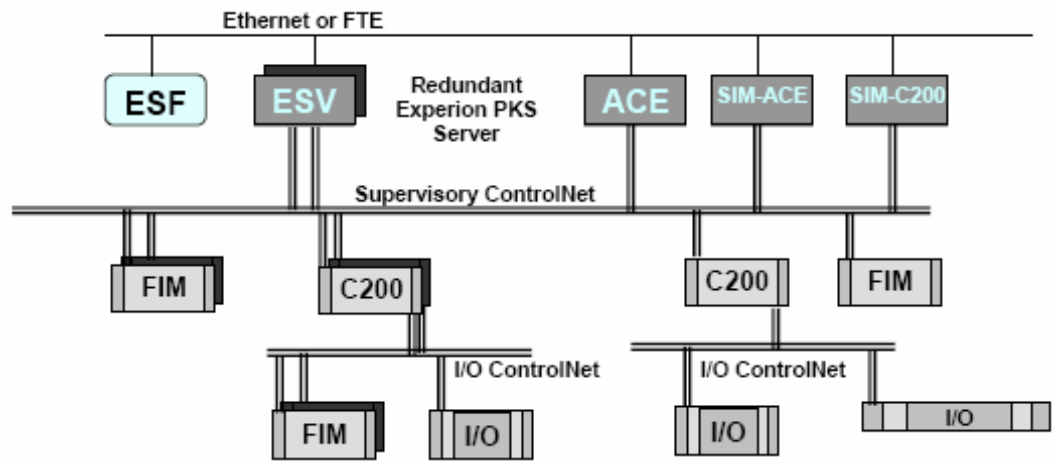


Figure 45 Typical ControlNet Simulation Topology

FTE simulation topology

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

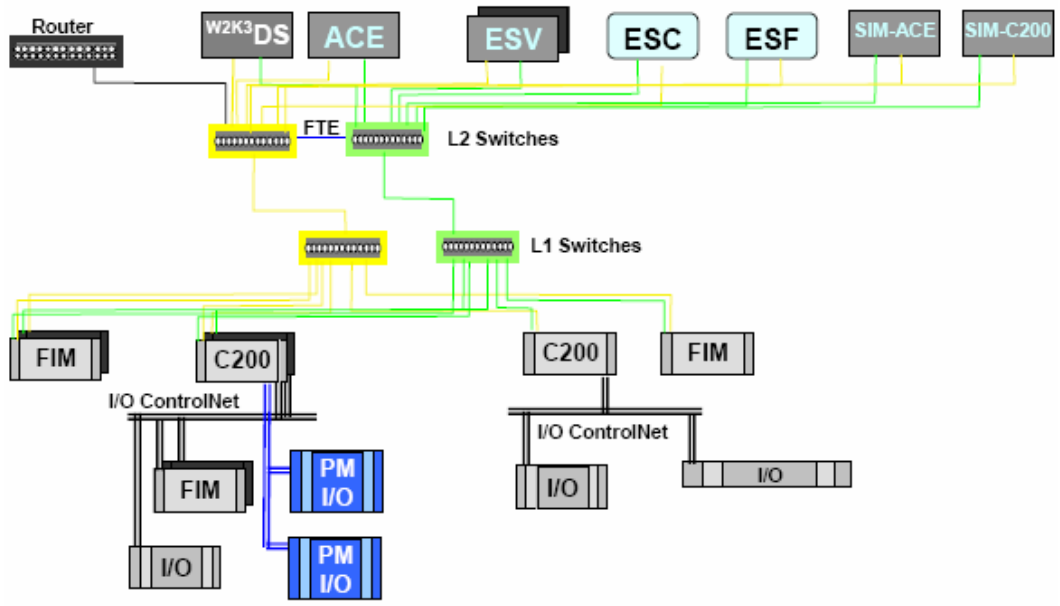


Figure 46 Typical FTE Simulation Topology

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)

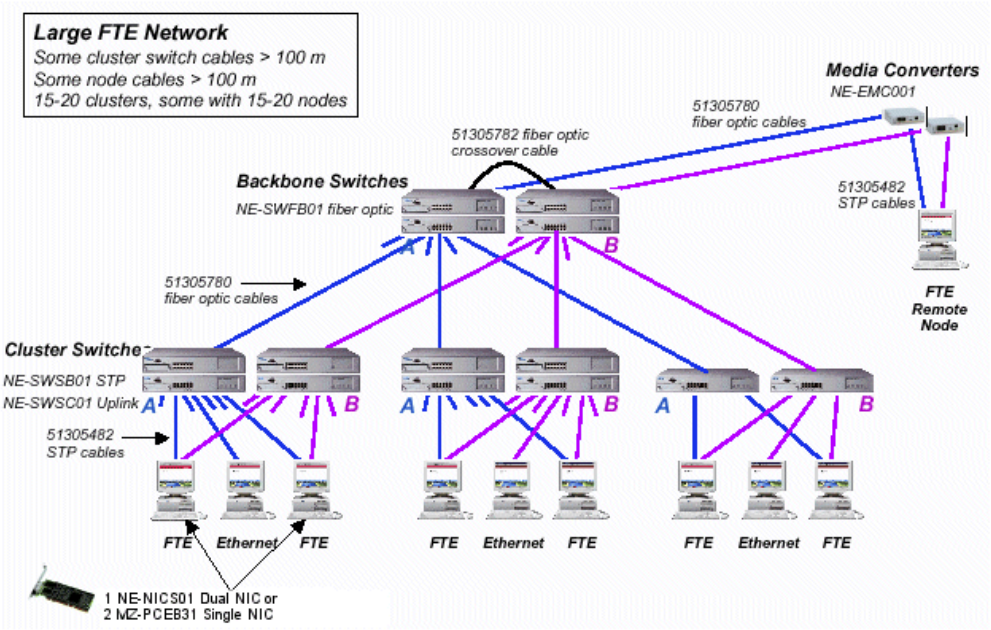
Reference	Description
CR_SAE.0	CAB and CDB blocks can run on the SIM-ACE platform, but will not run on the C200 embedded controller.
CR_SAE.1	Up to 5 ACEs (Both ACE and SIM-ACE together 5) are supported per Experion server.
CR_SAE.2	If SIM-ACE is used as a standalone simulation system, the number of 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:

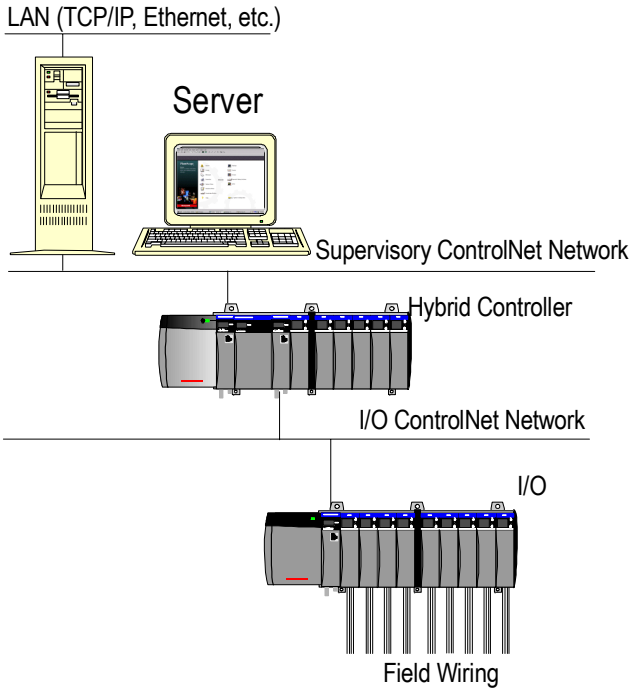
1 Experion Server—

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—

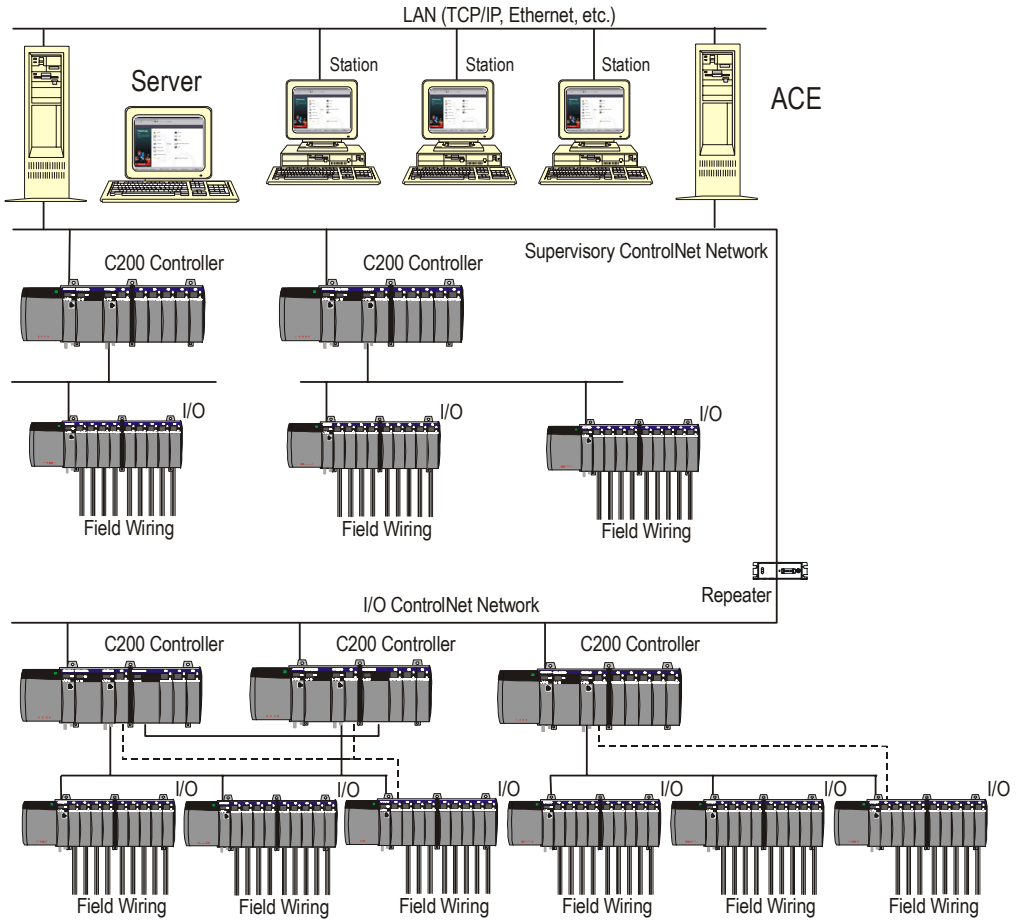
providing 360 points, configured as:

- 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

1 C200 Controller—

providing 92 points, configured as:

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

1 C200 Controller pair—

providing 360 points, configured as:

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

5 Experion Clients—

providing operator and engineering station functionality

1 C200 Controller—

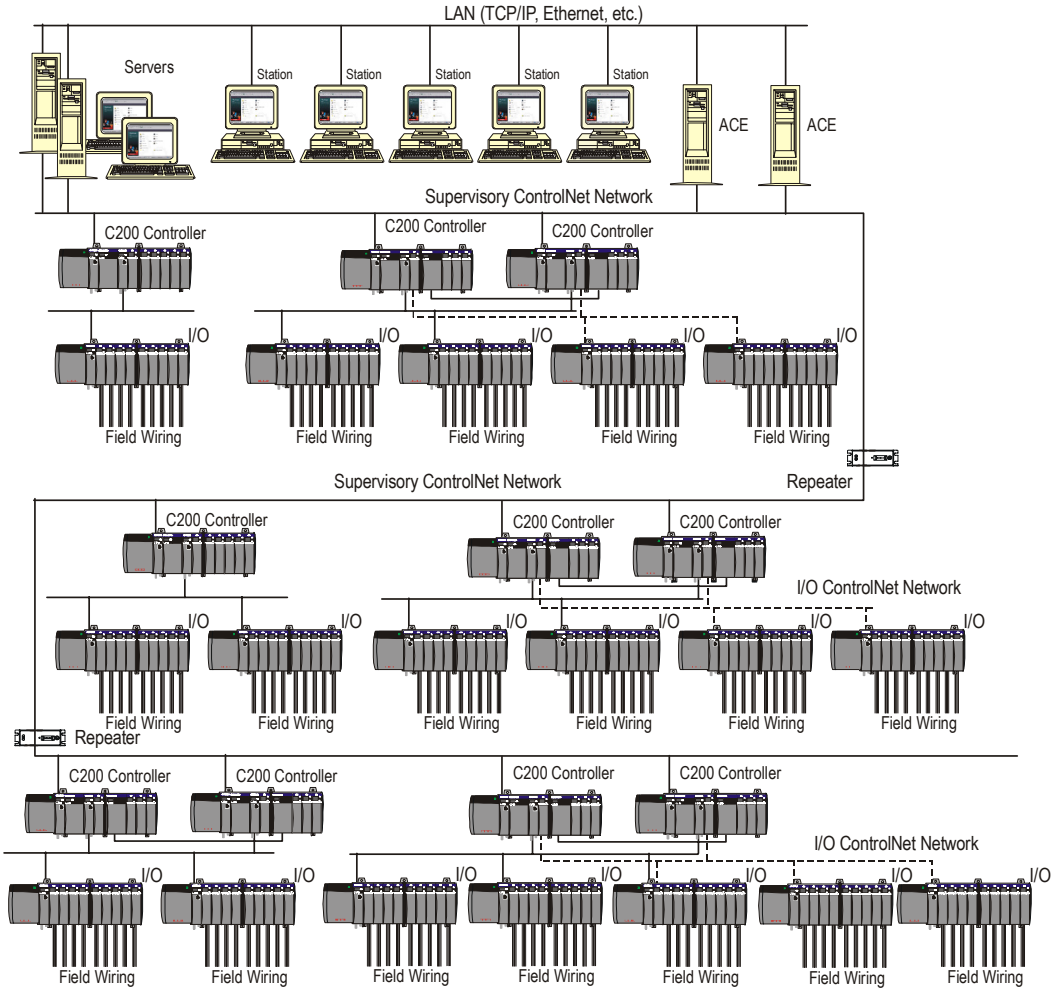
providing 222 points, configured as:

- 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



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.

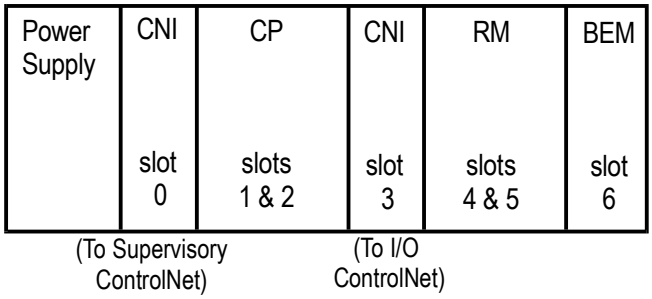
CAUTION

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

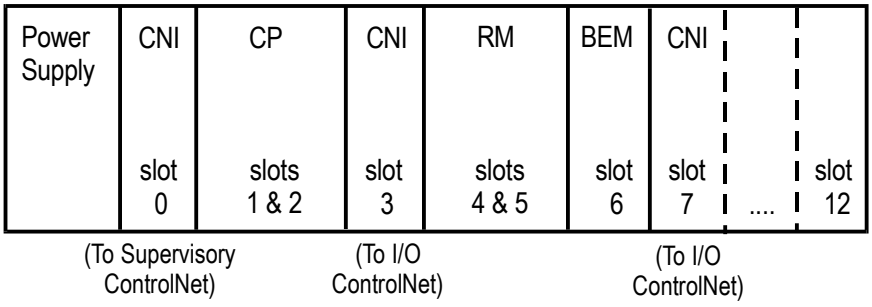
- each controller chassis must be identical in configuration.
- I/O modules are not permitted in the controller chassis, as their points could fail in the event of a failover or switchover to the backup controller.
- any unused slot of any chassis must have a Blank Cover Module installed. Two Blank Cover 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

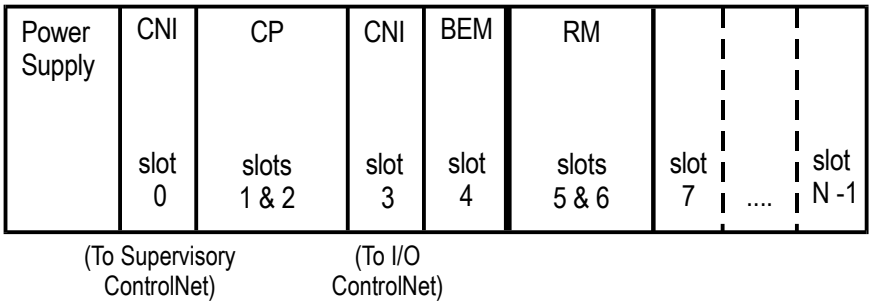
While control hardware modules are designed to permit removal and insertion under power (RIUP) without damaging the module, Honeywell recommends that you do **not RIUP** any module in an Experion control system since it may cause an indeterminable upset in the process.



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

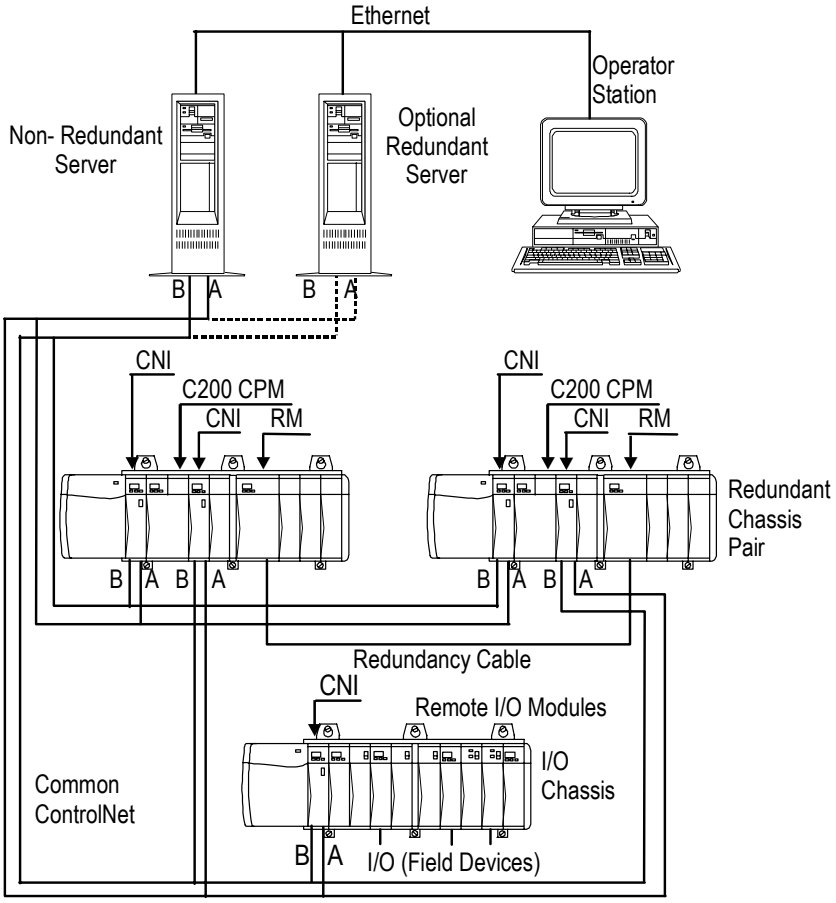
Upon redundant controller switchover, the CNIs within the Redundant Chassis Pair (RCP) are temporarily not visible on their respective ControlNet segments. To ensure that the network is maintained, a minimum of two other ControlNet Nodes must remain on the ControlNet segment during the switchover operation.

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

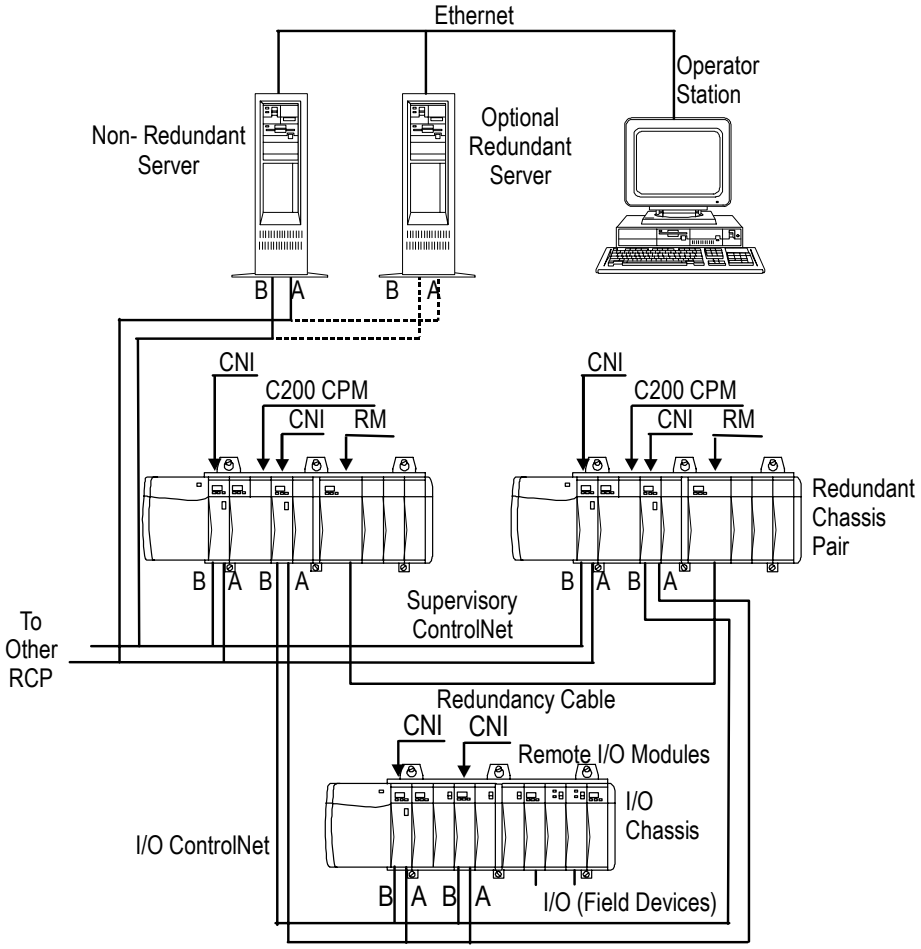
The following sample system configurations show how you can adapt a given small system architecture to meet minimum redundant controller system requirements.

- 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.

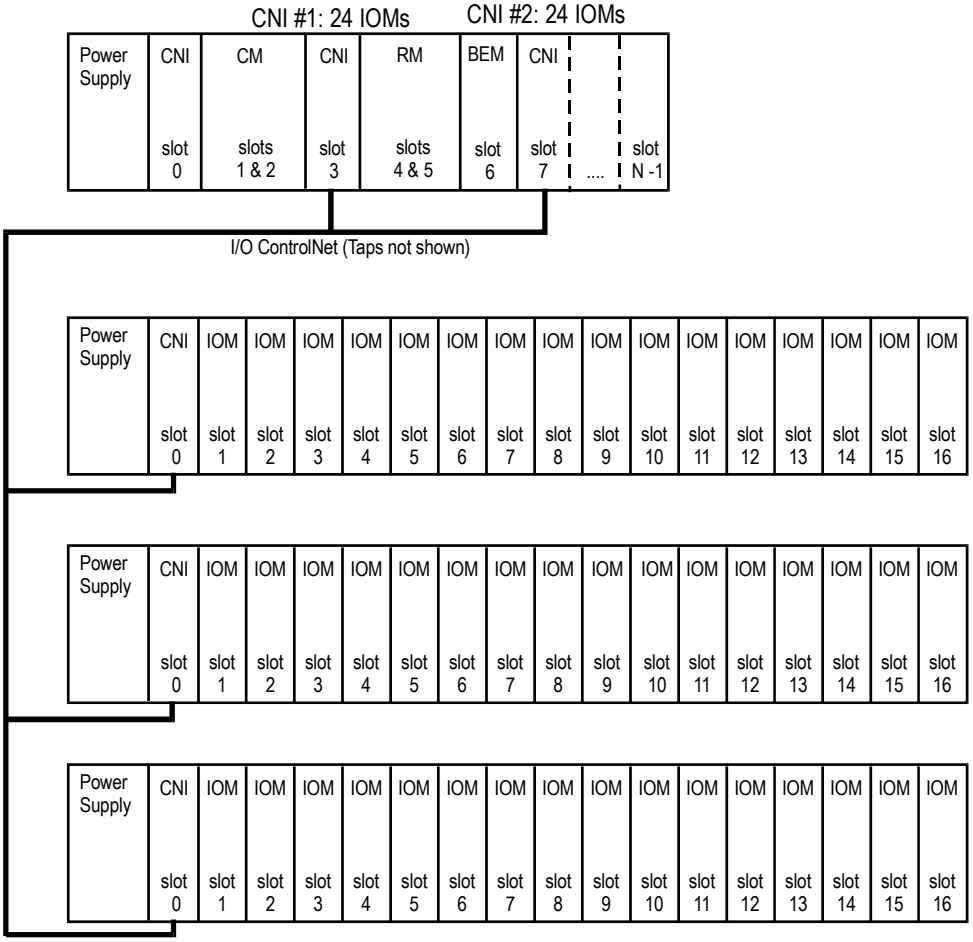
- Note that the default address for the I/O Chassis CNI in slot 0 is 3.
- Note that the default address for the I/O Chassis CNI in slot 4 is 4. (Note that the slot 4 location was chosen for example purposes only.)



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

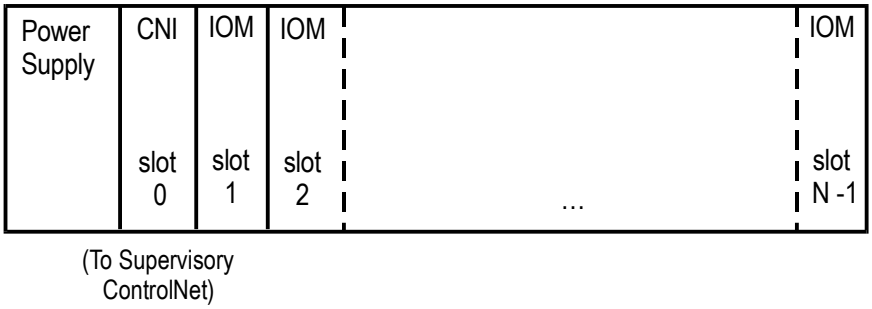
Slot 0 is preferred for the CNI because the ControlNet cables can be routed to the left without being routed past IOMs (and their field wiring) to the right. If more than one CNI module is required in the I/O chassis, the additional CNI module(s) should be placed in the left-most slots (after slot 0)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

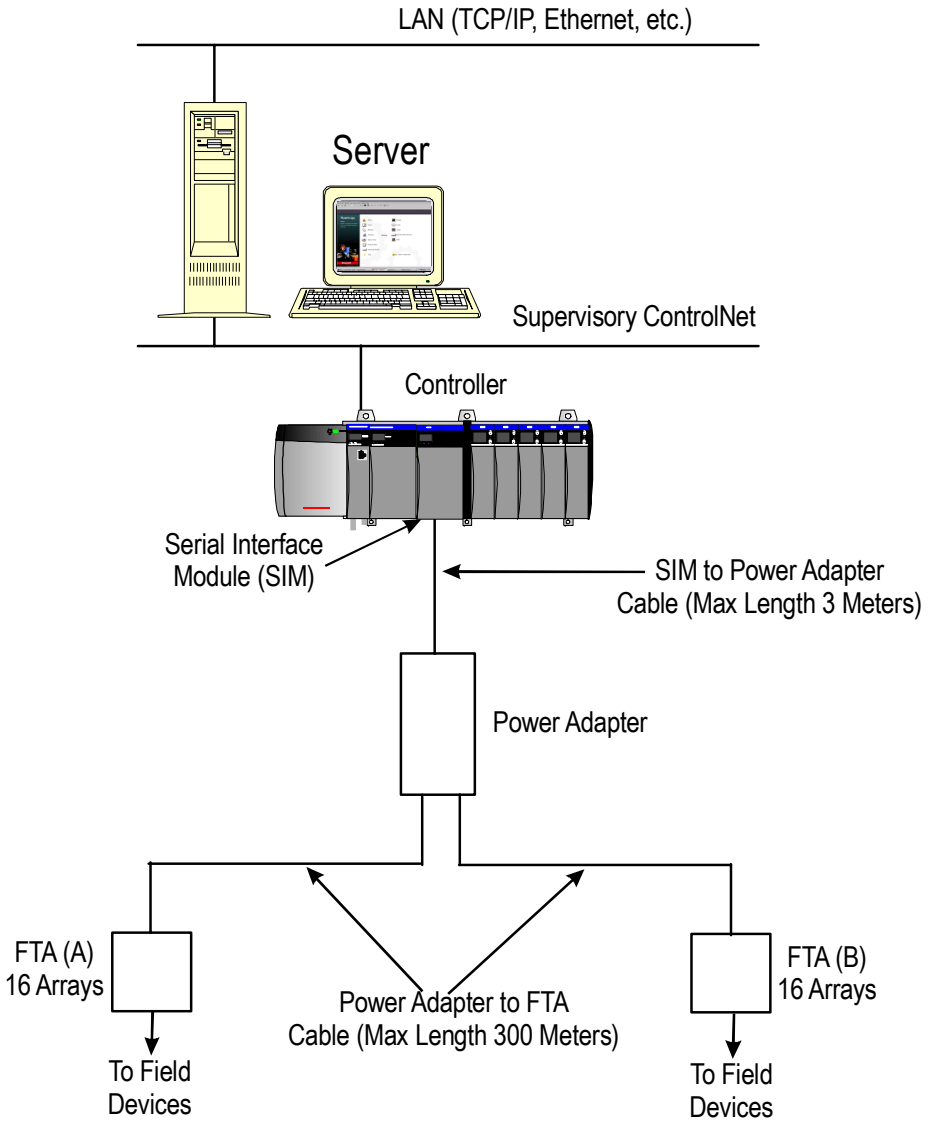
PROFIBUS Interface Module (PBIM) planning

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.

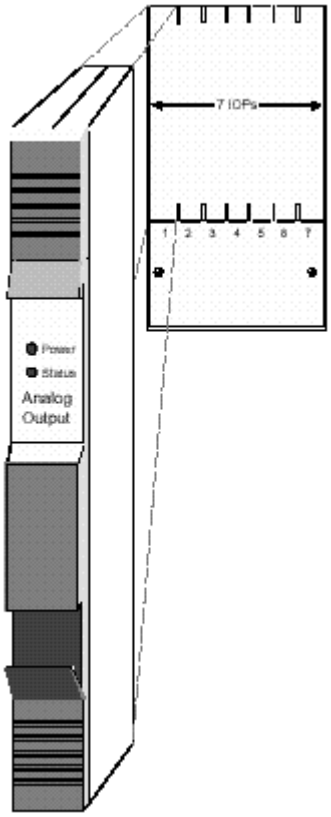
Card File Name	CE Compliant Model	Non-CE Compliant Model
Left 7-Slot IOP	MU-HPFI03	MU-HPFH01
Right 7-Slot IOP	MU-HPFI13	MU-HPFH11
15-Slot IOP	MU-HPFI23	MU-HPFX02

REFERENCE - INTERNAL

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

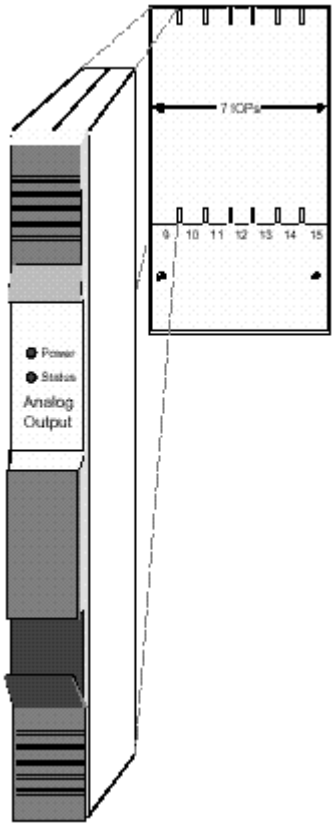
Left 7-Slot IOP

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.



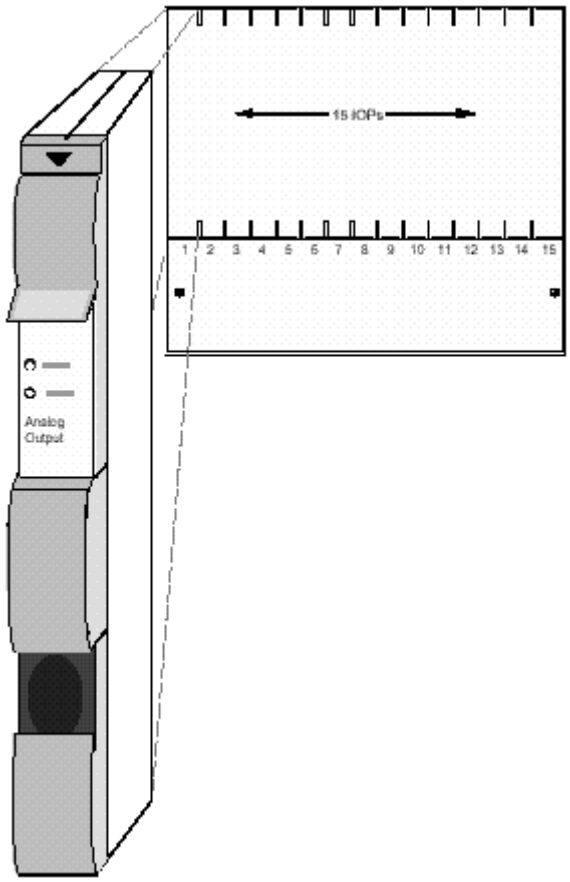
Right 7-Slot IOP

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

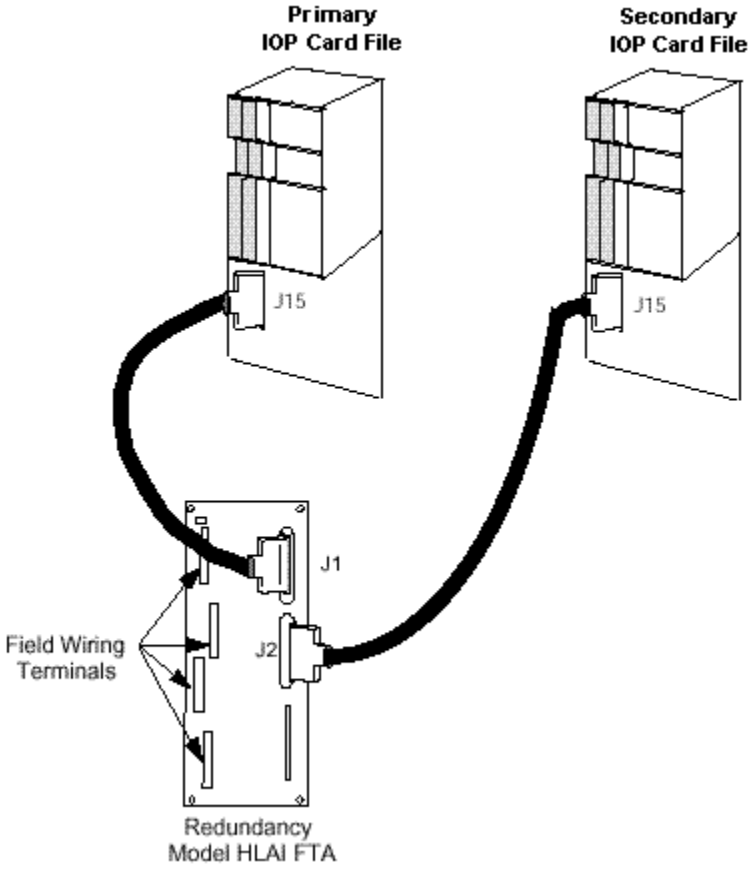
The I/O Link Interface Module supports IOP redundancy for the following types of IOPs:

- 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.

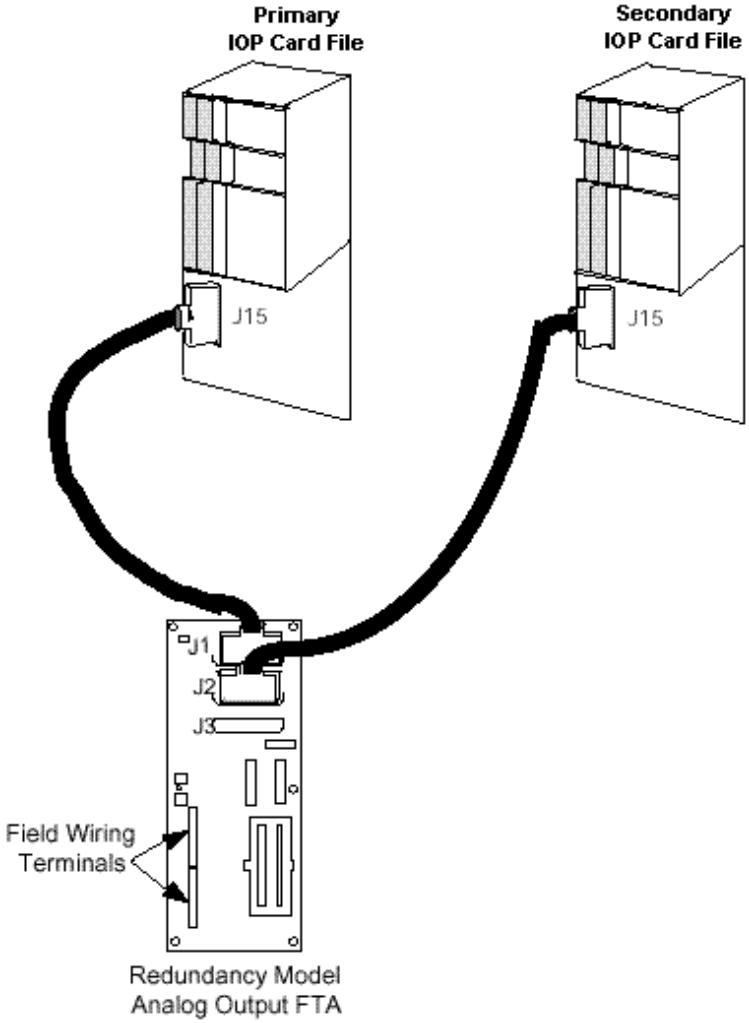
Redundant HLAI IOPs

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).

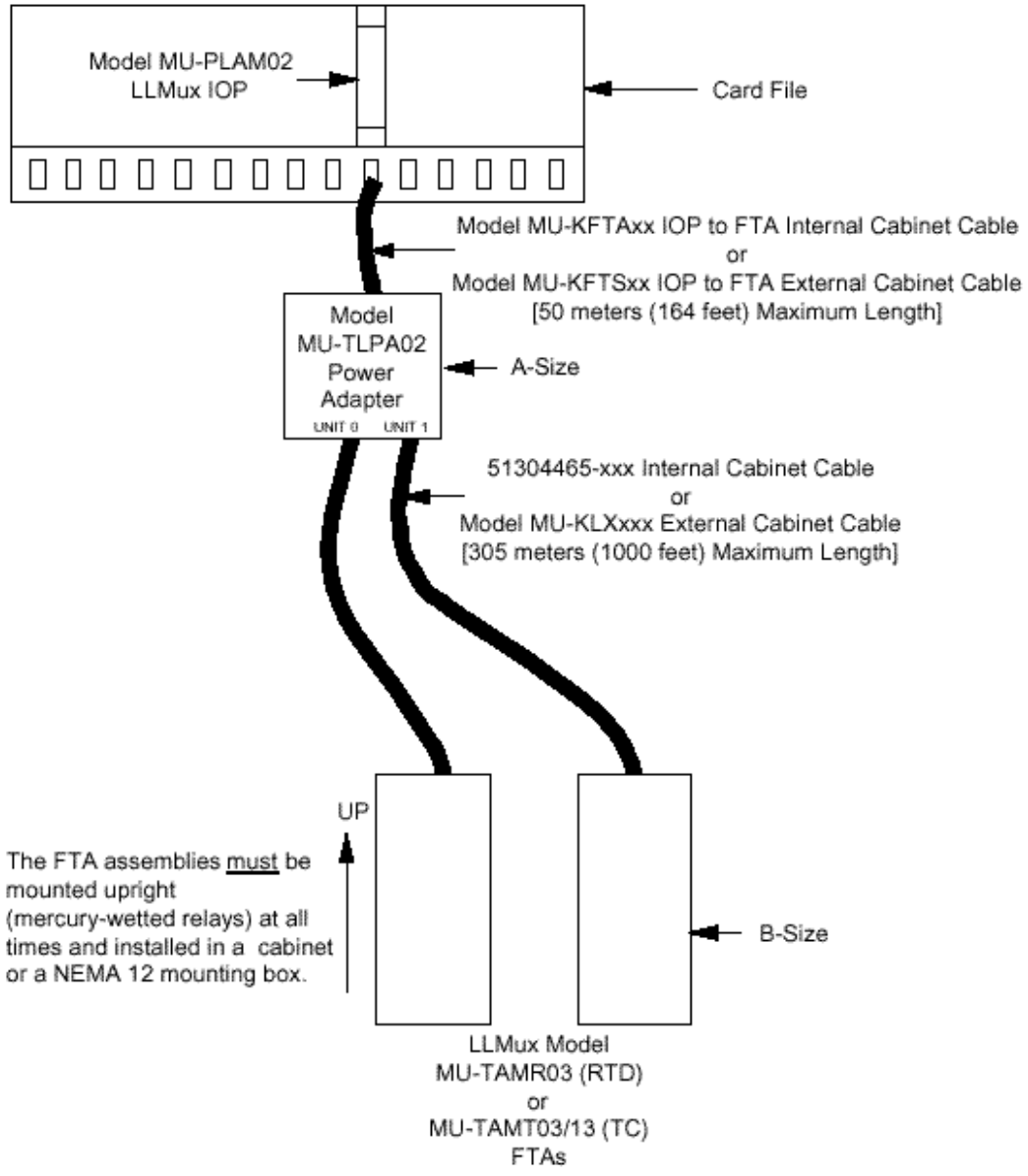
The RHMUX is Approved as Intrinsically Safe and Nonincendive for use in hazardous locations. However, the RHMUX assemblies can also be used in areas that are classified as nonhazardous. The RHMUX subsystem has the added advantage that the FTA can be located up to 2 kilometers from its Power Adapter.

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.

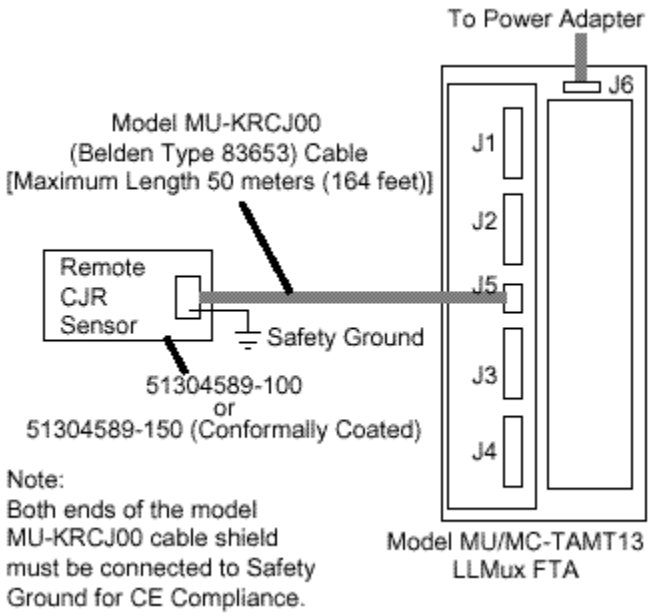
The following table lists general cable specifications for reference.

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.

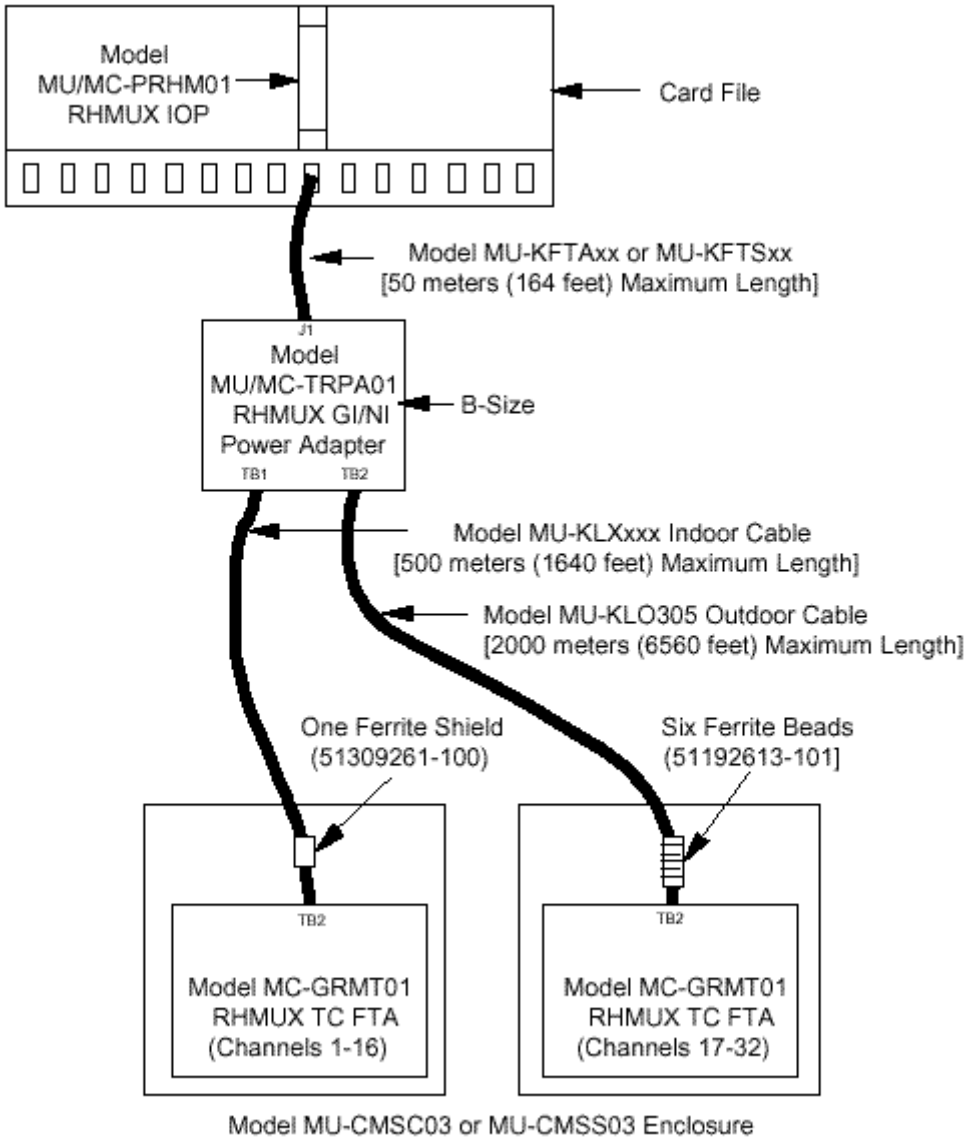
The model MU/MC-PRHM01 IOP supports 32 inputs from two RHMUX FTAs.

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.

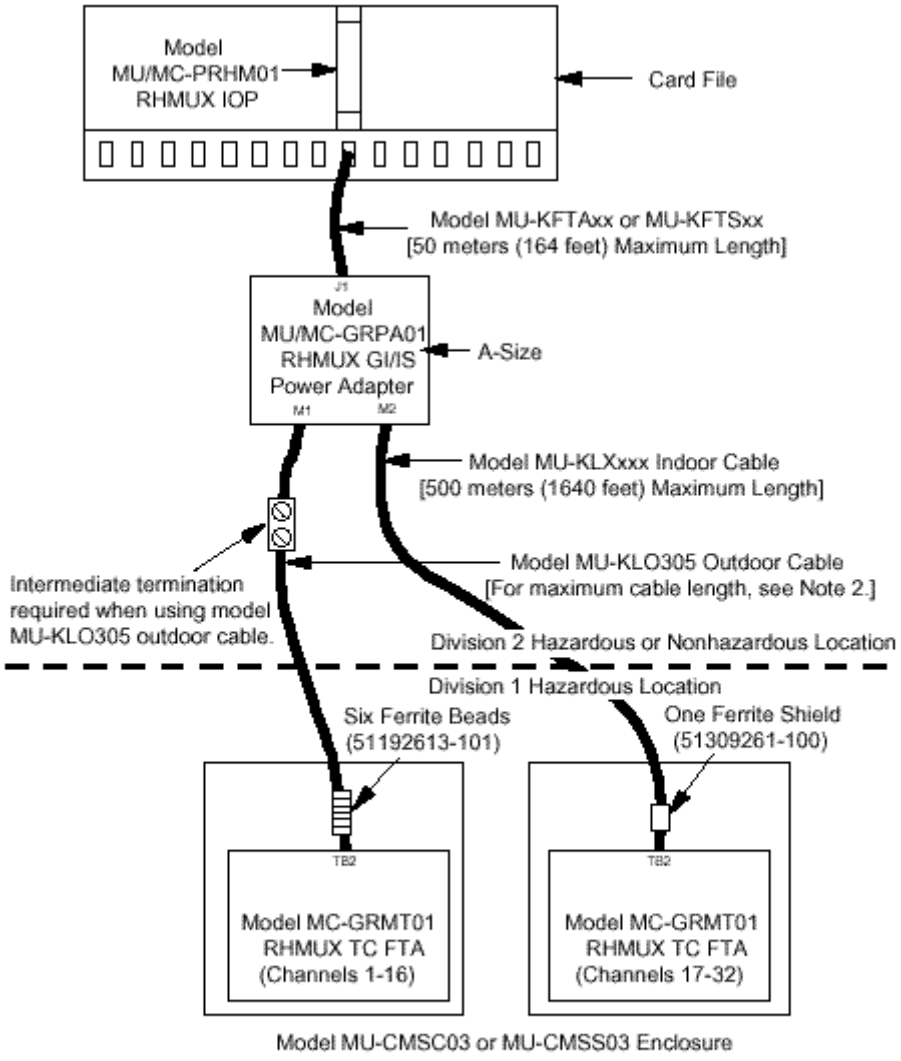
NonIncendive RHMUX Configuration



Model MU-CMSC03 or MU-CMSS03 Enclosure

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

Intrinsically Safe RHMUX Configuration



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

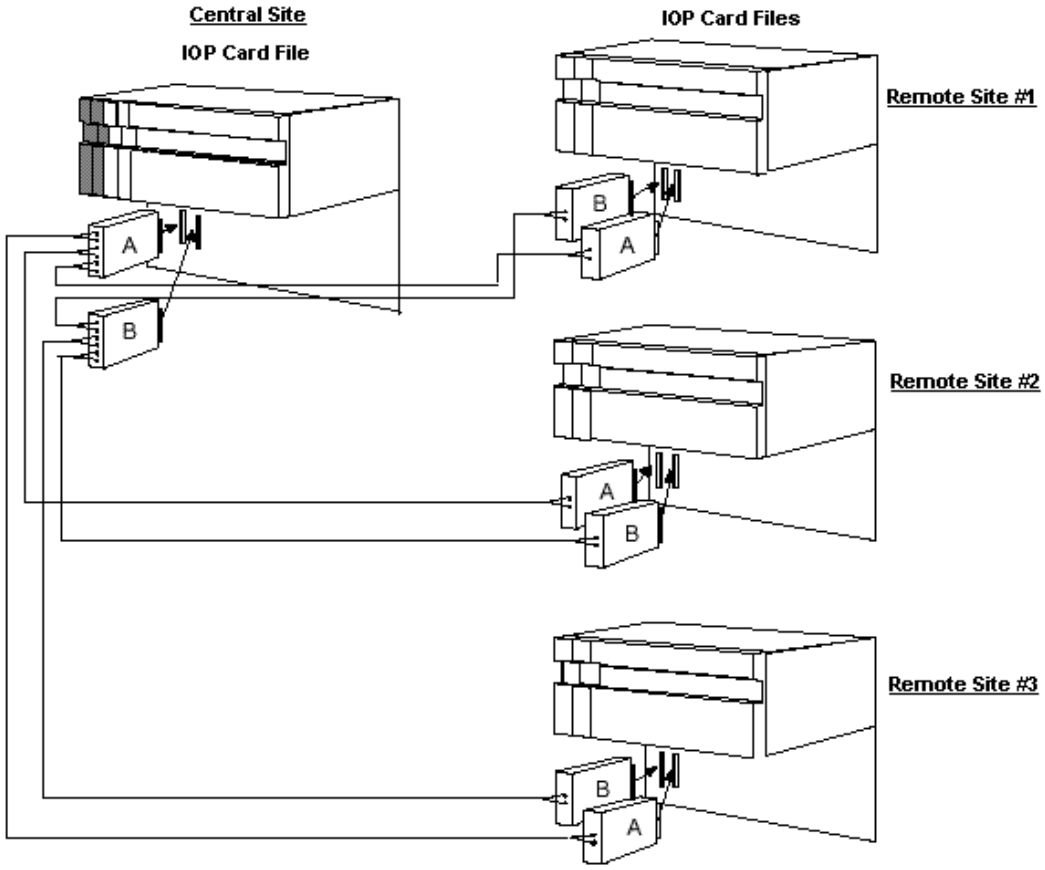
The Standard I/O Link Extender card will drive and terminate Link A or Link B, depending upon the number of the card file and the slot. If the number of the card file and the slot are both odd or both even, the card will drive Link A. If the number of the card file and the slot are not both odd or both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

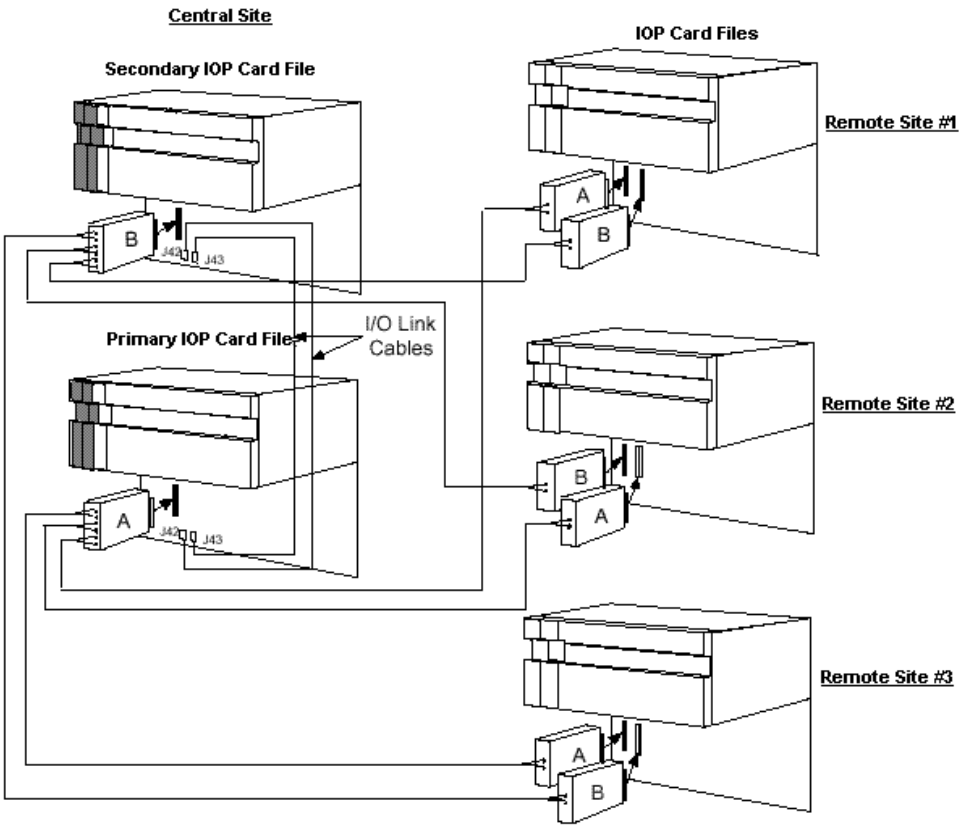
- The local IOP card file is configured as card file #1 (I/O Link Interface address of 0).
- Remote site # 1's I/O card file is configured as card file # 2 (I/O Link Interface address of 1).
- Remote site # 2's I/O card file is configured as card file # 3 (I/O Link Interface address of 2).
- Remote site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

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

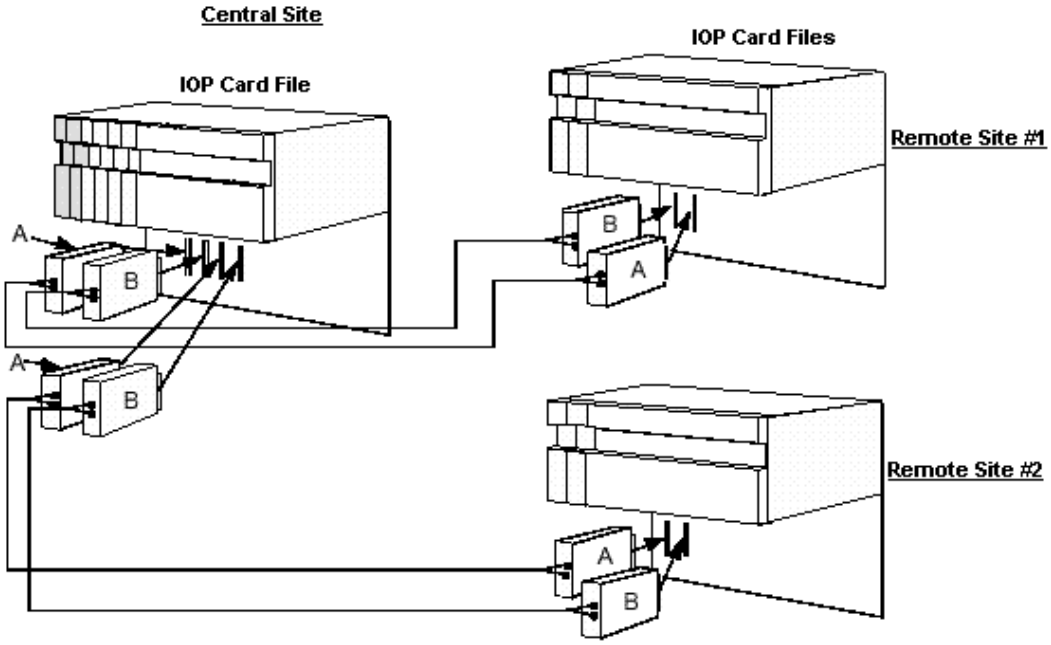
ATTENTION

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).

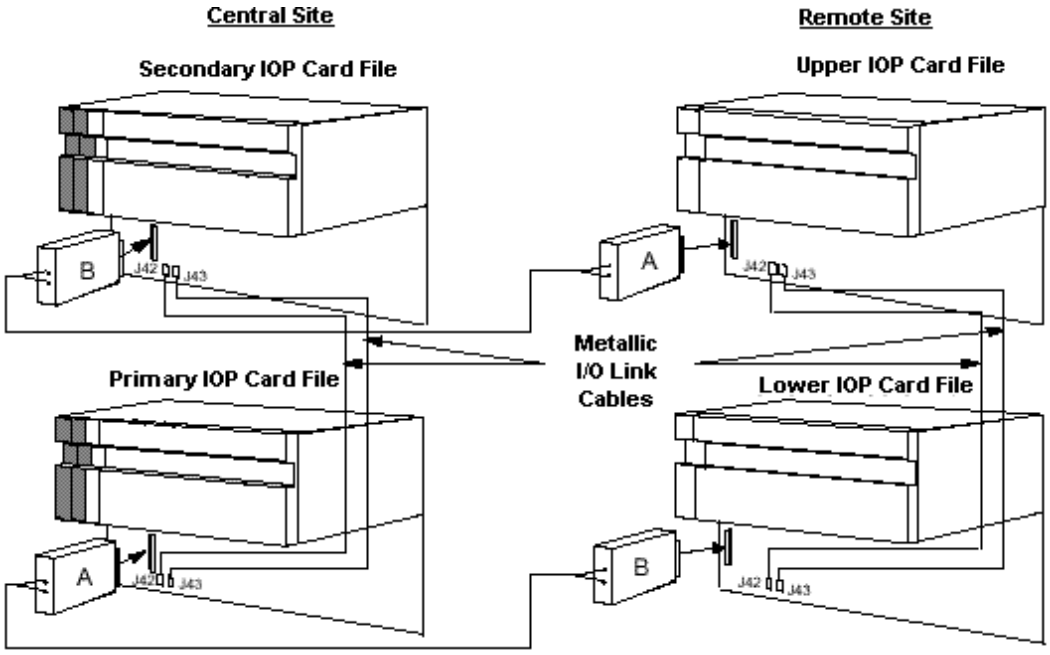


Multiple IOPs at remote site example

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.

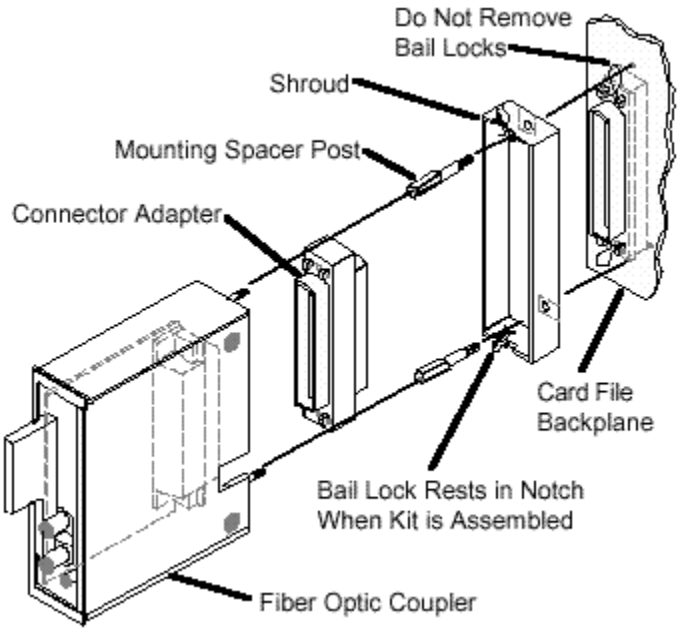
The following IOP subsystem configuration is assumed:

- 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.

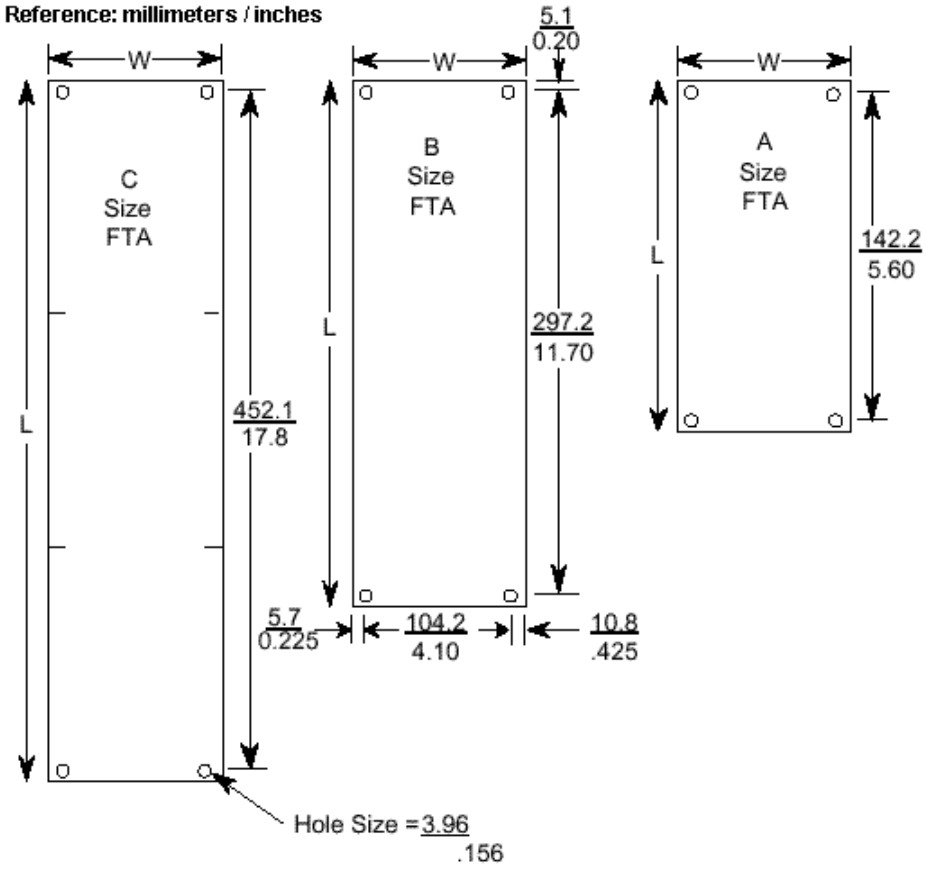
FTA Type	Description
Analog Output (AO)	The AO FTA provides isolated 4-20 mA outputs to proportioning loads such as valves.
Analog Output (AO) HART	The above AO functionality plus the ability to connect HART devices to the FTA without external filtering. This FTA also provides a connector to interface 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

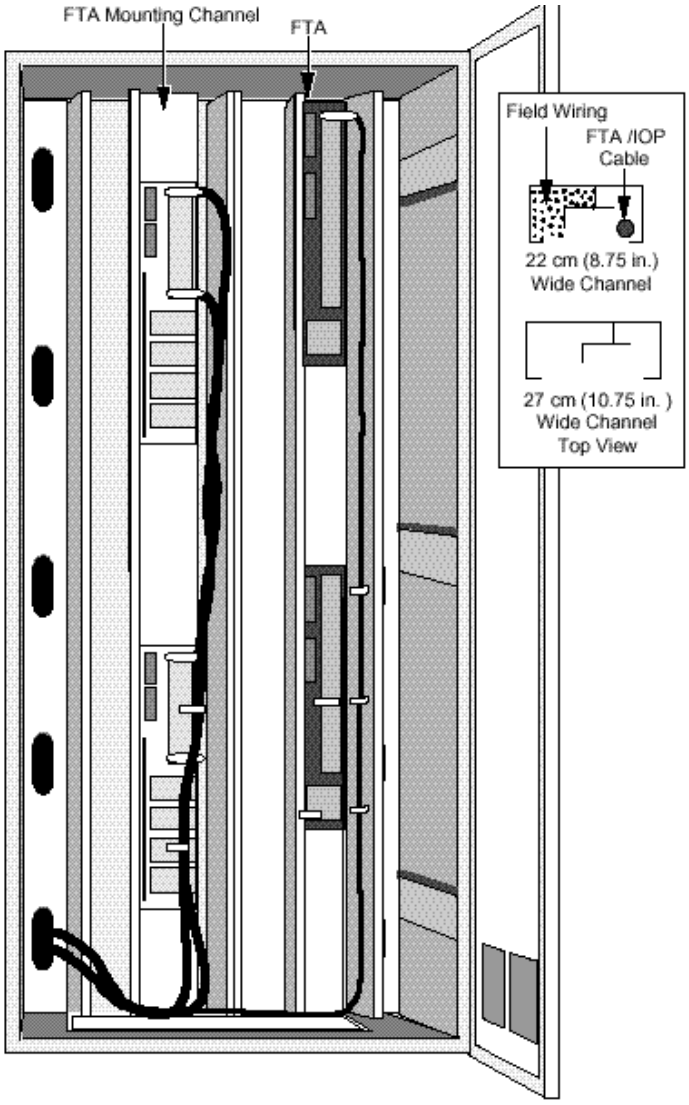
Do not mount Standard type and Galvanically Isolated type FTAs on the same FTA Mounting Channel

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.

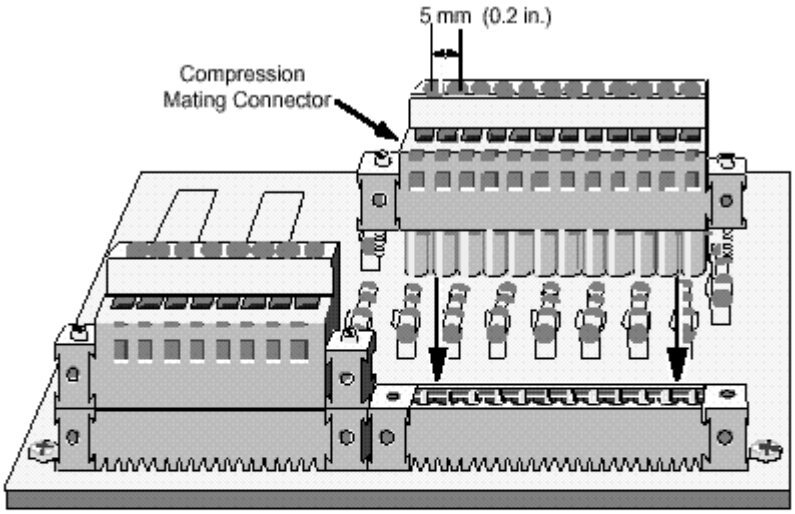
FTA terminal types

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.

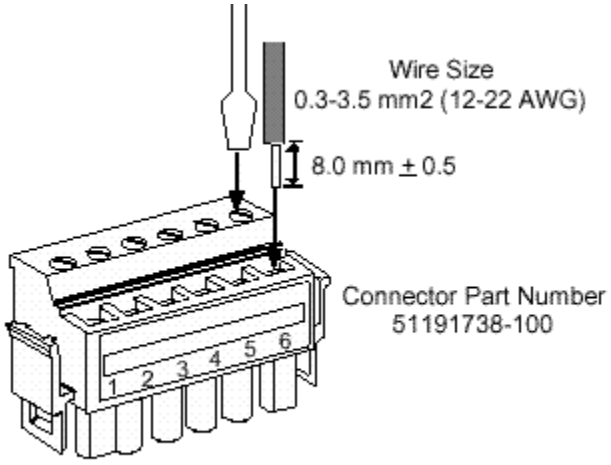


Compression Mating Connector for Standard Type FTA

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

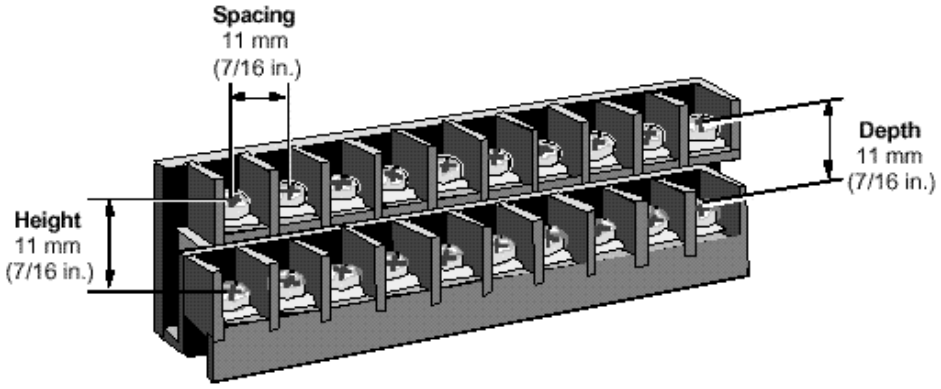
The following figure shows compression-type terminal connectors for mating with the six terminals on the Galvanically Isolated type FTAs. The acceptable wiring sizes are as stated above for connectors used with Standard type FTAs.



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.



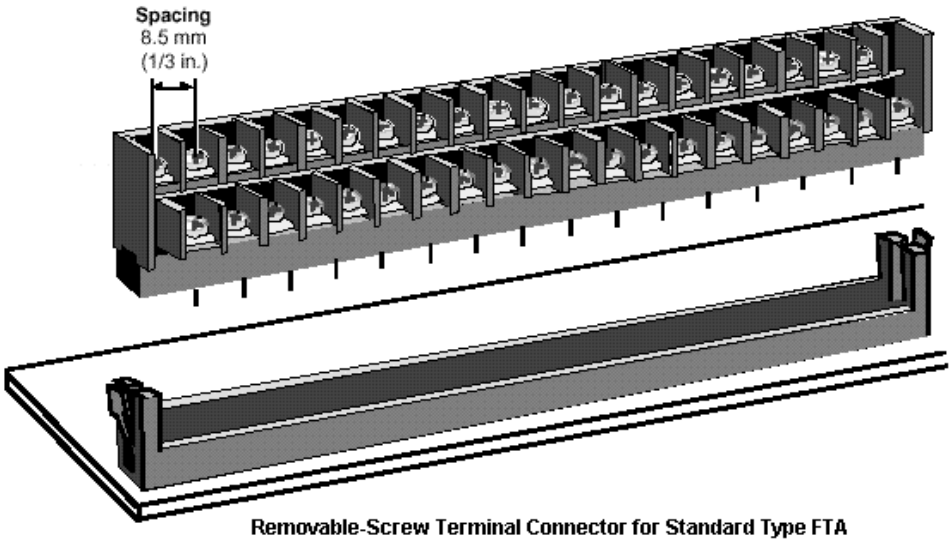
Fixed-Screw Terminal Connector for Standard Type FTA

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

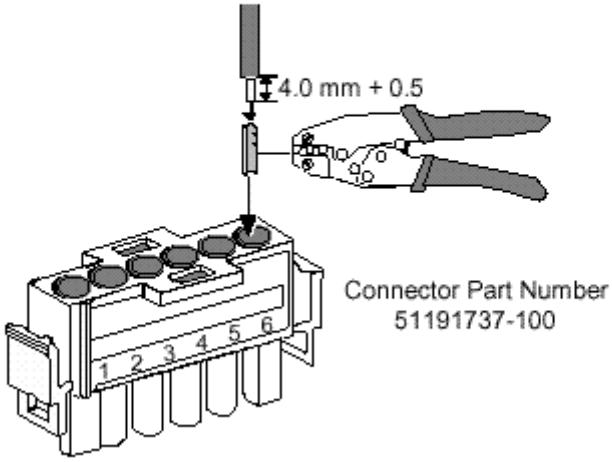
Screw Terminal Connector Size

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.

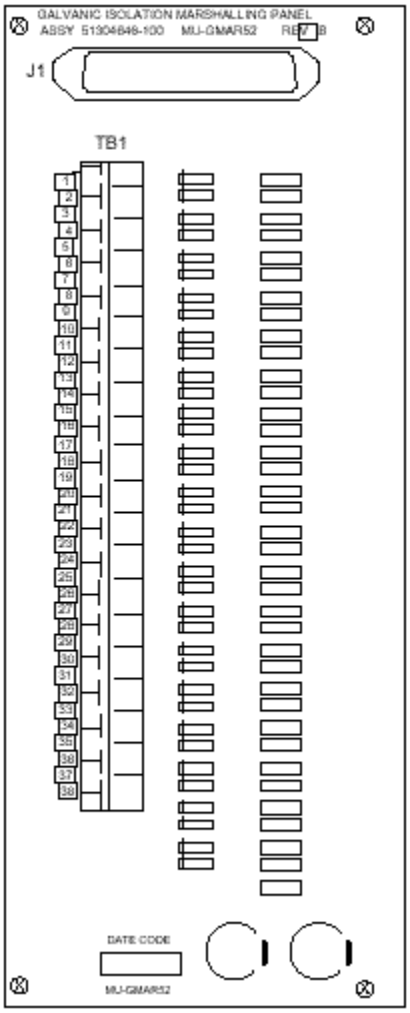
Wire Size	Crimp Pin Part Number	Crimp Tool Part Number
0.5-2.5 mm2 (14-20 AWG)	51191737-201	51191787-100



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