Honeywell

PlantScape®

Planning

Guide

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Notices and Trademarks

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About This Document

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Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our industrial automation and control customers.

Honeywell Organization	WWW Address (URL)
Corporate	http://www.honeywell.com
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Contact us by telephone at the numbers listed below.

	Organization	Phone Number	
United States and Canada	Honeywell ACS – Industry Solutions	1-800-343-0228 1-800-525-7439 1-800-852-3211	Solution Support Center On-Site Service Information Training Registrar
		PlantScape Support Program Information: 1-800-288-7491	
Asia Pacific	Honeywell Asia Pacific Hong Kong	(852) 28298298	
Pacific	Honeywell Limited Australia	(612) 9353 7000	
Korea	Honeywell Seoul, Korea	82-2-799-6318	
China	Honeywell China	86-10-65610371	
Europe	Honeywell PACE Brussels, Belgium	[32-2] 728-2111	

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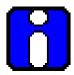
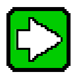
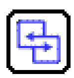
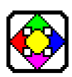
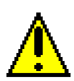
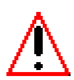
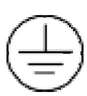
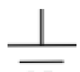
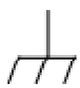
Symbol definitions

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

Symbol	Definition
	**ATTENTION** Used to identify information that requires special consideration.
	**TIP** Used to identify information that can not be classified as requiring special consideration, but as "nice-to-know."
	**REFERENCE - INTERNAL** Used to identify an information reference source internal to the document set.
	**REFERENCE - EXTERNAL** Used to identify an information reference source external to the document set.
	**CAUTION** Refers to the Product Manual for additional information.
	**WARNING** Refers the to the Product Manual for additional information.
	**SHOCK HAZARD** WARNING: risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD** Electrostatic Discharge (ESD) hazards. 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.

Symbol	Definition
	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 Protectiveearth 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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Initial Planning and Design Activities

Getting Started

TIP

For SCADA and Vista Planning, refer to the PlantScape Server Planning Guide.

Before you begin

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 pre-requisites for the planning process.

- An **understanding of basic monitoring and control concepts**—
  - To adequately plan your PlantScape system, you must have a basic understanding of the concepts of process monitoring and control.
  - The **Process Narrative**, providing a literal description of the plant processes.
- The **Piping and Instrumentation Diagrams** (P&IDs), In schematic format—
  - showing the equipment used on the plant and how it is connected.
  - which can be used to break down large processes into constituent subprocesses.
- **Flow Diagrams**—
  - describing the sequence of events in plant processes.
  - defining how PlantScape should be used to interact with the processes.
- **Engineering and System Specifications**, describing—
  - operational requirements; that is, what the system needs to do.
  - when and how your PlantScape system will be implemented.
  - details of the PlantScape system's hardware and software.

- **Other Resources** you may require include—
  - 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. The following checklist contains step-by-step planning information you can use to schedule and monitor the events that must occur prior to the actual delivery and installation of your system.

After acceptance of the layout, perform the steps below:

- 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 ESD and 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, perform the steps below:

- Install and test primary power equipment.
- 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 PlantScape 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 PlantScape 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.

System Configuration Planning

Network Considerations

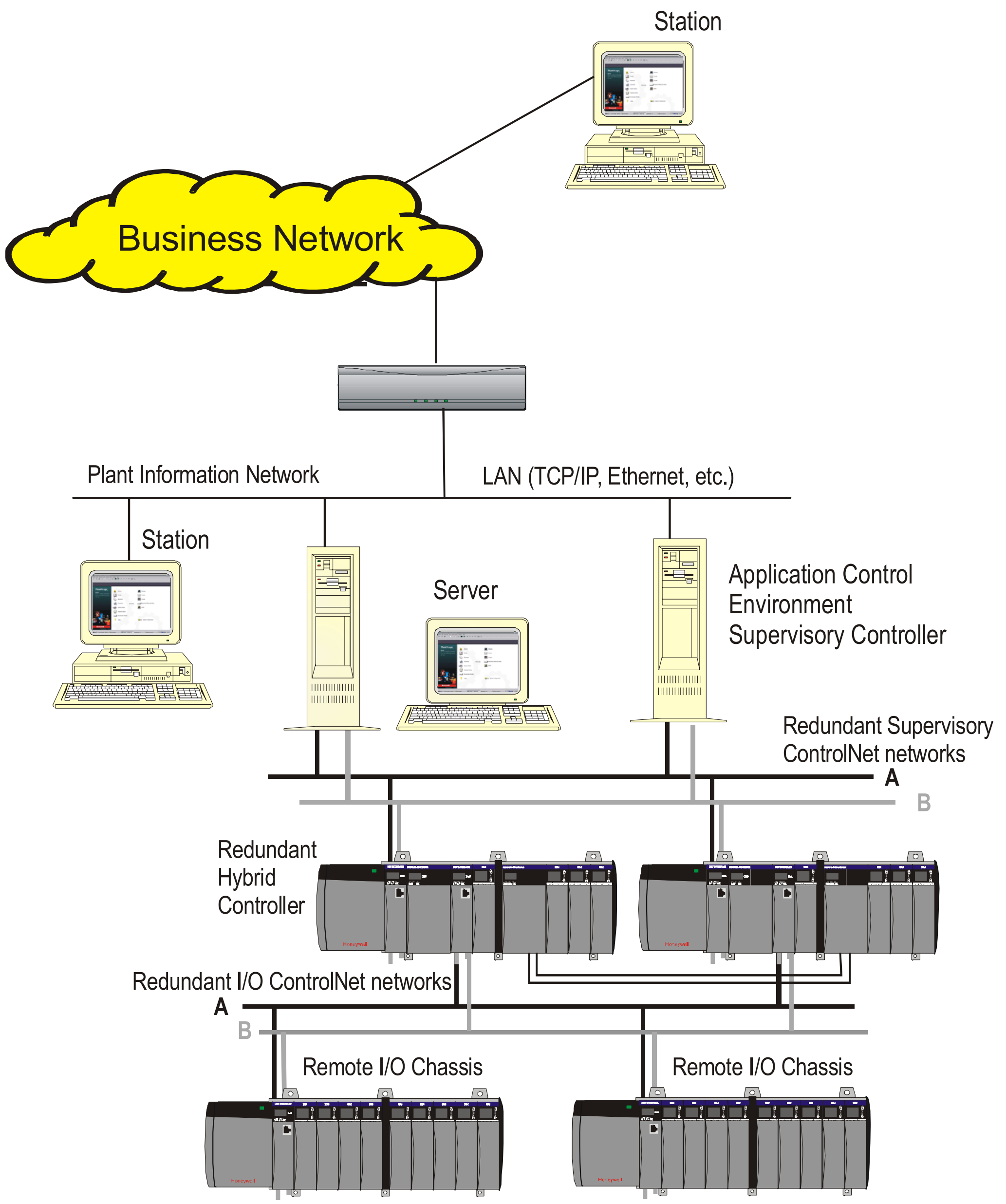
New or existing network

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.

Local Area Networks

The following figure shows a typical Local Area Network (LAN) for a basic PlantScape system that features a nonredundant Server, client Station, redundant hybrid controller, Application Control Environment supervisory controller, and remote chassis input/output.

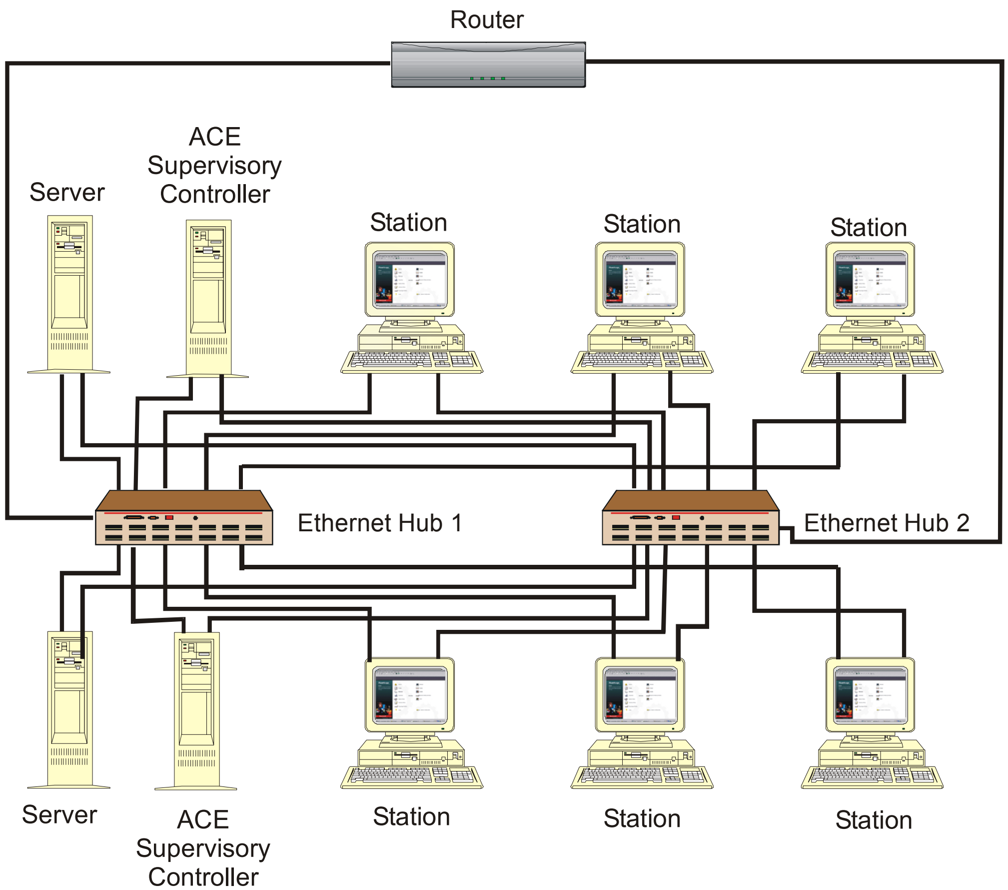

Station
Business Network
Plant Information Network
LAN (TCP/IP, Ethernet, etc.)
Station
Server
Application Control
Environment
Supervisory Controller
Redundant Supervisory
ControlNet networks
A
B
Redundant
Hybrid
Controller
Redundant I/O ControlNet networks
A
B
Remote I/O Chassis
Remote I/O Chassis

Business network

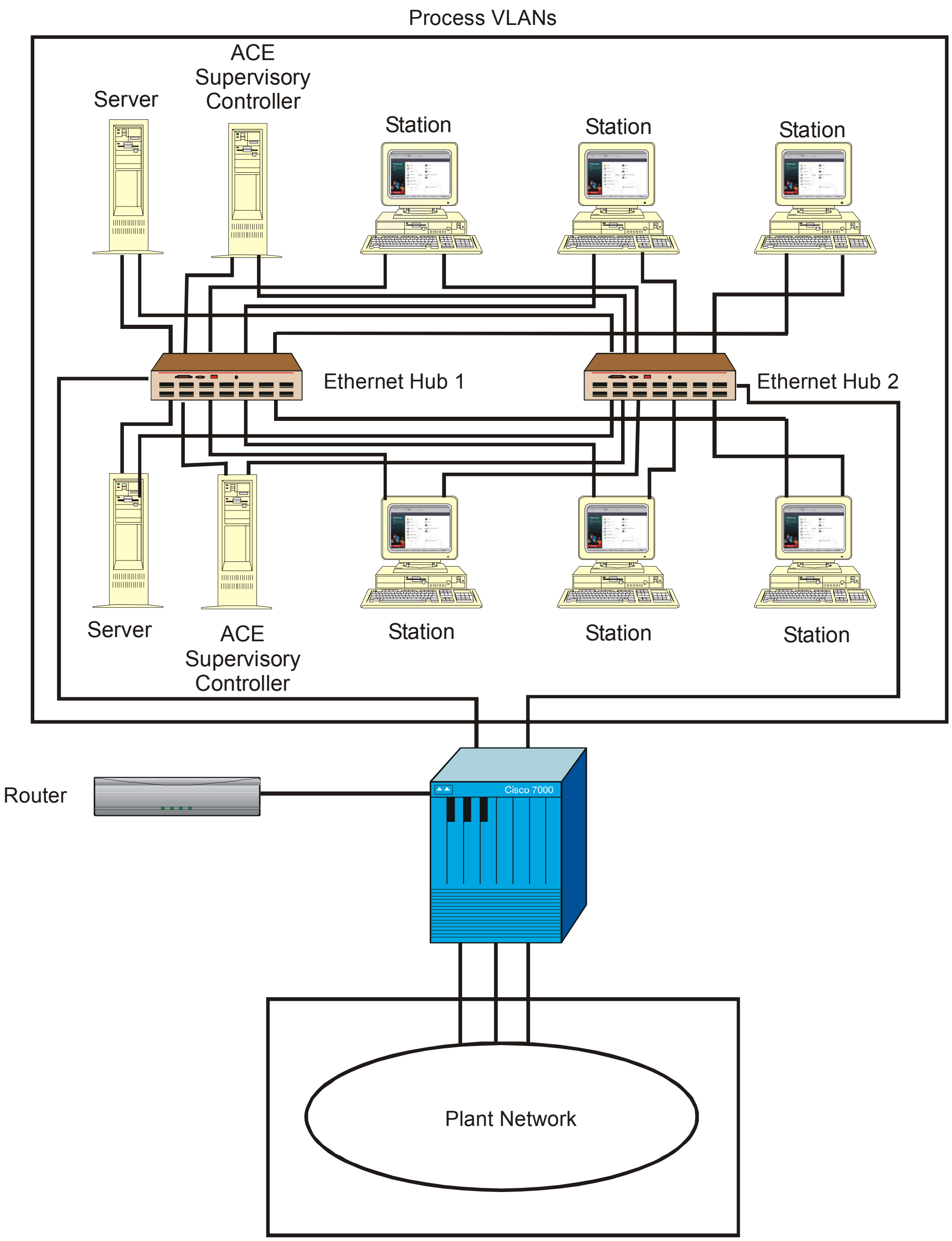
The business network is used for day-to-day operations such as e-mail traffic, file transfer and world wide web interface.

Do not integrate PlantScape system components with your Business Network. Only use it for occasional use clients and as a means to interconnect PlantScape Systems in a Distributed Server Architecture (DSA). PlantScape clients require Transmission Control Protocol/Internet Protocol (TCP/IP) and NetBIOS in order to communicate with PlantScape Servers.

The following figure shows a typical way to isolate the Business network from the other networks using a router. We recommend dedicating 1 (nonredundant system) or 2 (redundant system) TCP/IP subnets to your system. This isolates the control system from being externally effected by network problems, which could result in a "loss of view" scenario.



The following figure shows an alternative to the router isolation method shown above through the use of virtual networking or VLANs. You could setup a Business Network VLAN and a Plant Information Network VLAN located within the same physical hub, but yet still be physically isolated. You can make further setup of VLANs in combination with TCP/IP Subnetting to physically separate the two ethernet segments, so you do not require the use of two router port separated subnets.

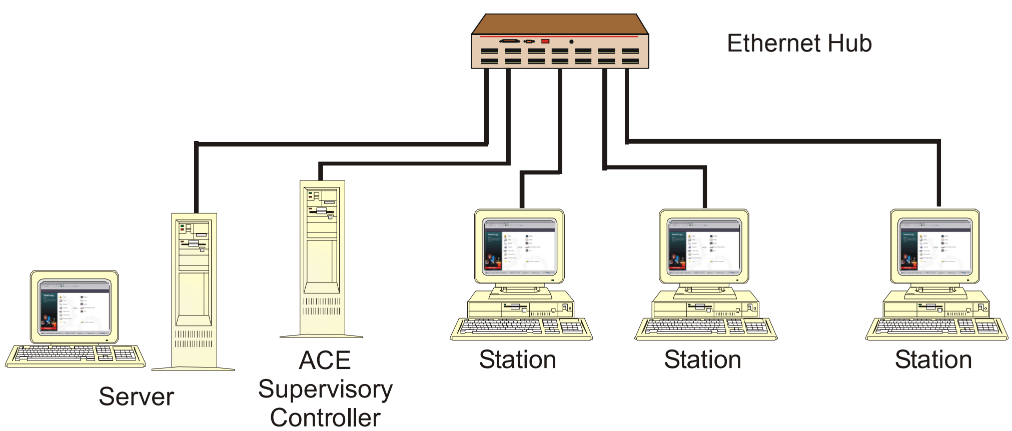

Process VLANs
Server
ACE
Supervisory
Controller
Station
Station
Station
Ethernet Hub 1
Ethernet Hub 2
Server
ACE
Supervisory
Controller
Station
Station
Station
Router
Cisco 7000
Plant Network
Plant Network VLAN

Plant Information Network (PIN)

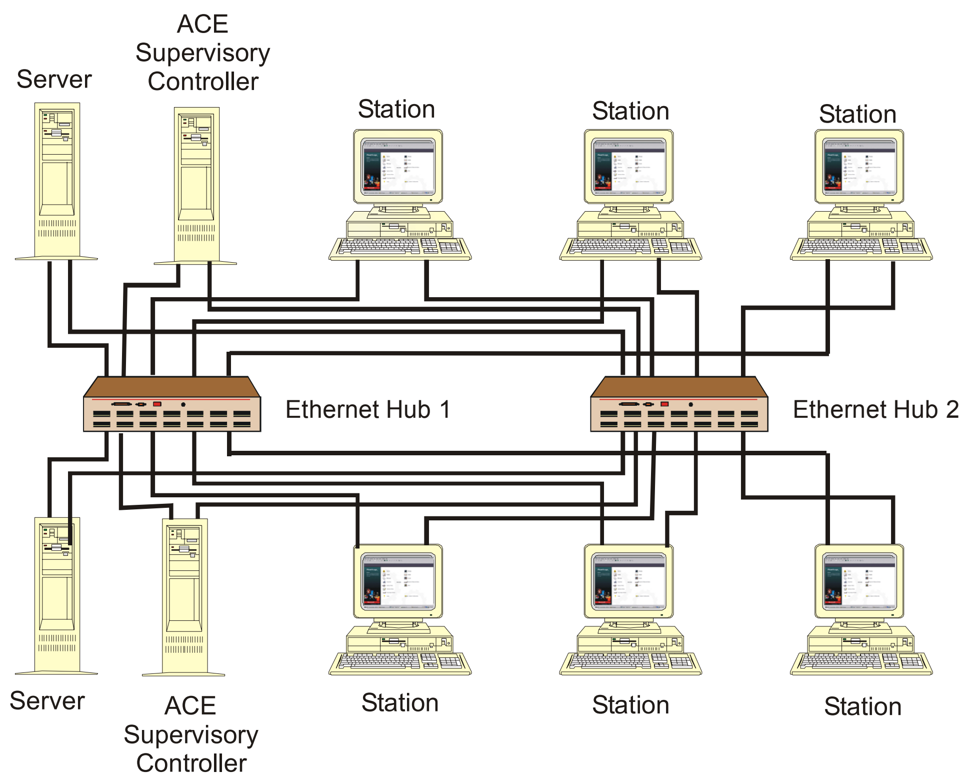
The Plant Information Network supports dedicated communications among the User Interface components of a PlantScape System including the optional Application Control Environment (ACE) supervisory controller. It usually only exists in a control room or other dedicated area for plant monitoring applications unless the Application Control Environment supervisory controller is present to provide OPC Client data access for control functions. It is used solely for Server/Station traffic and Application Control Environment supervisory control communications, if supplied.

We recommend the use of Ethernet switches, but shared Ethernet is also supported. You must isolate this network from the Business Network. Connection to outside Business Networks is not required unless the system must support remote PlantScape Clients or participate in a Distributed Server Architecture (DSA). Interconnection with Business Networks must be in the form of a router or virtual LANs as shown above.

The following figure shows a simple network environment with a single Network hub with the nonredundant Server, Application Control Environment supervisory controller, and Stations plugged into it. This is the basic minimum requirement for the Plant Information Network when multiple nodes are present. Note that Server redundancy is not linked to Network redundancy. The minimum Ethernet hub requirement is 10 Mb/s shared, although a 10/100 Mb/s switch is recommended.



The following figure shows the topology for a Dual Ethernet option. Each Ethernet hub represents one TCP/IP subnet. The minimum Ethernet hub requirement is two separate 10 Mb/s shared hubs, although two 10/100 Mb/s switches are recommended. Note that Server redundancy is not linked to Network redundancy.

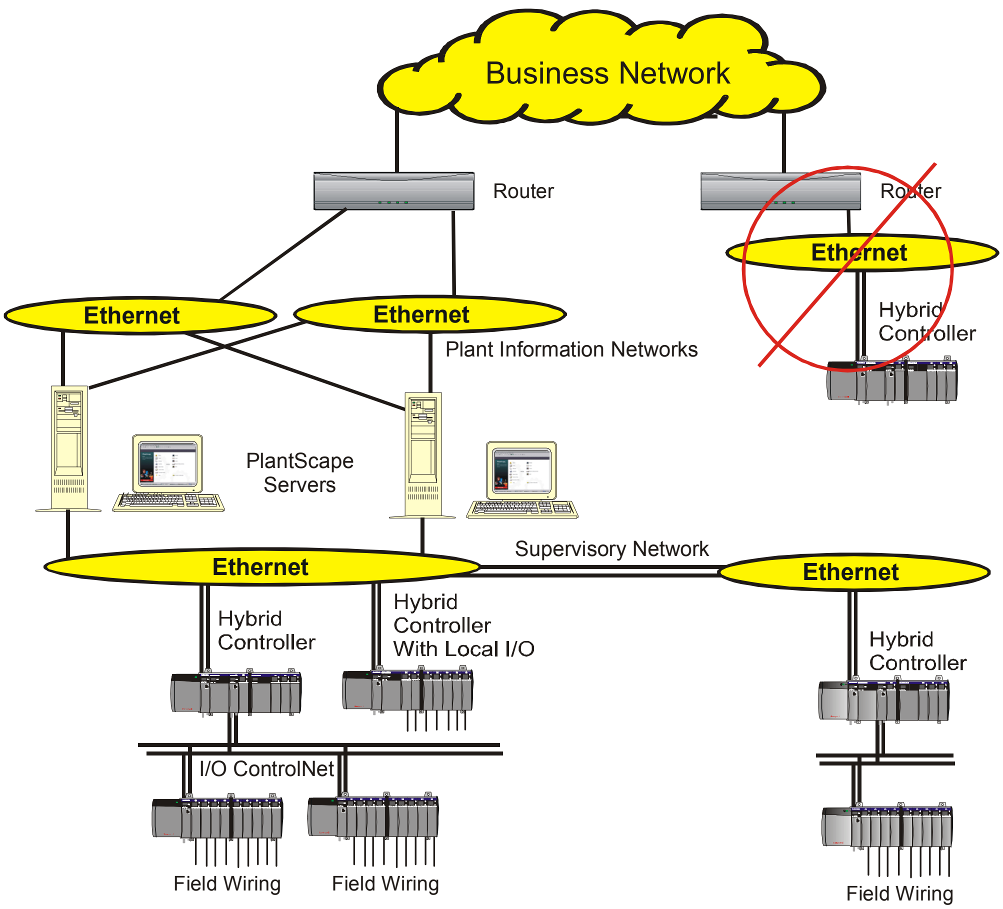


Supervisory network

The supervisory network is used for communication between PlantScape Servers and Controllers. The Controllers are the chassis-mounted Control Processor Module (CPM) that is also known as the Hybrid Controller or the C200 Controller, and the Application Control Environment (ACE) supervisory controller that is running on a separate personal 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 direct ControlNet connection. .

You must physically separate the supervisory network from other networks contained within the system. Co-joined Plant Information and Supervisory Networks is **not** supported. A typical ControlNet media based supervisory network is shown in the figure above under the Local Area Networks heading.

If Ethernet media is used for the supervisory network, you must use a switching hub, since shared Ethernet is not supported for the supervisory network. All Ethernet hubs in the supervisory network must be 10/100 Mb/s per port switch. The Server connection to the supervisory network should be at 100 Mb/s. The NetBIOS protocol should be disabled on the Network Interface Card (NIC) connected to the hub. The entire network should be one private Class C TCP/IP subnet with no external connections or gateways, as shown in the following figure.



While the figure above shows a remote connection to a Controller over the business network, it is **not** supported. If the system requires remote connections to other controllers, the proper method to integrate the controller would be to extend the supervisory network. When extending the supervisory network, it is better to use a dedicated extension interface rather than a network port. Using an extender (for example: backplane extension port or dedicated interconnect) will lessen the cascading port effect, which reduces latency time. Extending by port (increases latency) will have an impact to peer to peer traffic across the supervisory network.

ATTENTION

- Network Redundancy is only supported with ControlNet media.
- Do not use the Ethernet media for the supervisory network in applications that require a Fieldbus Interface Module or I/O Link Interface Module.

Input/Output (I/O) network

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, a variety of interface modules and gateways are available to support connections to:

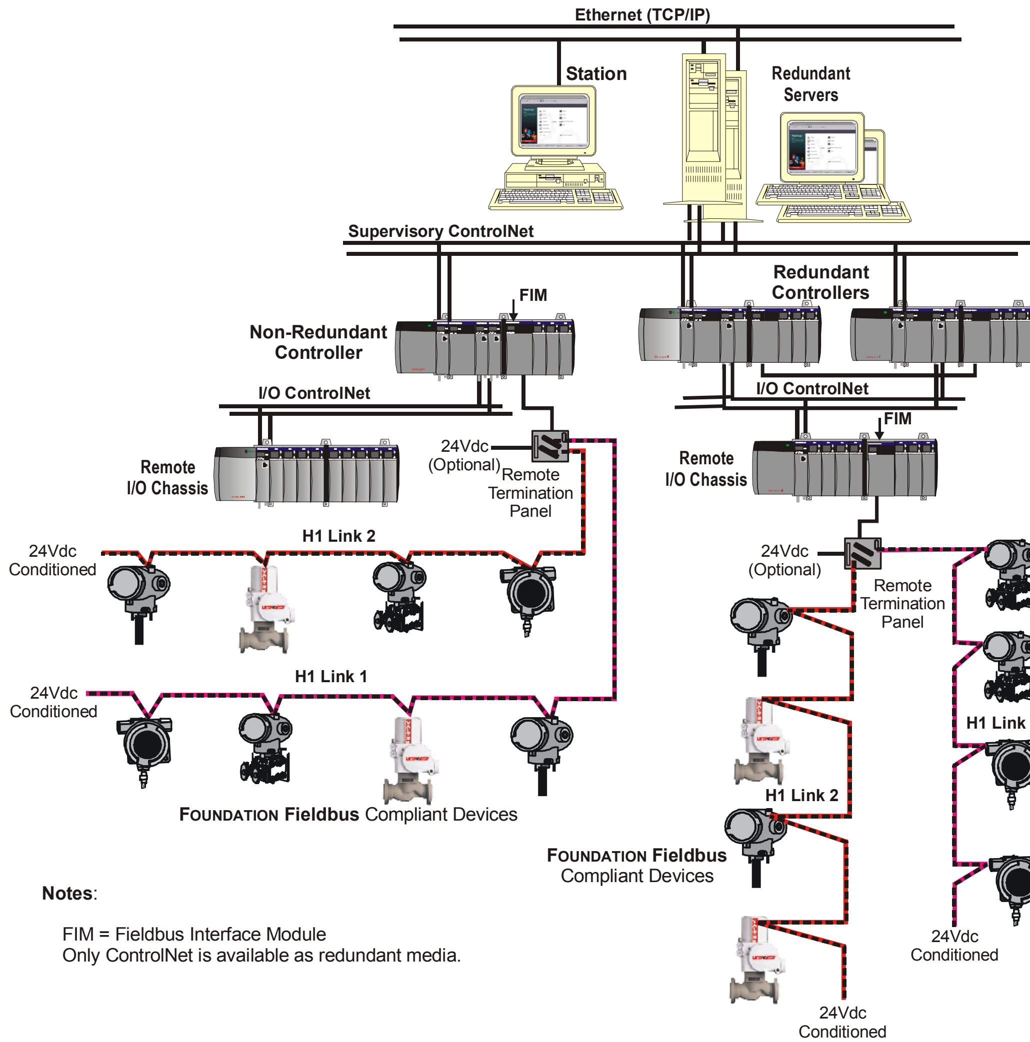
- Fieldbus H1 Networks
- Process Manager Input/Output
- Rail Input/Output
- PROFIBUS DP
- Allen-Bradley Drive Interface

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

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

ATTENTION

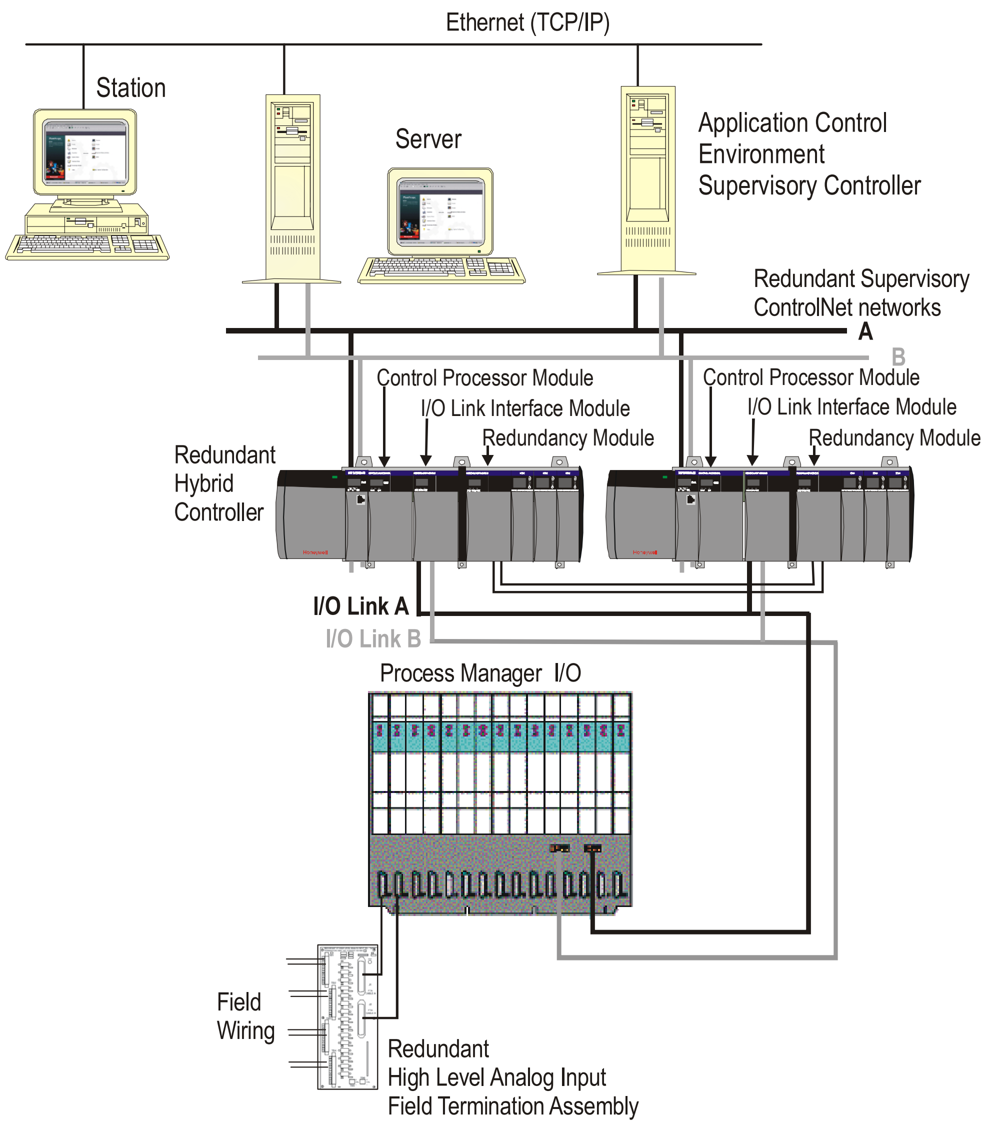
In PlantScape system version R400, the Fieldbus Interface Modules are not supported over any Ethernet segments.



The following figure shows a typical topology using I/O Link Interface Modules to interface with Process Manager I/O.

ATTENTION

The Supervisory network must use ControlNet media when the topology includes Process Manager I/O.


Ethernet (TCP/IP)
Station
Server
Application Control
Environment
Supervisory Controller
Redundant Supervisory
ControlNet networks
A
B
Control Processor Module
I/O Link Interface Module
Redundancy Module
Control Processor Module
I/O Link Interface Module
Redundancy Module
Redundant
Hybrid
Controller
I/O Link A
I/O Link B
Process Manager I/O
Field
Wiring
Redundant
High Level Analog Input
Field Termination Assembly

Communication Media

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.

REFERENCE - EXTERNAL

For more information about the use of Ethernet for industrial control, please refer to the Ethernet White Paper on the Allen-Bradley web site at http://www.ab.com/networks/enetpaper.html.

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 Mb/s) 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.

PlantScape Process Configuration Examples

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:

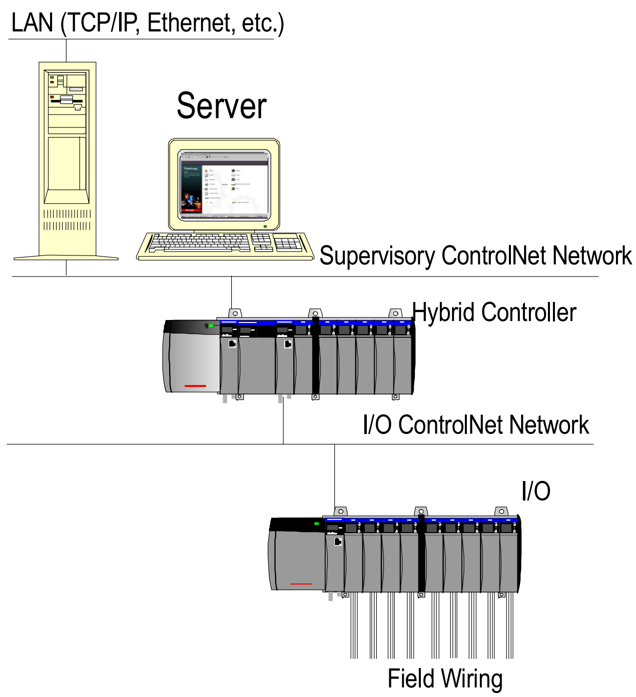
1 PlantScape Server—

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



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 PlantScape Server—

providing non-redundant system server functionality

1 Process Controller—

providing 222 points, configured as:

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

1 Process Controller—

providing a total of 150, points configured as:

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

3 PlantScape Clients—

providing operator and engineering station functionality

1 Process Controller pair—

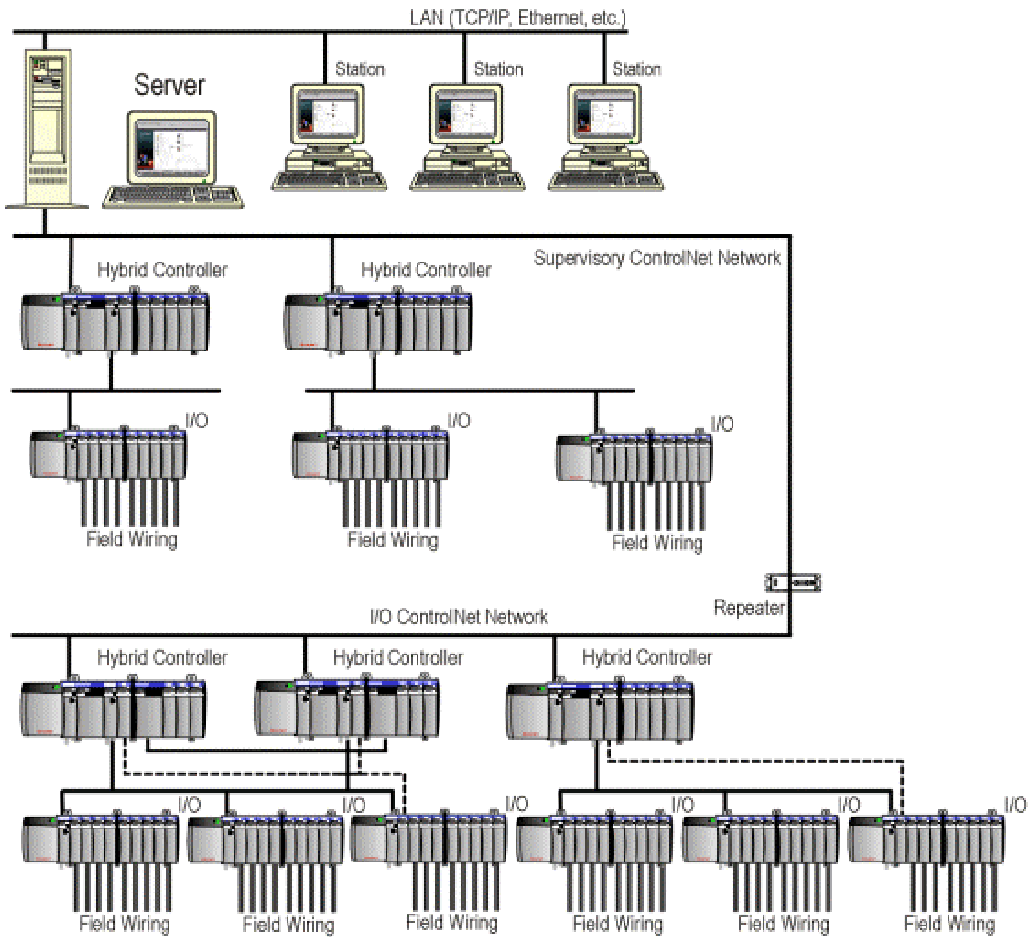
providing 360 points, configured as:

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

1 Process 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
Supervisory ControlNet Network
Hybrid Controller
Hybrid Controller
I/O
I/O
I/O
Field Wiring
Field Wiring
Field Wiring
Repeater
I/O ControlNet Network
Hybrid Controller
Hybrid Controller
Hybrid 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 PlantScape Server pair—

providing redundant system server functionality

1 Process Controller—

providing 92 points, configured as:

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

1 Process Controller pair—

providing 360 points, configured as:

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

7 PlantScape Clients—

providing operator and engineering station functionality

1 Process Controller—

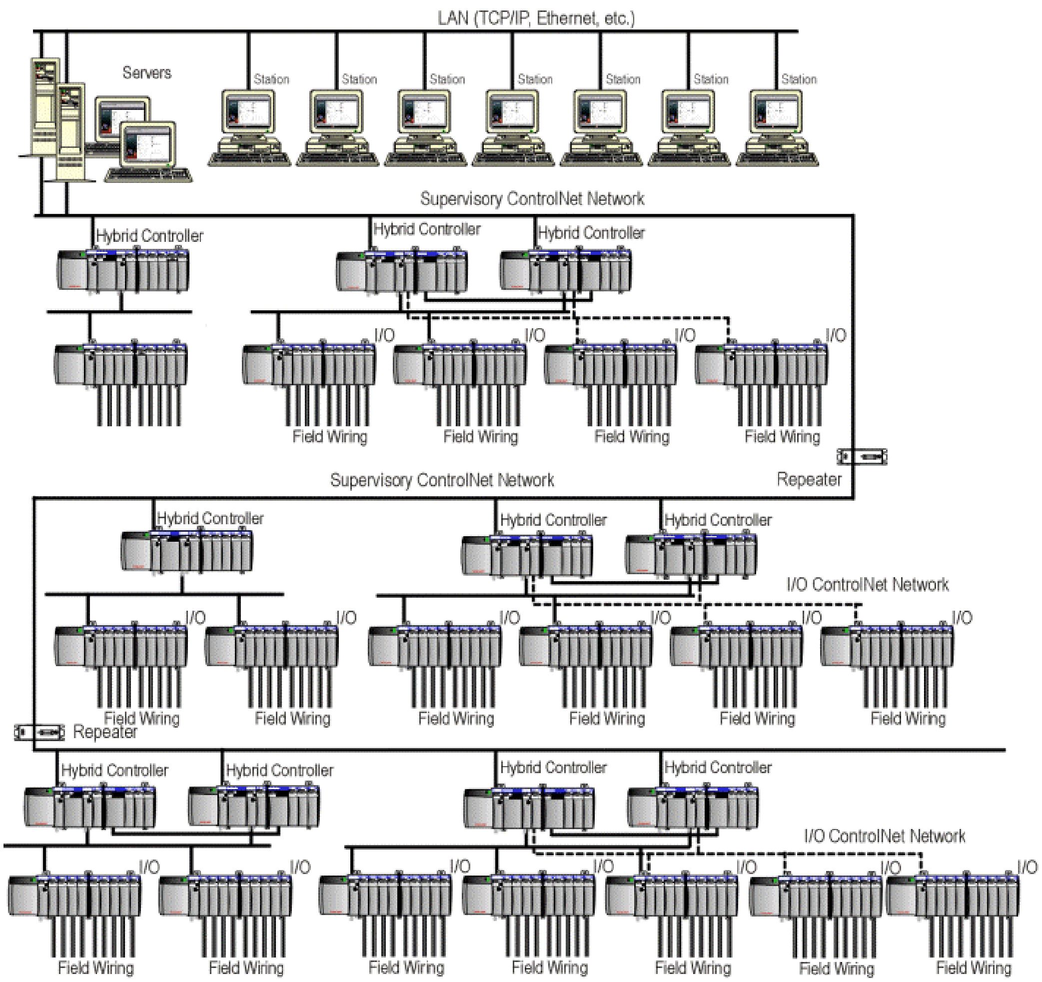
providing 222 points, configured as:

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

1 Process Controller pair—

providing 360 points, configured as:

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

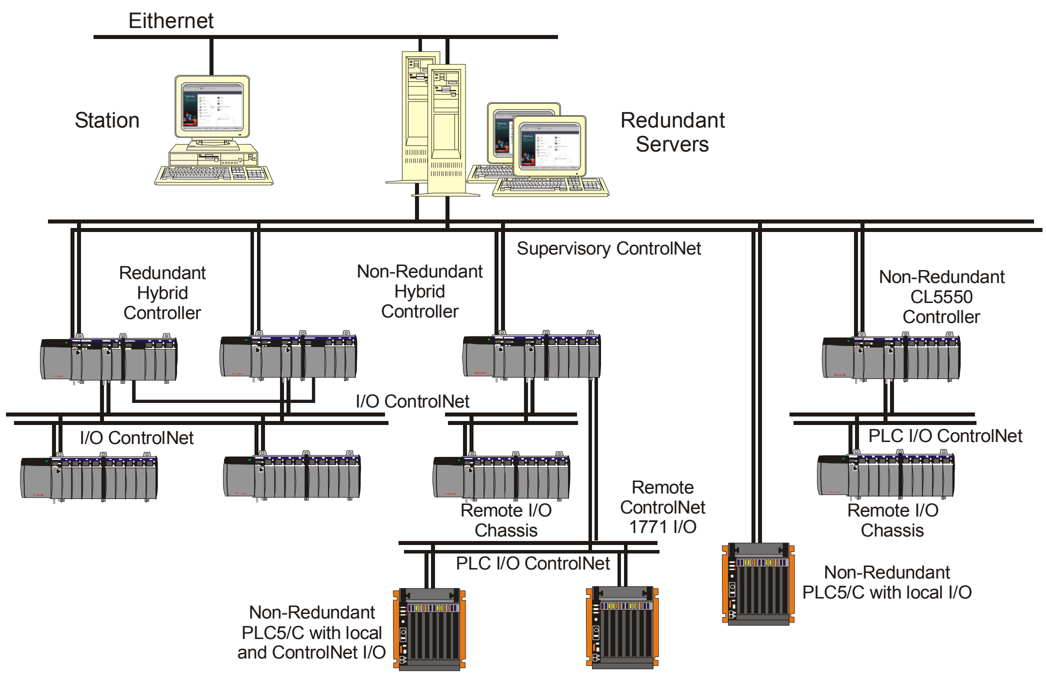

LAN (TCP/IP, Ethernet, etc.)
Servers
Station
Station
Station
Station
Station
Station
Station
Supervisory ControlNet Network
Hybrid Controller
Hybrid Controller
Hybrid Controller
I/O
I/O
I/O
I/O
Field Wiring
Field Wiring
Field Wiring
Field Wiring
Supervisory ControlNet Network
Repeater
Hybrid Controller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

System integrated with PLC controllers example

The following figure illustrates an example of a system integrated with Programable Logic Controllers (PLCs). The following general considerations apply to this example configuration.

- 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 model 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 Hybrid Controller, with its ControlNet I/O isolated from the supervisory ControlNet.
- If the supervisory control and data acquisition (SCADA) channel connections are formed to a PLC through any path that includes the PCIC or KTCx communications card, then that CL5550 or PLC5/C counts as a "Controller" in the maximum number calculation matrix.
- An I/O ControlNet segment cannot be connected to a PLC or to a PLC Remote I/O chassis.
- RSLinx software must be configured through its menu options to allow no more than two (2) PCCC connections/PLC for PLC communications from the Server SCADA channels.
- The Server **cannot** support configurations that include **PLC MSG Instructions** that form connections through the PCIC or KTCx card to points configured by Quick Builder.
- The CL5550 **cannot** be configured to use any I/O Modules in the Hybrid Controller chassis or any I/O Modules in a Remote I/O chassis being used by the Control Processor Module (CPM).
- PLC Controllers **cannot** use the supervisory ControlNet for "Scheduled" peer-to-peer connections with each other.

A ControlNet "Keeper" capable module, such as a ControlNet Interface module (CNI) or PLC5/C, must be configured with a Media Access Control (MAC) ID (or address) of "1". Additional CNIs or PLC5/Cs should use subsequent higher MAC IDs of 2, 3, and so on.


Eithernet
Station
Redundant Servers
Supervisory ControlNet
Redundant Hybrid Controller
Non-Redundant Hybrid Controller
Non-Redundant CL5550 Controller
I/O ControlNet
I/O ControlNet
PLC I/O ControlNet
Remote I/O Chassis
Remote ControlNet 1771 I/O
Remote I/O Chassis
PLC I/O ControlNet
Non-Redundant PLC5/C with local I/O
Non-Redundant PLC5/C with local and ControlNet I/O

Server and Client Station Planning

Planning Steps

To help plan the system, you can use the steps below. We suggest a sequence of planning steps; you should adapt this to your own special requirements.

- Plan the system architecture (operator Stations, controllers, printers, networks).
- Identify the role PlantScape server will play.
- Plan what points are needed.
- Plan how data will be acquired (for example, which scanning strategy is to be used).
- Plan what features will be used to view and analyze process data.
- Plan what features will be used to control processes, for example, algorithms
- Plan the alarm strategy.
- Plan system security.

Planning the System Architecture

When planning the system architecture, you need to think about components such as the number of server systems, operator Stations, networks, printers, and controllers. If you require a "high availability" system, you should also think about what components need to be made redundant. For information, see *Server Redundancy*.

Operator Stations

Refer to the *SCADA and Vista Planning Guide* for more information about planning Operator Stations

Issues to consider when planning for operator Stations include:

- How many operator Stations are needed, and where will they be put?

  In an entry-level PlantScape system, the server software is installed on the same machine as the client software. In larger systems, Stations may be networked together.

  When planning where to put operator Stations, you need to examine how the plant is organized. If you are planning on putting an operator Station in a hazardous environment, make sure that a suitable PC is used.

- How are operator Stations going to be connected to the server?

  If the Station is the same computer as the server, known as a 'server Station', this is obviously not an issue. It is best to connect operator Stations to the server by using a network, no matter how close the operator Station(s) are to the server. If operator Stations are located on plants that are geographically dispersed, they can be connected to the PlantScape server by dial-up serial connections using modems or a Wide Area Network (WAN).

- What type of operator Station should be used for which users?

  Operators (users who operate the plant on a day-in, day-out basis) have different needs than other, more informal users. Operators need static Stations, that is, a Station that is used continuously. Informal users (for example, laboratory technicians or managers) can use a rotary Station, a station that can connect only when required.

- How many Station licenses will be needed?

  The PlantScape license agreement specifies how many people can use the Station software at the same time; for example, if you purchase three copies of Station, you can install it on all your PlantScape operator Stations, but only three operators will be able to use PlantScape at a time. Depending on the kind of license you have, you will be able to connect a certain maximum number of operator Stations concurrently. Rotary Stations can provide a cost effective method of adding part-time users. For more information about PlantScape licensing, contact your Honeywell representative.

- What kind of input devices will operators use?

  To enter data into the system, you can use any of the following:

  – Standard keyboard and mouse

  – Operator keyboard

  – Honeywell mouse (these are specially constructed to operate in dusty environments)

  – Trackball

  – Joystick

  – A touch screen (in this case, use a large monitor, as some of the user interface items are small; for example, the toolbar)

Printers

When planning for printers, ask:

- How many printers are needed, and what type should they be?

  Alarm printers must be 132 column line printers (dot-matrix, inkjet, or equivalent) so that alarms can be printed as they occur. The alarm printer can also be the report printer, however most sites prefer to print their reports on a laser printer. If you want to print out screen dumps of custom graphics or trends, using a color printer is recommended: trend set displays are easier to interpret when printed in color.

- How will the printers be connected to the network?

  In a basic PlantScape system, printers connect directly to the server by using serial or parallel ports. In networked systems, reports can be sent to printers connected to print servers or operator Stations.

- Where will printers be located?

  For the convenience of operators, it is recommended that printers be placed near operator Stations. Printers work best in dry, cool locations such as control rooms, however, printer noise must be considered before a control room is used.

Networks

The first issue to consider when designing a network is whether PlantScape will be incorporated into an existing network, or whether 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.
- Before connecting your PlantScape System to your Plant Network you should try to isolate your system from the rest of your network as much as possible. It is our recommendation that you dedicate 1 (for non-redundant server systems) or 2 (for redundant server systems) TCP/IP Subnets to your system. This essentially means dedicating 1 or 2 router ports and a cable to connect to the ethernet hub(s). This

isolates the PlantScape systems from being externally effected by network problems which could result in a “loss of view” scenario.

- If planning to use server redundancy there are required TCP-IP host naming conventions for the primary and backup servers. Problems with Host names can be resolved by using third party services such as DNS (Domain Name Service), WINS (Windows Internet Naming Service) or DHCP (Dynamic Host Configuration Protocal).
- If planning dual ethernet option and/or Redundant Server, two network hubs would be required.
- If planning to use the Linking Device for the Foundation Fieldbus (FF) network, Process Controller intergration of HI devices is required. Configuration of FF devices and H1 networks must be through a third party (National Instruments) builder. Special wiring and components are needed along with proper maintenance and administration.
- If planning security you will need to issue passwords for each workstation. An administrator can get around this by creating the same accounts and passwords on all workstations in the workgroup.
- If planning to run the Control Builder remotely the Server must be able to resolve the hosting node via NBT.

Consideration should be given to isolating the network between servers from other LAN traffic. This is required if fast failover is required between the servers.

IP addresses also need to be allocated. If redundant networks are planned, each network adapter needs to be allocated an IP address on a different link. If a complex network is being planned, it might be advisable to consult professional network designers. Honeywell can design and implement your network if required.

Controllers

Issues to consider when planning how to use controllers include:

- How many controllers are there?
- What type are they? What model?
- Do you want to use a controller that is not supported by PlantScape?
  - To communicate with controllers that are not supported by PlantScape, you can either use the User Scan Task toolkit, OPC Server toolkit, or an AdvanceDDE toolkit to write a controller interface yourself, or ask Honeywell to write one for you.
- Do you want PlantScape to interface to all the controllers you have?
- Will the controllers support the scanning strategy you want to use?
- 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 plants 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 controllers?

You should plan your scanning strategy around the controllers you have, unless you plan to upgrade your controllers. For details on scanning strategies, see *Designing a Scanning Strategy* in this section.

Distributed Server Architecture System Sizing Specification

Publishing Server (Process)			
Network Speed (Kb)	***Max Network Throughput (1)*** (Param / Second)	***Max Throughput / Server(2,3)*** (Param / Second)	***Maximum Subscribing*** Servers (4)
64	100	100	1
128	200	200	2
256	400	400	3
512	800	800	4
1M	1000	1000	4
2M	2000	1000	4
10M	10000	1000	4

Subscribing Server		
Network Speed (Kb)	***Max Network Throughput(1)*** (Param / Second)	***Max Publishing*** Servers
64	200	1
128	400	2
256	800	4
512	1200	6
1M	1600	8
2M	2000	10
10M	4000	10

1. Maximum traffic on any individual network segment.
2. For PlantScape Process Servers, the total parameter throughput caused by remote station displays, local station displays, fast history, etc cannot exceed 1000 parameters/sec
3. A subscribing Station is one that displays data from another server through DSA. A larger number of Stations subscribing to remote data will result in a greater amount of network traffic. Absolute maximum number of subscribing Stations/publishing Server is 20
4. No more than 10 total network connections (subscribing servers and local stations) are allowed per server.

Distributed Server Architecture System Example:

REFERENCE

For information on configuring Distributed Server Architecture refer to the ***PlantScape Server and Client Configuration Guide / Configuring Distributed Server Architecture.***

Server A is a subscribing server with 5s connected to it. Stations A1 and Server A. Stations B1, B2, and B3 are connected to Server A, but the displays on these stations display data from Server B (i.e they are subscribing Stations for Server B). Assume that the B stations are displaying unique points as shown below:

Station	Analog Points	Digital Points	Total points subscribed
B1	40	60	100
B2	40	60	100
B3	40	60	100
Subscription Grand Total:			300

Station	Analog value changes/sec(1)	Digital Value changes/sec(1)	Total parameters changing/sec
B1	40	20	60
B2	40	20	60
B3	40	20	60
Changing Grand Total:			180

(1) The total amount of subscribed points appears to be above the limit specified for 128Kb network bandwidth. However, only the changing data points contribute to the network traffic. In this case, the total amount of changing data totals 180, which is within spec.

Identifying the Role of PlantScape Server

To help identify the role of the PlantScape server at the plant, you need to identify the plant's basic characteristics. A process narrative helps to answer questions such as:

- How is the plant started up and shut down (is this handled automatically or by an operator)?
- What are the plant's production cycles?
- What are the plant's critical processes?
- What kind of materials does the plant handle?

Next, identify the role of the PlantScape Server on the plant:

- What problems should PlantScape system solve?
- Will the PlantScape Server be a real-time operator interface, or an event/history collector?
- Which kinds of reports are required?
- Will some high-level control logic be planned into the PlantScape server?
- What happens if there is no operator intervention?
- What happens if the PlantScape server loses its power?

The answers to these questions form a foundation for general planning.

Which Types of Points Are Required

Determine which types of points are needed. PlantScape uses control processor points, analog points, accumulator points, and status points. They handle different types of process variables.

Planning the Configuration of Points

Design how the points will be configured. You need to consider:

- **Naming strategy**. Decide on a consistent naming convention for easier reporting.
- **Areas**. Which points belong to which areas? If areas are used, then all points must be assigned to an area. When configuring points, first define the area codes, and then decide which points belong to that area.
- **Alarms**. Which points have alarms? Which kinds of alarms will be used with what priority?
- **History collection**. Which points need to collect history? Which types of history will be collected?
- **Algorithms**. Which algorithms will be used with which points? Algorithms can be planned after other system functionality, as an enhancement. Note that algorithms can only be attached to analog, status and accumulator points.
- **Displays to be assigned**.

Designing a Scanning Strategy

The way in which the PlantScape server scans (or polls) controllers is referred to as the scanning strategy. Scanning strategies are used to reduce the “traffic” over the network being used

For communications with the control processor, it is not necessary to configure a scanning strategy. The server automatically acquires data from the controller.

For other controller types the PlantScape server has several types of scanning strategies: periodic, demand, and exception scanning. A PlantScape system does not have to use one type of scanning exclusively: periodic, demand and exception scanning can be combined in the same controller, in the same point, or both. Use the following descriptions to decide which type of scanning is suitable.

Periodic Scanning

Periodic scanning is the regular scanning of a point parameter at a configured interval. For example, if you assign a scan period of 15 seconds to the PV parameter of a point in a controller XYZ, the server scans the XYZ controller every 15 seconds for that point value.

You can choose from several scan periods, ranging from seconds to minutes, and you can assign a different scan period to each input/output point parameter when you configure each point.

Periodic scanning:

- Is supported by most controllers but is not usually required as most controllers use exception scanning
- Is simple to implement
- Places a predictable (but possibly additional) load on the PlantScape system

Demand Scanning

A one-time only scan of a point parameter that can be requested either by an operator, a report, or an application.

Exception Scanning

In exception scanning, PlantScape polls the controller for change of state data stored in the controller memory. Exception scanning is thus triggered by events, not time.

Exception scanning has the following characteristics:

- It is supported by fewer controllers than periodic scanning. Often requires additional programming in the controller.
- Most points are only scanned when there is a state change, reducing the load on the system.
- Is typically more suitable for digital changes of state because deadbands need to be considered for analog values.

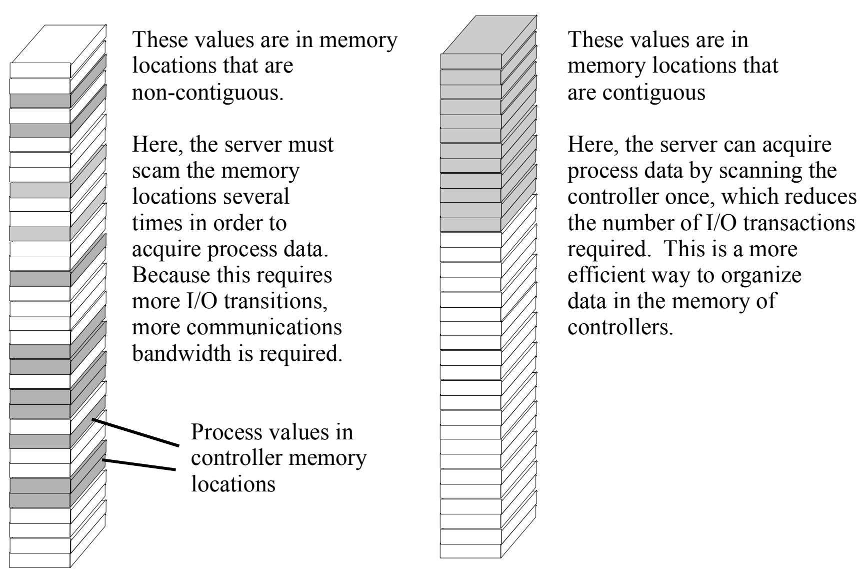
Optimizing Periodic Scanning

Choose appropriate scanning periods for the types of values being scanned. For example, you do not need to scan a temperature every 5 seconds if it changes only slightly over 1 hour.

You should aim to minimize the number of scan packets used by:

- Making scan packets reference the controller and use the same scan period. Each scan period created requires a new scan packet, increasing system overhead.
- Using contiguous blocks of memory addresses in controllers. This means the server can read multiple locations in one transaction, reducing the number of times the server must scan the controller. The following figure shows how organizing data efficiently can optimize system performance.
- Placing packets on the slowest required scan rate. Use longer intervals that read more values, rather than fast rates that read fewer.

Honeywell can provide advice about creating an optimum scanning strategy for your plant.



Planning How to Implement the Point Design

This task involves planning how to enter the data into PlantScape.

- Plan point IDs. The tag names from P&IDs can be used when configuring points in the PlantScape database.
- If there is a naming convention on the plant, use it; otherwise, create one. Naming conventions help to indicate where a point is; for example, points in a drying room might begin with the letters “DR”. Remember point IDs are required for reports and point schedule tasks and need to be easy to recognize.
- Area codes. You must define the area codes you are going to use. A two-character code is used to specify an area.
- Tools to use. Control processors points are automatically configured in the server by the Control Builder tool. For other controller types, the Quick Builder tool is used. Point information can also be entered into a spreadsheet and then imported into Quick Builder.

Planning How to Acquire Process Data

Concepts important to understanding this section are explained in "Understanding Points and Scanning" in the *PlantScape Overview*.

After identifying the plant processes to monitor, you need to think about:

- How to organize the point database
- How to configure points
- Which scanning strategy to use
- How to optimize the scanning strategy
- How to implement the point design

The order in which these steps are carried out is not important. What *is* important is that these issues are considered at some point during planning.

Identifying the Processes to Monitor

Use process narratives, P&IDs, flow diagrams, and so on to determine the processes to monitor. Ask questions such as:

- Are there processes in which pressures and temperatures play a critical role?
- What are the operational requirements?
- How could these processes benefit from being monitored and alarmed?

Consult the plant engineer or operators for help with this task.

Planning the Point Database

Planning the point database involves identifying the:

- Quantity of points needed (this will tell you the size of database you need)
- Types of points needed
- Mix of points in the database

There are differences depending on whether your system will use the Honeywell control processor or other Honeywell/third-party controllers.

How Many Points?

On the P&ID (or by some other method), count the number of points required, and then see which size of PlantScape database would be appropriate. For information on the different database sizes and the number of points they can contain, refer to the *PlantScape Server & Client Installation Guide.*

For control processors the required number of server points can be determined as follows:

2 X number of processors +

1 X number of IO modules (IOM) +

1 X number of inputs +

1 X number of sequential control modules (SCM)

For other Honeywell and third-party controllers, remember that the composite point structure that PlantScape uses means that you do not need one point per I/O value. An analog point in a PlantScape system consists of a PV, SP, OP, mode, and 4 auxiliary parameters. A status point consists of a PV, OP, and a mode parameter. Determine the total number of inputs and outputs (analog input, analog output, digital input, digital output). By assuming that each analog input has an associated analog output (and each digital input a digital output), you can approximate the number of composite points you need. Using these assumptions, you can estimate the database size to be the sum of analog inputs and digital inputs, plus any internal points that may be needed either for displaying intermediate states .

You can refine this rough estimate if there are a large number of valves or drives that have two inputs each.

After estimating the database size, round the number of points up to the nearest available database size. Allow for possible future expansion.

Planning How to View and Analyze Process Data

You can view process data using both custom and standard displays. Process history can be collected in order to view trends in point values.

The update rate for each operator Station display can be configured (the default is 5 seconds, and 1 second is the fastest update rate). Individual standard and custom displays can be configured to update at a slower rate than the operator Station update rate in order to reduce the load on the server. This is important to consider if you plan on using a remote link, such as a modem connection. As a guideline, processes that change more rapidly require a faster refresh rate.

Standard Displays

You can plan to monitor processes using the standard PlantScape displays, which include various preformatted standard point detail, alarm and event summary, trend, and group displays.

Point Displays

The Point Detail displays show process and configuration data for a particular point. It is also possible to operate the point and change certain configuration parameters.

Alarm Summaries

The Alarm Summary lists those points that are in the alarm state; it shows their point ID, the time the point went into alarm, the alarm priority, and so on.

When planning alarms, ask:

- Which processes require alarming, and which priority level of alarming is appropriate?
- What would happen if a particular process were not alarmed?
- Should alarms be audible?
- Should alarms be printed?

P&ID schematics often show the alarms that are associated with plant processes.

When planning alarms, define your areas before configuring alarms. If areas are defined after the alarms, the pre-existing alarms will not observe area restrictions.

Trend Set Displays

Trend sets can be used to view values of points associated with time-critical processes. If a process has been modified, process history can be reviewed to see if the process has become more efficient.

The type of process history standard, fast, or extended you choose to collect for point values will depend upon the processes associated with them. For example, more meaningful information can be obtained about a fast-moving conveyor belt if a snapshot of the associated points is taken every 5 seconds rather than every hour.

Conversely, you would probably use a longer snapshot interval for other types of processes, such as a refrigerated room. Here, you might use a 1-hour snapshot or longer.

Extended history is often used for taking snapshots of production totals.

Operating Group Displays

Operating groups can be used to compare the values of points that are logically related. If points are associated with a specific piece of plant equipment or process, operating groups can show this information on the same display. Operating groups are easily configured and provide a quick and efficient way to visually organize points.

Reports

Reports can be sent to printers or displayed on operator Stations. Planning reports involves deciding which information to extract from the PlantScape server database. For example, reports can be used at the end of operator shifts to show which points have alarmed, which pieces of plant equipment are in delays, and so on.

Different reports are used for:

- Analyzing alarms and events
- Searching for points with specific attributes
- Producing a cross reference of points
- Analyzing down time
- Creating special, custom format reports using options such as the ODBC Driver or Integrated Microsoft Excel reports.

When planning reports, ask:

- What type of reports are needed?
- Are custom reports needed?
- Should a report be produced only when requested, or should it be generated periodically?

Event Summaries

The Event Summary shows a summary of events that have occurred. You can choose what type of events should be included in reports, from all events and alarms, to only urgent priority alarms.

Message Summary

You can attach messages to points in the server database that give operators a course of action to follow if the point goes into alarm. The Message Summary enables you to review these messages and the points to which they are attached.

Custom Displays

The Display Builder tool is used to create custom displays. Custom displays can provide a familiar visual environment for operators and must be created for PlantScape Control Processor point details. P&IDs are useful for planning custom displays as they can be translated easily into graphics. Plan to use menus and other on-screen devices to help operators quickly navigate from one custom display to another. For information about creating displays for PlantScape Control Processor points see the *PlantScape Control Building Guide*.

When planning custom displays, ask:

- Does the operator need to see all of a process or only a section?
- How will an operator navigate the displays?

Perhaps one screen can be a “map” of the entire plant with active areas that access another display page when clicked, showing a close-up of a specific area or process. Or every display could have a panel that contains navigation controls. You can also define function keys to access specific display pages and customize the pull-down menus.

- What is the best way to represent a process?

Some processes can be represented using animated displays that change to show, for example, the level of liquid in a tank, the speed of a conveyor belt, and so on.

- How will displays incorporate features for changing security levels (if you are using standard security)?

P&IDs are a good resource to use when planning displays. They often can be used to determine:

- Information about the processes PlantScape needs to monitor and, consequently, what role PlantScape will play on the plant.
- Ways to group points.
- The processes that warrant their own displays.

Try to involve operators and managers in the display design process: they often know what types of process information is the most useful. Try to create display prototypes for operators to test before settling on a design.

Display Guidelines for Custom Displays

When planning custom displays:

- Consider carefully how the display will use color.

  Do not use color alone to represent meaning; some operators may have trouble distinguishing colors. Also, colors are not associated universally with the same meanings. Use dynamic text, effects, or animation as a backup.

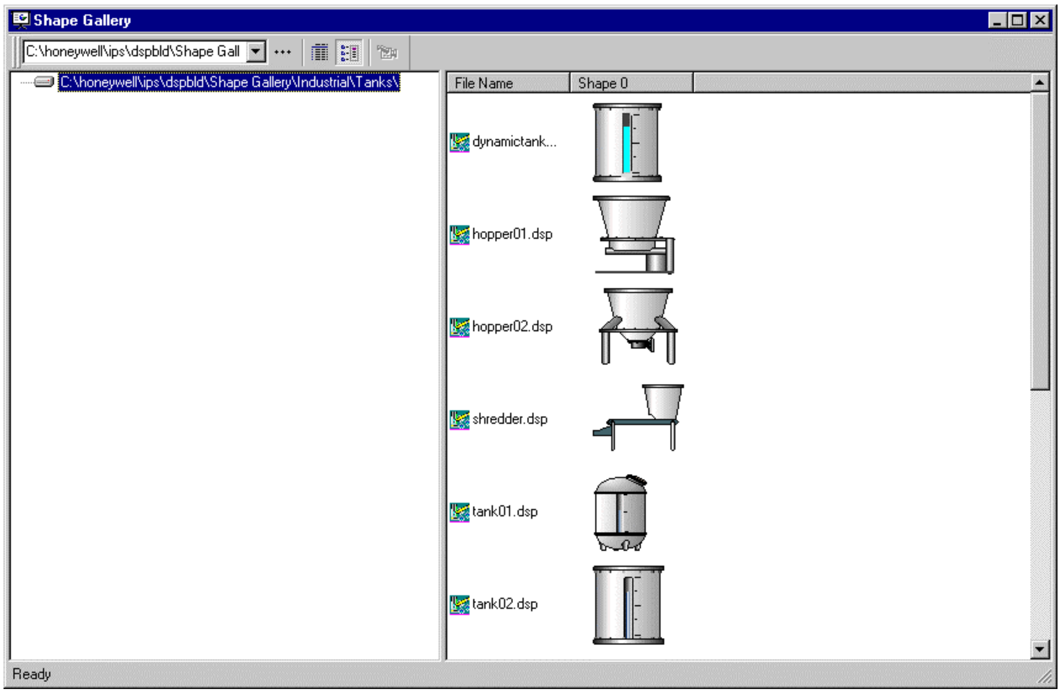
- Keep custom displays as simple as possible.

- If possible, use the predrawn shapes in the Display Builder library of images.

- Use the same display effects, font sizes, and so on as used in the standard displays. Alternatively, spend some time designing and documenting display “standards” to be used on any given project.

Refer to the style guide for custom displays in the *PlantScape Display Building Guide*.

The following figure shows some examples of pre-drawn images.



Generally a P&ID is enough to build most of the custom displays. For information on the sequence of process events that you need to define supervisory control, use a logic diagram.

For details on the Display Builder tool, refer to the *PlantScape Display Building Guide*

Planning Station Display Functionality

When planning how operator Station displays should work, consider:

- The types of information the display will show
- Who will use the display
- Which process(es) the display will show

In addition, ask:

- Will the display be used for monitoring, controlling, or both?
- Does the operator need to enter data? If so, which type of controls will be used: checkboxes, push buttons, comboboxes, or a combination?
- Which security is required?

Planning How to Control Processes

When planning how to use PlantScape to control plant processes, you need to identify the processes that the server will control, and the processes that will be guided by the control logic in controllers.

If the server will control processes, ask:

- Can the control be put into the controllers?
- What happens if a communications channel fails at a critical time? How will control of that process be affected?
- Should there be any restrictions on who can perform control?

You can control plant processes information:

- From custom displays
- From operating group displays.
- From point detail displays.
- By using point algorithms. Point algorithms can exercise control automatically; they can be configured to write values back to controllers or perform other actions (such as supervisory control, producing reports, and so on) without operator intervention.

Planning System Security

PlantScape uses security to restrict:

- Access to Station functions
- Control of points
- Access to areas of the database

The security type you choose depends on:

- Whether or not users need to sign on to that Station with a special user ID and password
- The security level setting used when Station starts up
- The total number of security levels available to your system
- The tasks you need to carry out to configure Station access

Consult your process engineer or system administrator for help with designing and implementing security.

Access to Station Functions

The choice of which type of Station security to use is often influenced by whether the Stations are located in a control room that is secure or not.

As a general rule, use:

- Standard Security for Stations when access to the control room is restricted to authorized plant personnel
- Operator Sign On for Stations in a control room that is not secure

The security level assigned to an operator depends upon their responsibilities within the plant.

Control of Points

To plan the control of points, identify:

- The processes that require controlling
- The operators responsible for that control

Operator tasks often help to clarify the responsibilities of different operators and the areas of the system they should have access to.

Access to Areas

Process diagrams and P&IDscan help to identify the parts of the plant or processes to configure as an area. Look for processes that use equipment that is arranged in identical or similar configurations.

Planning Your Server Options

Server Redundancy

When you have Redundant Servers, the two physical boxes must maintain communication between them to keep in sync. One server is designated as the Primary Server and the other designated as the backup. The primary must update the backup server with all pertinent information so if there is a failover, the backup can take over in the primary's place. The information transferred between can be summarized to two major components: The Server information and the database information. The Primary's (PlantScape) Server service must be able to communicate via TCP/IP and NBT with the Backup's Server Service.

When planning redundancy, you need to consider how much redundancy is required. Will you have a single or redundant LAN? If you are planning redundant servers you will need to have a redundant LAN to ensure that data is copied to the backup server if a LAN fails. Will you have redundant operator Stations? If it is within your budget, you can make almost every aspect of your system redundant.

During Redundant Server Setup, Server Alias names were setup for each server/role and Network Card. They would be something like this: Primary Server NIC 1, Primary Server NIC 2, Backup Server NIC 1, and Backup Server NIC 2. (Documentation refers to this as ServerA0, Server A1, ServerB0, and ServerB1.) Since the Server Service is communicating using TCP/IP via an alias name assigned to it for each NIC, the Server must be able to resolve this alias name. In the Microsoft NT Operating System, this is done via the Hosts file. (C:\winnt\system32\drivers\etc\hosts.) The communication is a two way street, so the appropriate entries must be also in the Backup Servers Hosts file as well.

Since NetBIOS does not support alias naming natively, you must have the configuration option for "Enable DNS for Windows Resolution" checked in your TCP/IP Protocol WINS Address Properties Page. This allows NBT to resolve the alias names for the servers during this communication. (Note: Station uses this same option when communicating with the server.)

You also need to plan how you will monitor the redundant server to ensure that data is being updated. Who will be responsible for ensuring that synchronization is always working?

Database Backup and Restore Utility Planning

Database Backup and Restore

For up-to-date Backup and Restore information and instructions, refer to the *PlantScape Process Software Change Notice*.

Control Hardware Configuration

Planning Your Control Hardware

ATTENTION

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

Hybrid Controllers

You can install Hybrid Controllers in a nonredundant 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	ControlNet Interface Module (CNI, Latest Version) Control Processor Module (CPM, C200 Version) Redundancy Module (RM) I/O Link Interface Module (IOLIM) Battery Extension Module (BEM)

If Controller Configuration Is. . .	Then, These Modules Are Controller Chassis Compatible. . .
Nonredundant	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 nonredundant 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 supervisory ControlNet network to support peer-to-peer communications with a Hybrid 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 pc running Windows 2000 Server operating system.

- ·Do not load system Server/Client, Station, or Control Builder program on a dedicated ACE pc.
- ·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 supervisory ControlNet can peer-to-peer with Hybrid 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 PlantScape for supported non-PlantScape controllers.
- You will need to use the User Scan Task Kit to write interfaces to communicate with controllers not supported by PlantScape. 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.

Printers

When planning for printers, determine:

- How many printers are needed, and what type should they be?
  - Alarm printers must be 132 column line printers (dot-matrix, inkjet, or equivalent) so that alarms can be printed as they occur.
  - The alarm printer can also be the report printer.
  - If you want to print out screen dumps of custom graphics or trends, using a color printer is recommended: displays are easier to interpret when printed in color.
- How will the printers be connected to the network?
  - In small-scale systems, printers may connect directly to the server by using serial or parallel ports.
  - In medium- and large-scale systems, reports can be sent to printers connected to networked print servers or operator stations.
- Where will the printers be located?
  - For the convenience of operators, it is recommended that printers be placed near operator Stations.
  - Printers work best in dry, cool locations such as control rooms, however, printer noise must be considered before a control room is used.

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 Hybrid Controllers, and between the Hybrid 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-CCN013 and TC-CCR013 or TK-CCR013 are required for use in redundant controller chassis. Earlier CNI models TC-CCN012 and 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-CCN013, are for nonredundant 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-CCR013, must be used.

Refer to *Planning Your Chassis Configurations* in the *Planning Guide* for more information about CNI placement in your 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

PlantScape output modules may be used to drive a variety of output devices. Typical output devices compatible with the PlantScape 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

PlantScape 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 available with PlantScape system version R500 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 Implementation GuideLinking Device Implementation 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 PlantScape 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 PlantScape system provides power supplies for both AC (120/240 Vac) and DC (24 Vdc) supply voltage inputs.

CAUTION

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

The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links.

Process controller chassis configuration

The factory default size for a redundant Process Controller (also known as Hybrid 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) 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 1 Redundant controller chassis slot configuration rules

Rules	7- or 13-slot chassis slot number	10- or 17-slot chassis slot number
• ControlNet Interface (CNI) module for connection to the Supervisory ControlNet. – Non-Redundant media version TC-CCN013 must be used if network cable redundancy is not required. – Redundant Media version TC/TK-CCR013 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-CCN013 must be used if network cable redundancy is not required. – Redundant Media version TC/TK-CCR013 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.

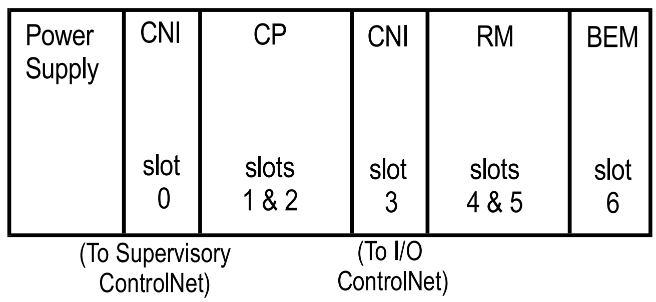
CAUTION

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

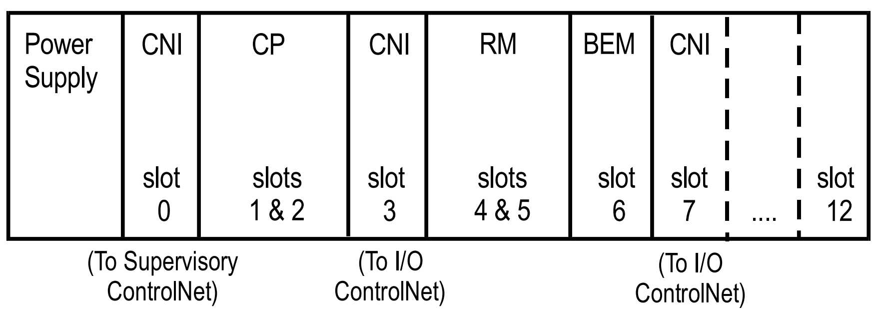
- each controller chassis must be identical in configuration.
- I/O modules are not permitted in the controller chassis, as their points could fail in the event of a failover or switchover to the backup controller.
- any unused slot of any chassis must have a Blank Cover Module installed. Two Blank Cover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

WARNING

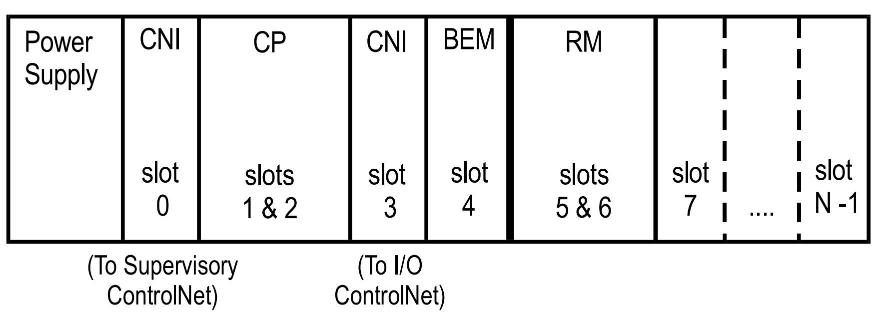
Before considering Removal and Insertion under Power (RIUP) on any module, refer to the *Control Hardware Installation Guide*, *Removal and Insertion Under Power (RIUP) function guidelines*.



Default Module Placement for a 7-slot redundant controller chassis



Default Module Placement for a 13-slot redundant controller chassis

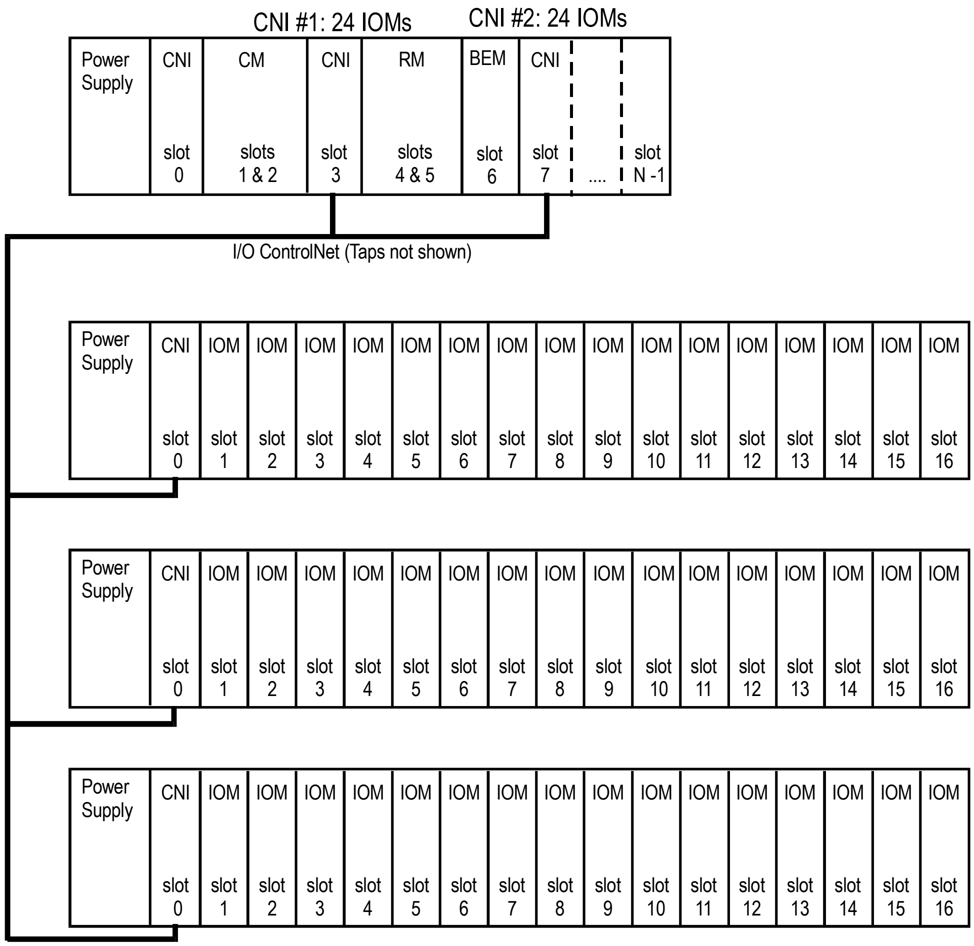


Default Module Placement for 10 and 17-slot redundant controller chassis (N = 10 or 17)

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 2 I/O chassis configuration

Rules	Slot(s)
ControlNet Interface (CNI) for connection to the I/O ControlNet • Non-redundant Media version TC-CCN013 is the default. • Redundant Media version TC/TK-CCR013 is required if ControlNet cable redundancy is required.	0
Chassis I/O Modules (IOMs) provide connections to process connected field devices.	1 & up

TIP

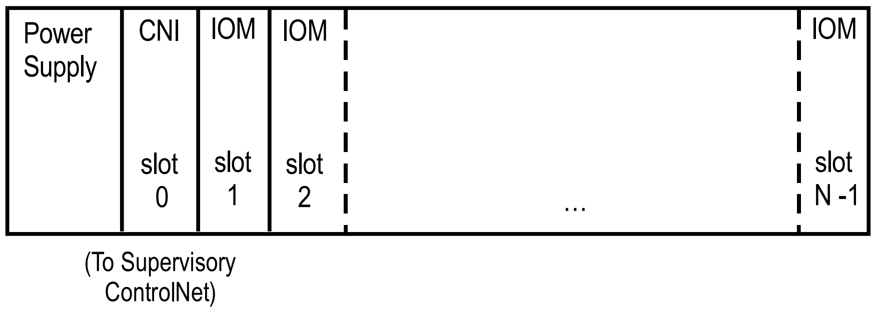
Slot 0 is preferred for the CNI because the ControlNet cables can be routed to the left without being routed past IOMs (and their field wiring) to the right. If more than one CNI module is required in the I/O chassis, the additional CNI module(s) should be placed in the left-most slots (after slot 0)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

CAUTION

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

WARNING

Before considering Removal and Insertion under Power (RIUP) on any module, refer to the *Control Hardware Installation Guide*, *Removal and Insertion Under Power (RIUP) function guidelines*.



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 *ControlNet Configuration, 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 PlantScape specifications for capacities and model numbers: The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links.

A copy of the *Chassis – Series A I/O Specification and Technical Data* is included in Knowledge Builder for quick reference.

Remote Termination Panel planning

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

Fieldbus Interface Module (FIM) planning

REFERENCE - INTERNAL

Refer to the *Fieldbus Implementation Guide* for complete information on planning, installing, and wiring the FIM and its companion Remote Termination Panel.

Linking Device (LD) planning

REFERENCE - INTERNAL

Linking Device Implementation Guide for complete information on installing and using the Linking Device.

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.

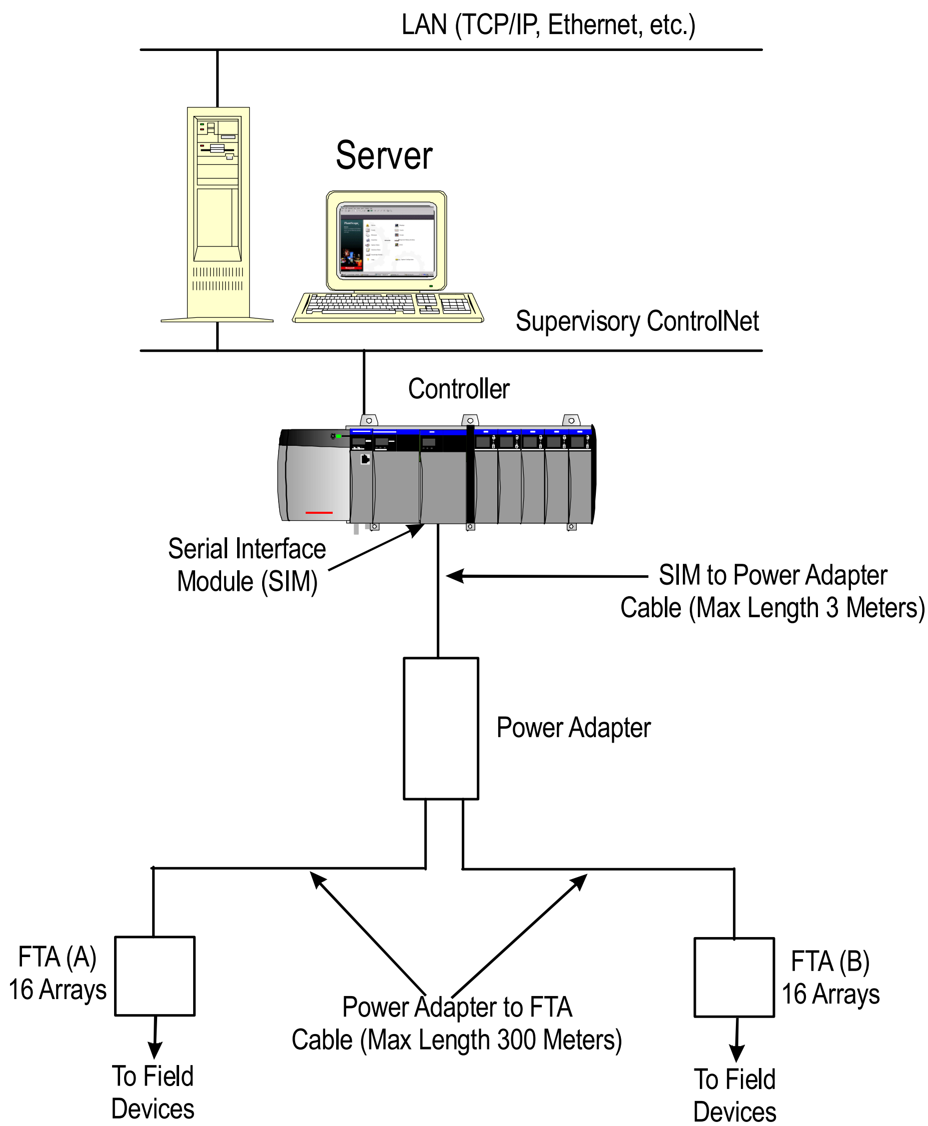
PROFIBUS Interface Module (PBIM) planning

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.


LAN (TCP/IP, Ethernet, etc.)
Server
Supervisory ControlNet
Controller
Serial Interface
Module (SIM)
SIM to Power Adapter
Cable (Max Length 3 Meters)
Power Adapter
FTA (A)
16 Arrays
Power Adapter to FTA
Cable (Max Length 300 Meters)
FTA (B)
16 Arrays
To Field
Devices
To Field
Devices

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.

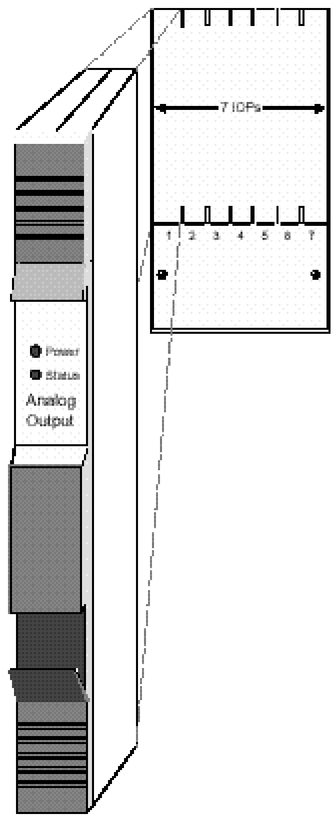
Card File Name	CE Compliant Model	Non-CE Compliant Model
Left 7-Slot IOP	MU-HPFI03	MU-HPFH01
Right 7-Slot IOP	MU-HPFI13	MU-HPFH11
15-Slot IOP	MU-HPFI23	MU-HPFX02

REFERENCE - INTERNAL

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

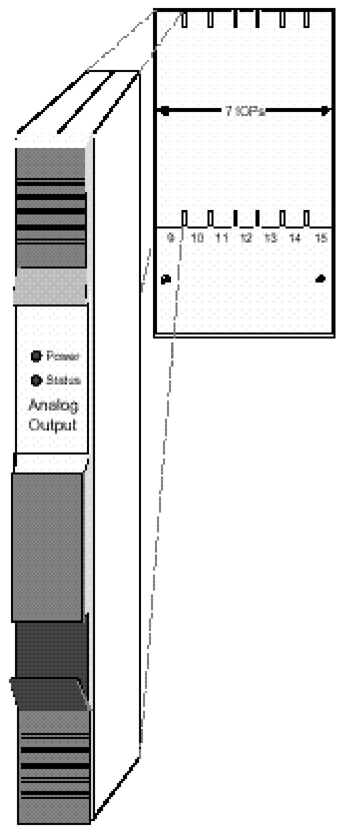
Left 7-Slot IOP

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.



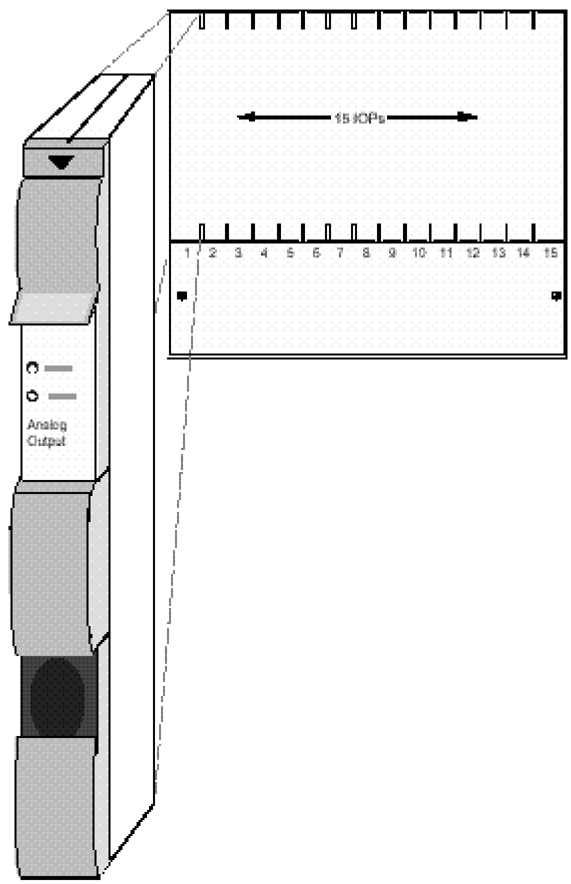
Right 7-Slot IOP

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

* Some IOP types may be unavailable. Check with Honeywell sales representative.

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 PlantScape 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

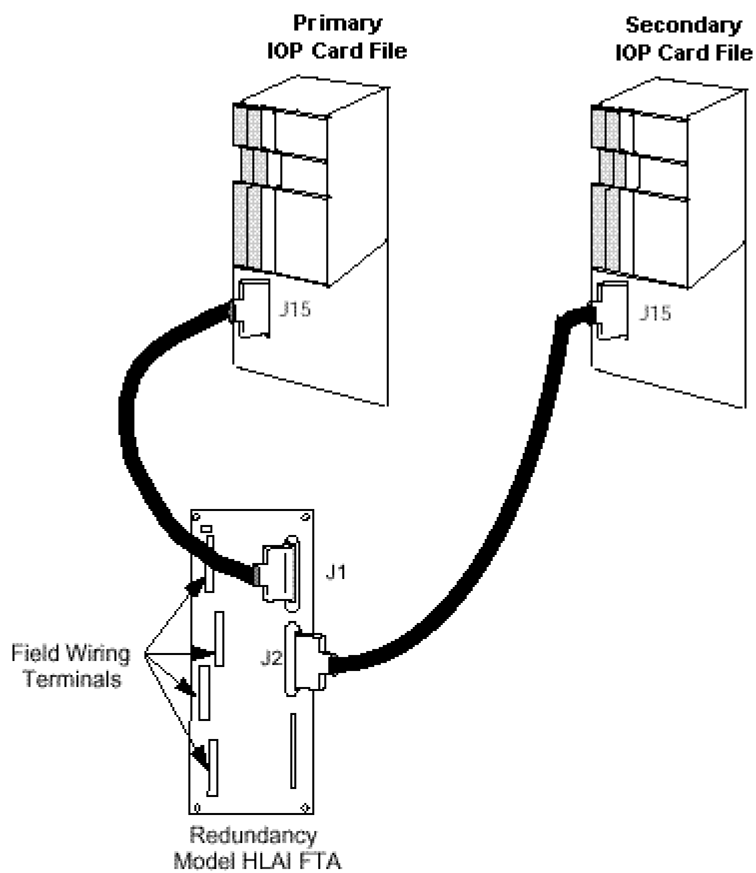
The I/O Link Interface Module supports IOP redundancy for the following types of IOPs:

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

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

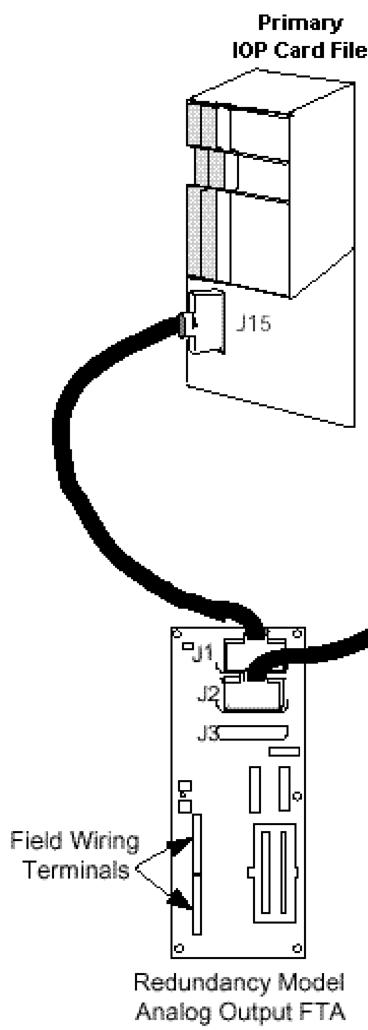
Redundant HLAI IOPs

A pair of IOPs can be connected in a redundant configuration with both IOPs connected by separate cables to the same FTA. 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-PAI100, which is only available in a coated version.
- Not all IOP models listed are supported by the I/O Link Interface Module supplied with PlantScape system version R500.

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

IOP Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number
With Conformal Coating			
AO	MC-PAOX03	51304672-150	51309152-175
AO	MC-PAOY22	N/A	80363969-150
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
HLAI100	MC-PAI100	N/A	51304754-250
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).

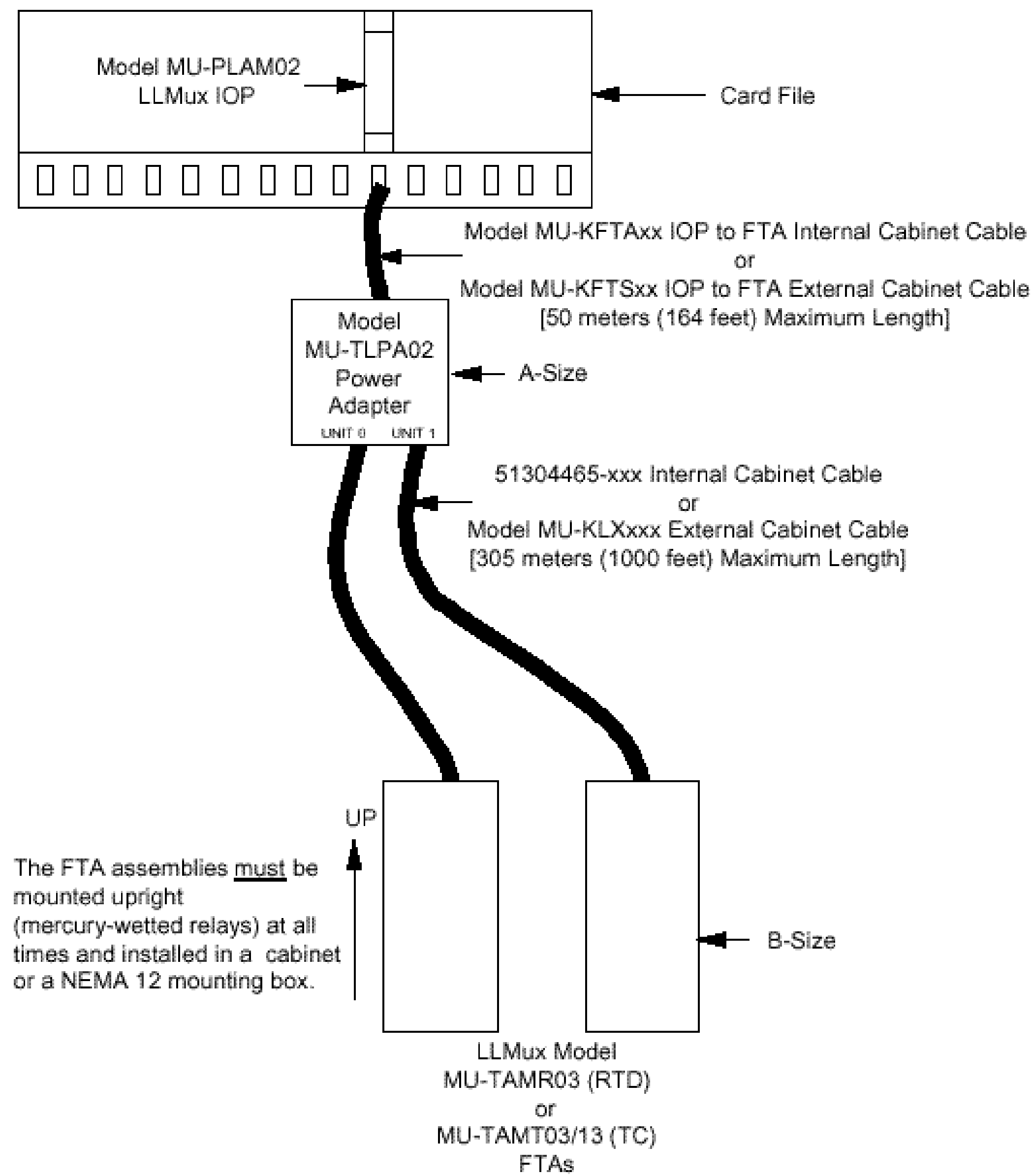
The RHMUX is Approved as Intrinsically Safe and Nonincendive for use in hazardous locations. However, the RHMUX assemblies can also be used in areas that are classified as nonhazardous. The RHMUX subsystem has the added advantage that the FTA can be located up to 2 kilometers from its Power Adapter.

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.

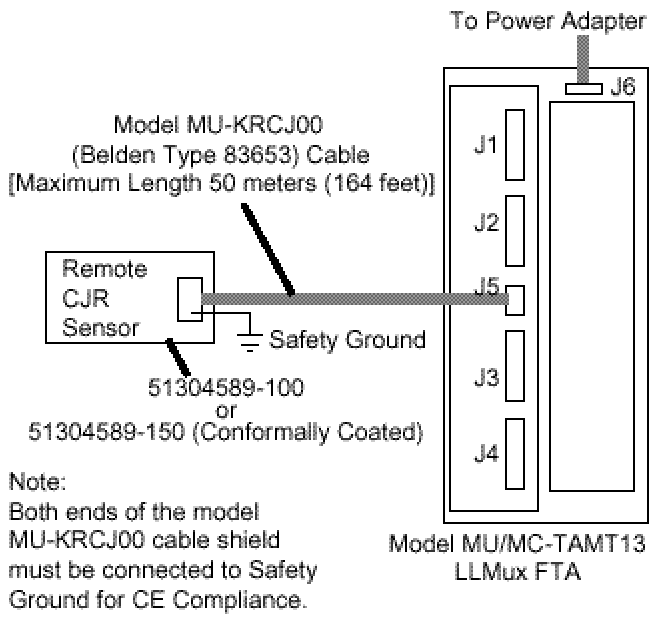
The following table lists general cable specifications for reference.

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.

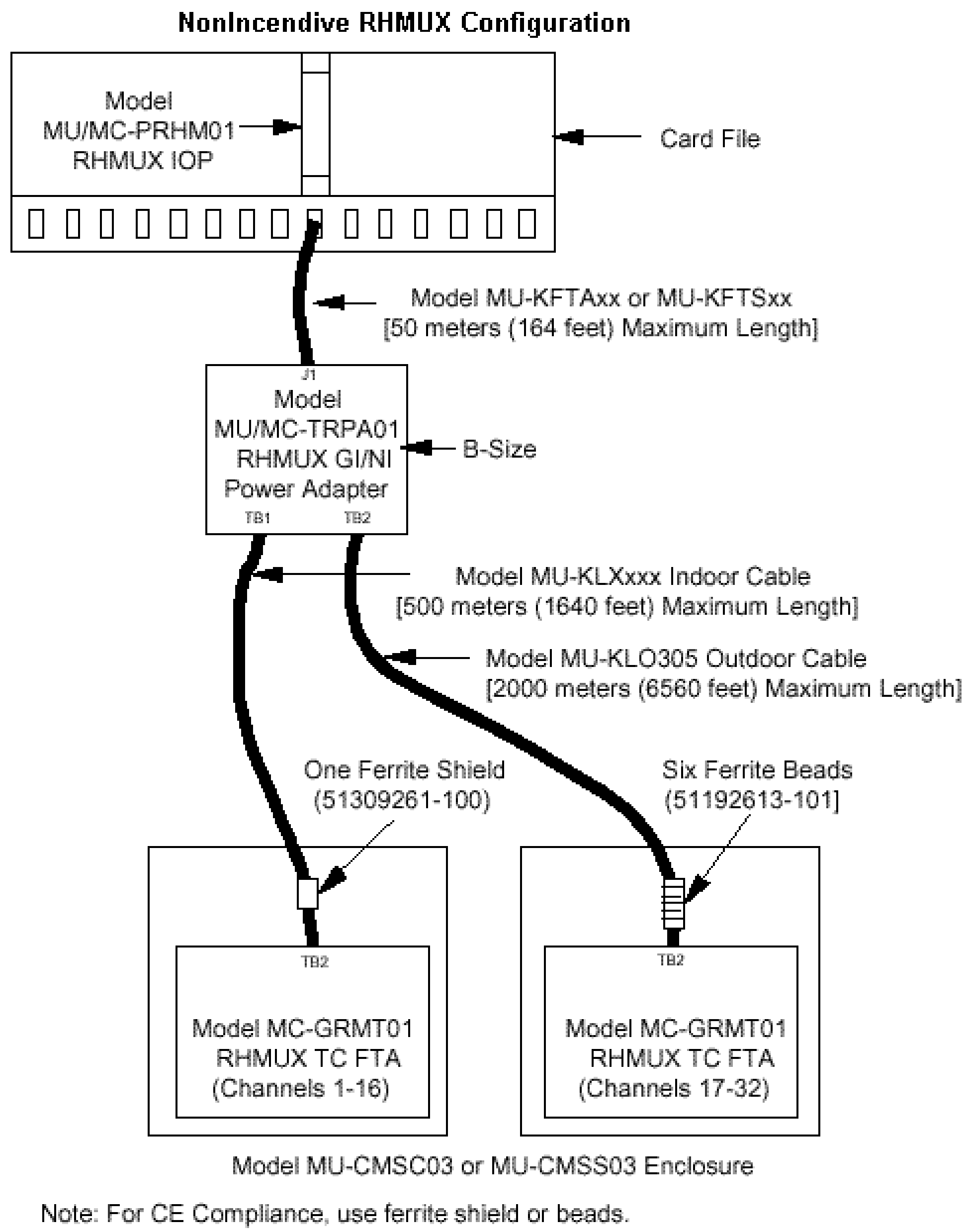
The RHMUX FTA supports 0 to 100-millivolt and thermocouple inputs. RTD inputs are not supported.

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

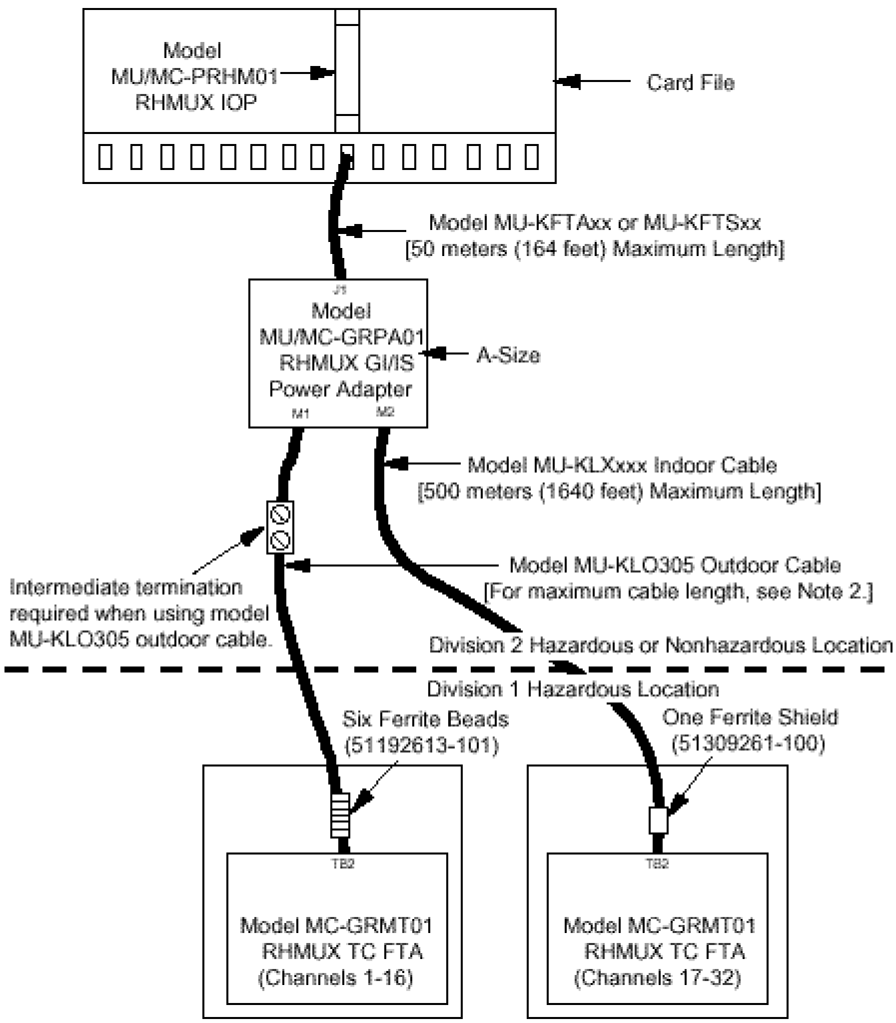
The following figures show typical RHMUX configurations for Nonincendive and Intrinsically Safe applications, respectively.

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/MC-PRHM01
RHMUX IOP
Card File
Model MU-KFTAxx or MU-KFTSxx
[50 meters (164 feet) Maximum Length]
J1
Model
MU/MC-TRPA01
RHMUX GI/NI
Power Adapter
TB1
TB2
B-Size
Model MU-KLXxxx Indoor Cable
[500 meters (1640 feet) Maximum Length]
Model MU-KLO305 Outdoor Cable
[2000 meters (6560 feet) Maximum Length]
One Ferrite Shield
(51309261-100)
Six Ferrite Beads
(51192613-101]
TB2
Model MC-GRMT01
RHMUX TC FTA
(Channels 1-16)
TB2
Model MC-GRMT01
RHMUX TC FTA
(Channels 17-32)
Model MU-CMSC03 or MU-CMSS03 Enclosure
Note: For CE Compliance, use ferrite shield or beads.

Intrinsically Safe RHMUX Configuration



Model MU-CMSC03 or MU-CMSS03 Enclosure

Notes: 1. For CE Compliance, use ferrite shield or beads.

2. 1400 meters (4590 feet) Maximum Length for Class I, Group A or B.
2000 meters (6560 feet) Maximum Length for all other locations.

CE Compliance

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

Non-CE Compliance

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

RHMUX Power Adapter location

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

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

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

RHMUX IOP to Power Adapter cable

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

RHMUX FTA location

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

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

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

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

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

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

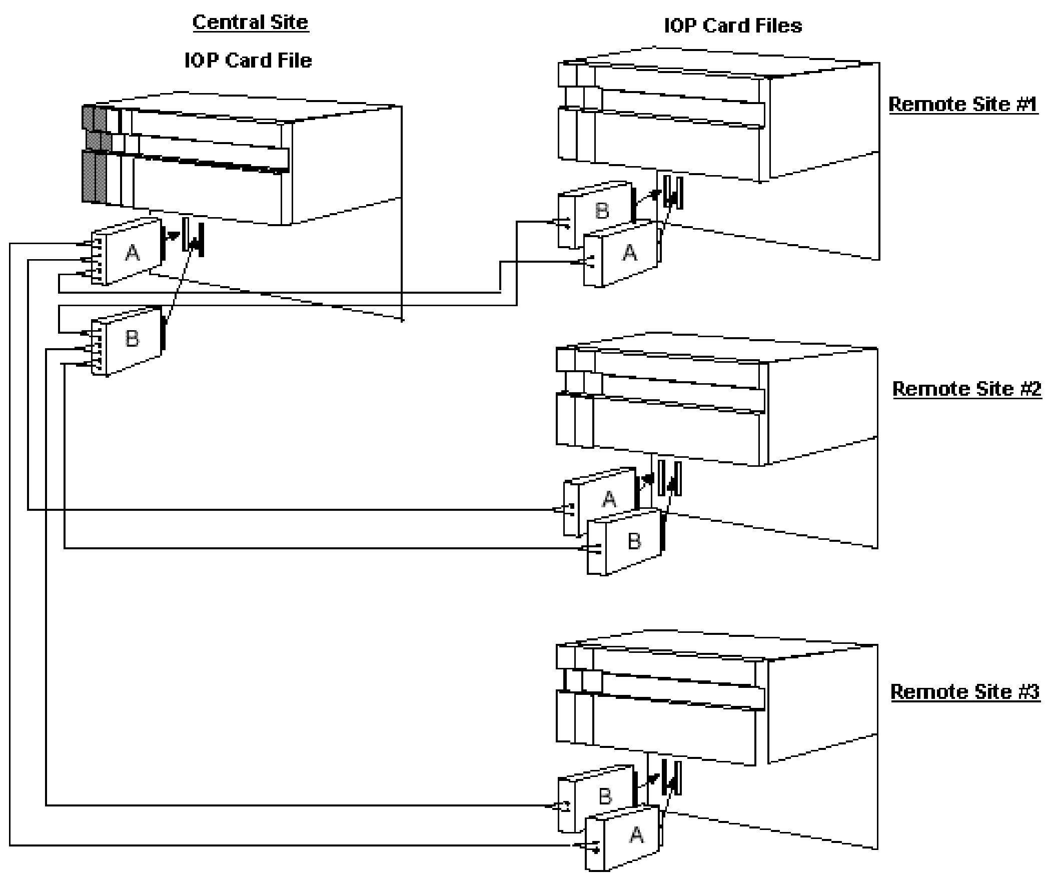
The Standard I/O Link Extender card will drive and terminate Link A or Link B, depending upon the number of the card file and the slot. If the number of the card file and the slot are both odd or both even, the card will drive Link A. If the number of the card file and the slot are not both odd or both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

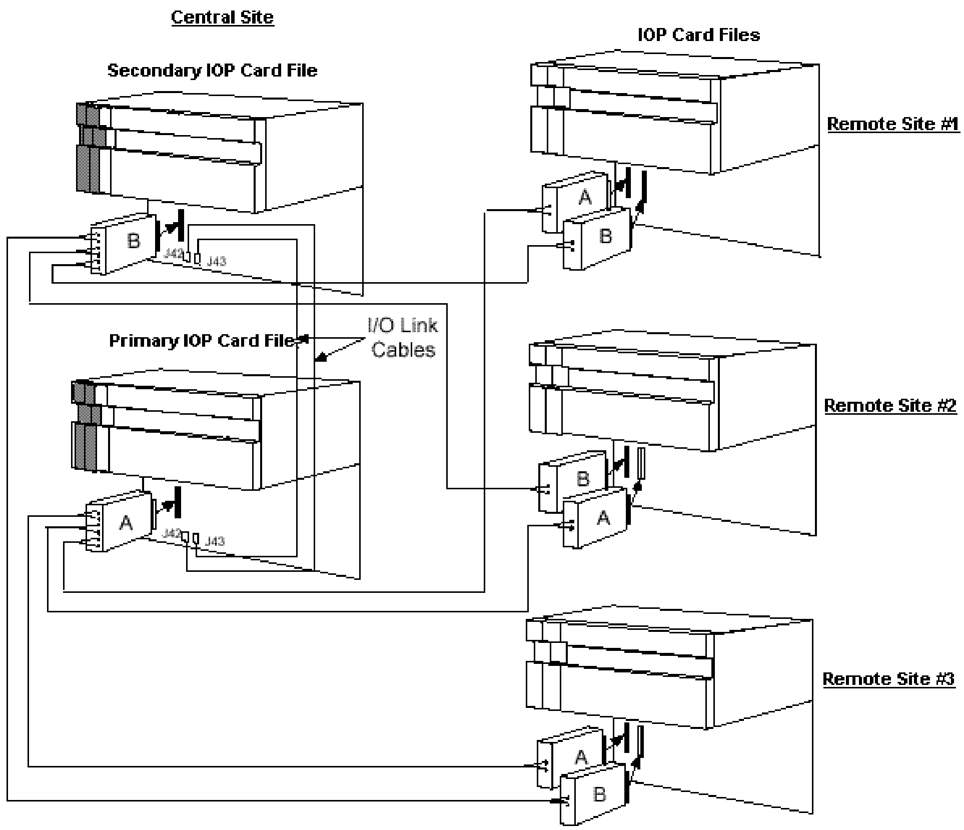
- The local IOP card file is configured as card file #1 (I/O Link Interface address of 0).
- Remote site # 1's I/O card file is configured as card file # 2 (I/O Link Interface address of 1).
- Remote site # 2's I/O card file is configured as card file # 3 (I/O Link Interface address of 2).
- Remote site # 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
Secondary IOP Card File
IOP Card Files
Remote Site #1
B
J42
J43
A
B
I/O Link
Cables
Primary IOP Card File
Remote Site #2
B
A
A
J42
J43
Remote Site #3
A
B

Long Distance type Extender

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

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

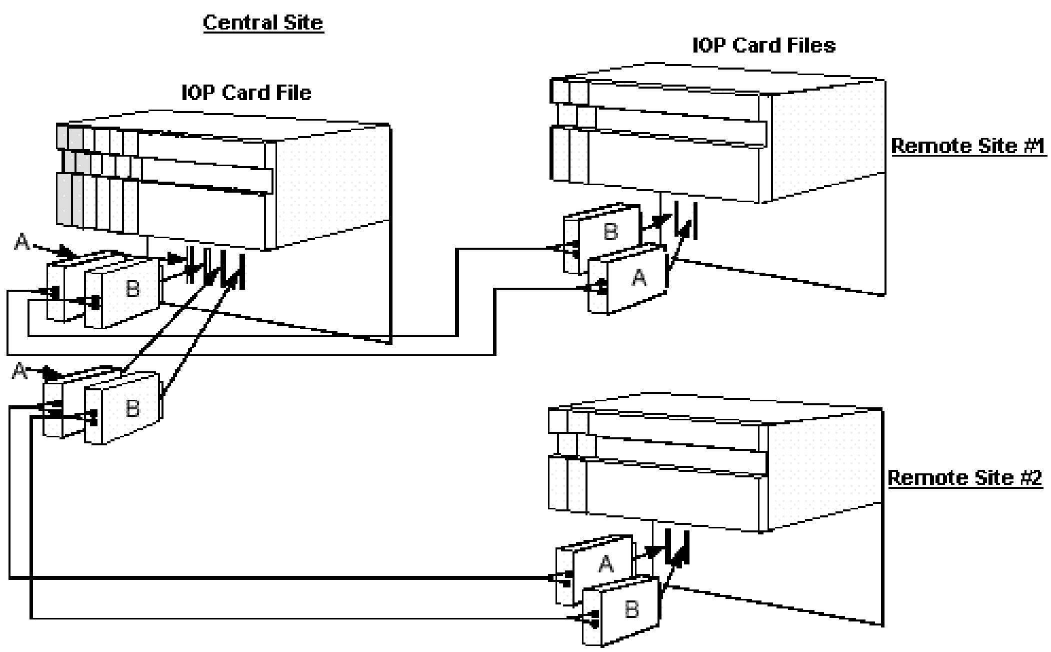
ATTENTION

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

Long Distance type extender with single IOP example

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

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

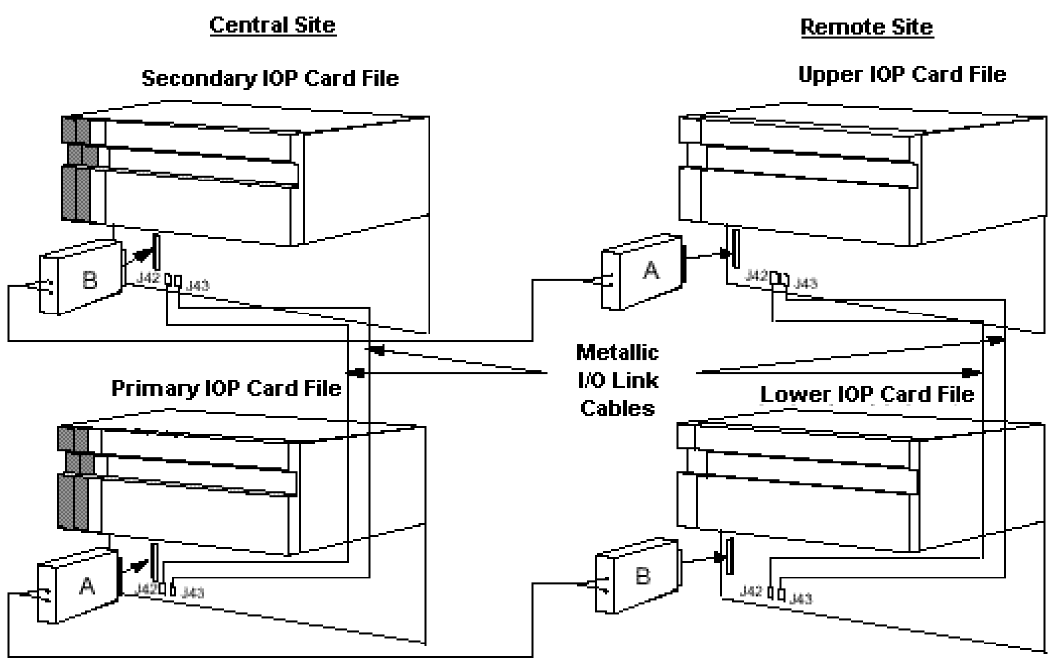


Multiple IOPs at remote site example

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

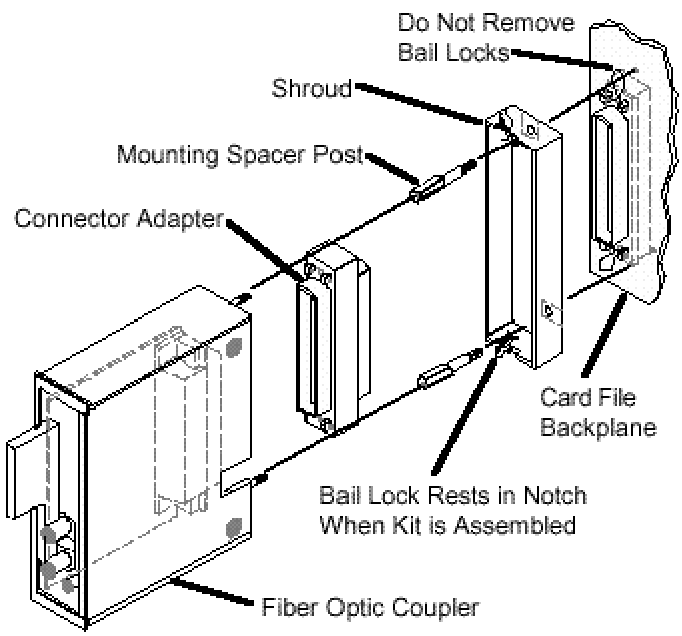
The following IOP subsystem configuration is assumed:

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



I/O Link Extender adapter kit

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



I/O Link Extender models

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

ATTENTION

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

Model Number	Description	CE Compliant Part Number
MC-IOLM02	Standard I/O Link Extender - Local Card File	
	Standard I/O Link Extenter 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.
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.
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.
Analog Output (AO)	The AO FTA provides isolated 4-20 mA outputs to proportioning loads such as valves.

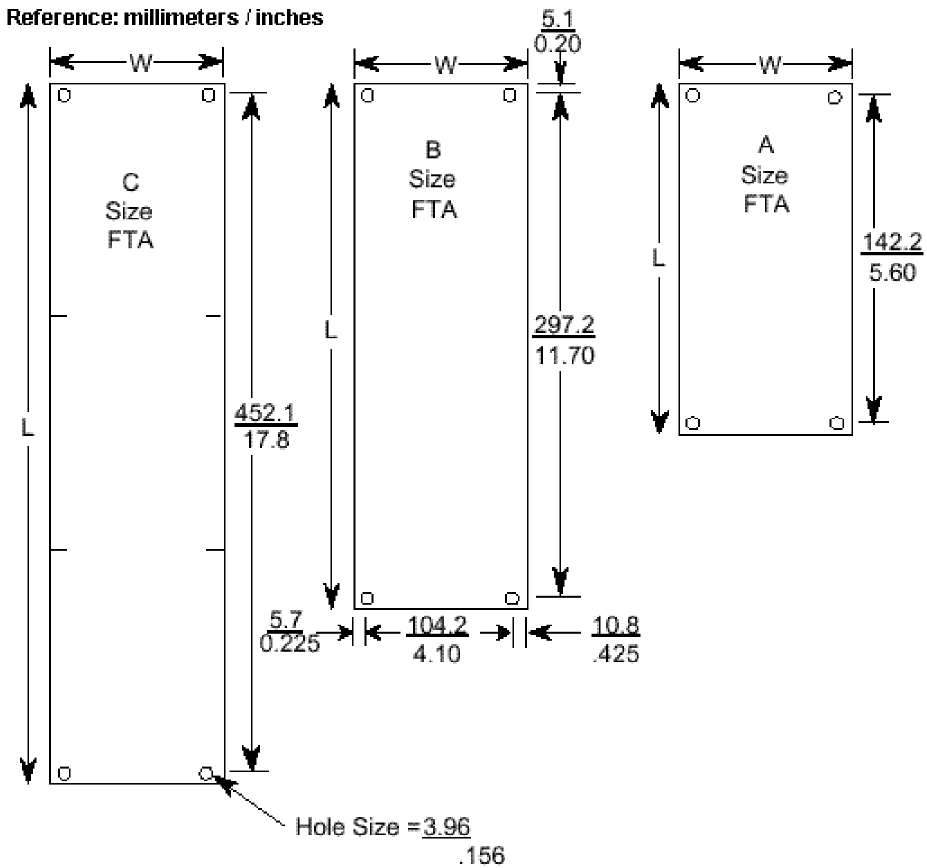
FTA Type	Description
Analog Output (AO) HART	The above AO functionality plus the ability to connect HART devices to the FTA without external filtering. This FTA also provides a connector to interface to an external HART multiplexer system.
High Level Analog Input (HLAI)	The HLAI FTA accepts high level analog inputs. All inputs are isolated from ground and each other.
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 circurity requirements, as shown in the following figure. The Galvanically Isolated type FTAs come in only the "B" size.

ATTENTION

- The center of the mounting hole is a constant distance from the edge of the assembly board for all three FTA sizes as shown for size B.
- Sizes B and C, depending on the type of FTA, can have additional mounting holes along the length (sides) of the FTA. The additional mounting holes all fall on a grid established for mounting adjacent A-size FTAs.



Size	Length L	Width W
A	152.4/6.00	120.7/4.75
B	307.3/12.10	120.7/4.75
C	462.3/18.20	120.7/4.75

FTA Mounting Channels

The FTAs are installed at the rear or front of a dual-access cabinet on one or more FTA Mounting Channels. In a single-access cabinet, the FTAs are mounted on FTA Mounting Channels at the front of the cabinet. The number of FTA Mounting Channels that can be accommodated in a cabinet is dependent upon whether the cabinet is single access or dual access, and whether the standard or wide FTA mounting channels are installed. The FTA Mounting Channels also function as cable and wiring channels, or troughs.

CAUTION

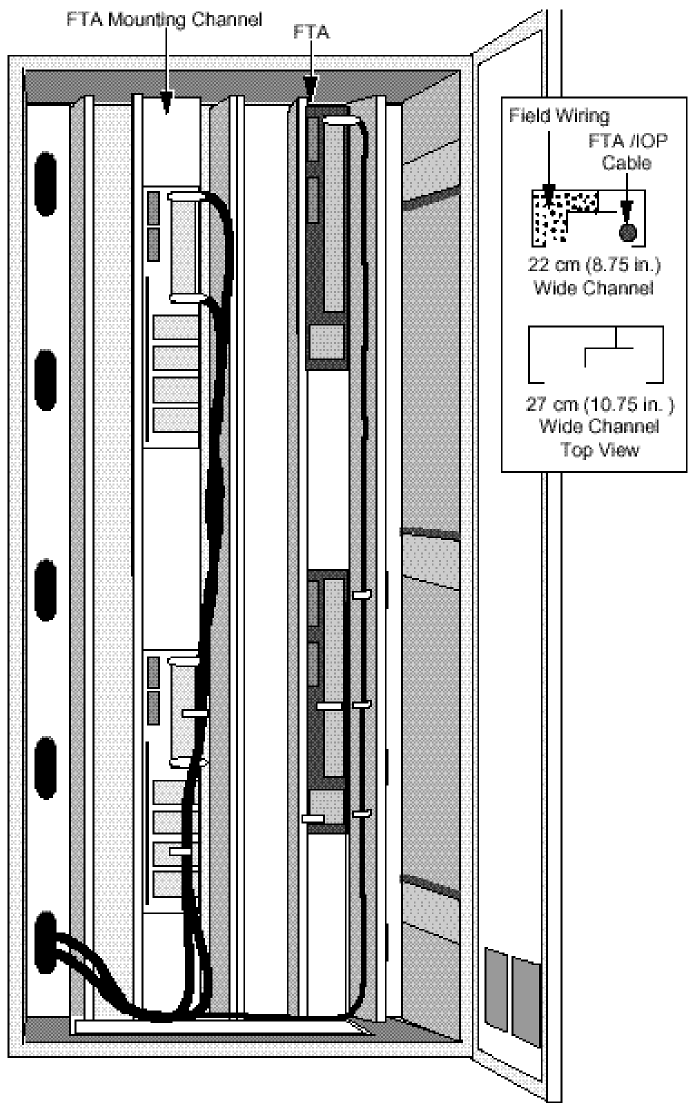
Do not mount Standard type and Galvanically Isolated type FTAs on the same FTA Mounting Channel

FTA mounting orientation

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

Typical cabinet layout

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



Cable routing

The Standard type FTA to IOP or Power Distribution Assembly cabling is routed in the right channel, and the process control wiring is routed in the left channel. The reverse is true for Galvanically Isolated FTAs , since the FTA Mounting Channel is installed in an inverted position.

ATTENTION

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

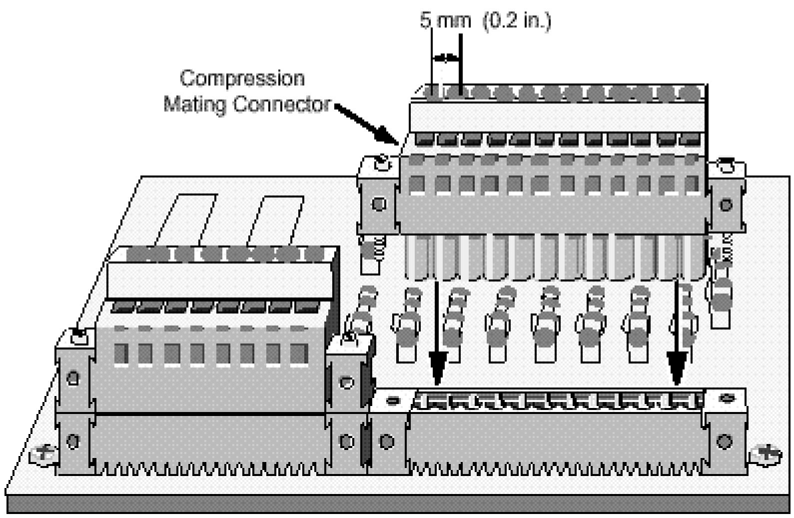
FTA terminal types

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

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

FTA compression-type terminal Connector

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

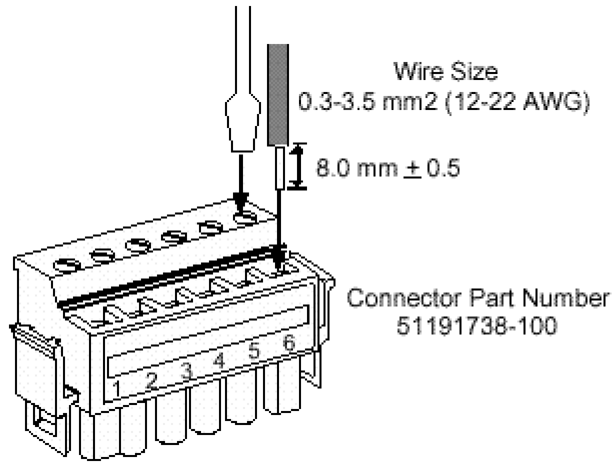


Compression Mating Connector for Standard Type FTA

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

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

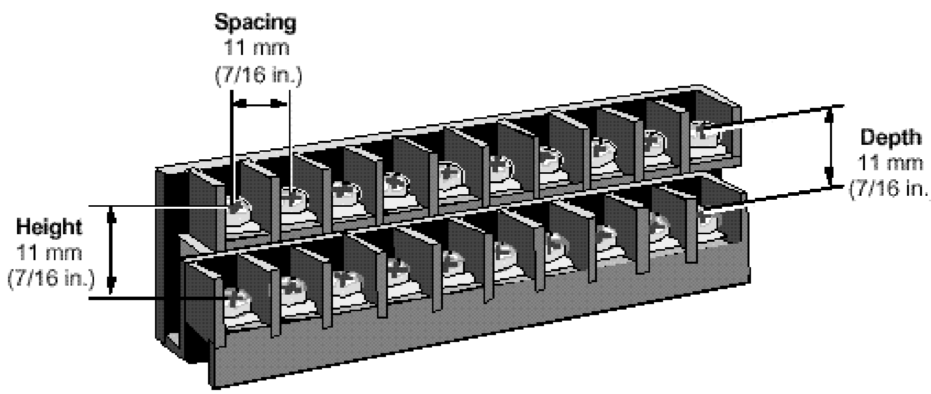
The following figure shows compression-type terminal connectors for mating with the six terminals on the Galvanically Isolated type FTAs. The acceptable wiring sizes are as stated above for connectors used with Standard type FTAs.



Compression Mating Connector for Galvanically Isolated Type FTA

FTA fixed-screw terminal connector

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



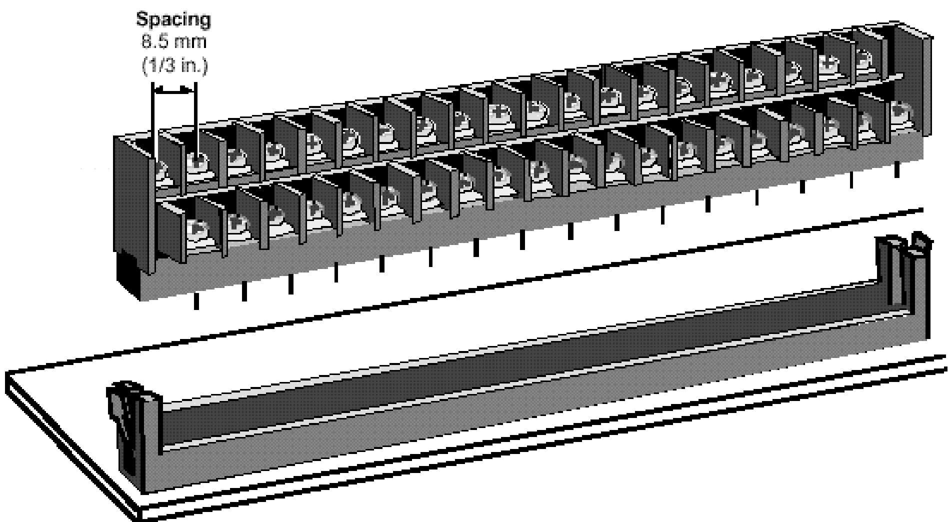
Fixed-Screw Terminal Connector for Standard Type FTA

Screw Terminal Strip Sizes

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

FTA removable-screw terminal connector

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



Removable-Screw Terminal Connector for Standard Type FTA

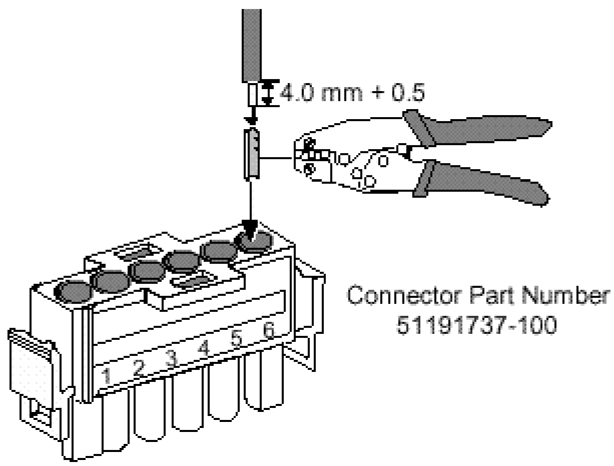
Screw Terminal Connector Size

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

FTA crimp-pin terminal connector

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

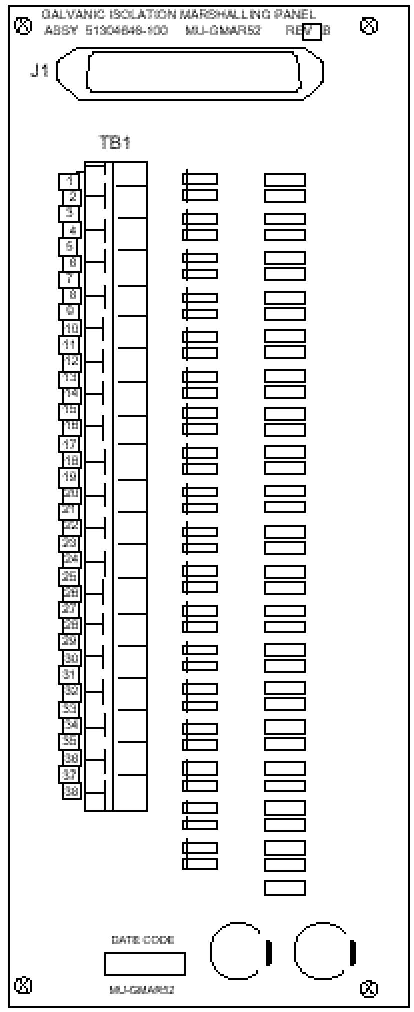
Wire Size	Crimp Pin Part Number	Crimp Tool Part Number
0.5-2.5 mm2 (14-20 AWG)	51191737-201	51191787-100



Crimp-Pin Terminal Connector for Galvanically Isolated Type FTA

FTA Marshalling Panel

The Marshalling Panel provides access to the signals from the auxiliary connectors on the Galvanically Isolated FTAs. It can also be used as a general purpose Marshalling Panel in the Input/Output Processor subsystem. The following figure shows an assembly layout of the panel. The model MU-GMAR52 or MC-GMAR52 Marshalling Panel is similar in shape and appearance to a "B" size FTA. The Panel provides surge and ESD protection for the field wiring terminals. It has a 50-pin connector to accept an IOP to FTA cable.


GALVANIC ISOLATION MARSHALLING PANEL
ASSY
MU-GMAR52
REV B
J1
TB1
DATE CODE
MU-GMAR52

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 Confromal 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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
120 Vac/125 Vdc Relay DO	MU-TDOR52	51304443-200	51309148-225	S	16	B
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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
AO	MU-TAOY52	80364007-100	80366484-125	S	16	B
AO	MU-TAOY53	80364007-200	N/A	S	16	B
AO	MU-THAO11	N/A	51309542-125	c	16	B
HLAI	MU-TAIH03	N/A	51309136-125	C	16	A
HLAI	MU-TAIH13	N/A	51309138-125	C	16	B
HLAI	MU-TAIH23	N/A	80369165-125	C	16	B
HLAI	MU-TAIH53	N/A	51309138-225	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
HLAI/STI	MU-TAIH22	80366195-100	N/A	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
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
AO	MC-TAOY52	80364007-150	80366484-175	S	16	B
AO	MC-TAOY53	80364007-250	N/A	S	16	B
AO	MC-THAO11	N/A	51309542-175	C	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
HLAI	MC-TAIH03	N/A	51309136-175	C	16	A
HLAI	MC-TAIH13	N/A	51309138-175	C	16	B
HLAI	MC-TAIH23	N/A	80369165-175	C	16	B
HLAI	MC-TAIH53	N/A	51309138-225	S	16	B
HLAI/STI	MC-TAIH02	51304453-150	N/A	C	16	A
HLAI/STI	MC-TAIH12	51304337-150	N/A	C	16	B
HLAI/STI	MC-TAIH22	80366195-150	N/A	C	16	B
HLAI/STI	MC-TAIH52	51304337-250	N/A	S	16	B
HLAI/STI	MC-TAIH62	80366192-150	N/A	S	16	B
LLAI	MC-TAIL02	51304437-150	N/A	C	8	B
LLAI	MC-TAIL03	N/A	51309202-175	C	8	B
LLMux RTD	MC-TAMR02	51304477-150	N/A	C	16	B
LLMux RTD	MC-TAMR03	N/A	51309218-175	C	16	B
LLMux TC	MC-TAMT02	51401491-150	N/A	C	16	B
LLMux TC	MC-TAMT03	N/A	51309223-175	C	16	B

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

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
24 Vdc DI	MU-GDID83	51304728-300	51304728-325	C	32	B
24 Vdc DO	MU-GDOD12	51304642-100	51304642-125	C	16	B
AO	MU-GAOX02	51304638-100	51304638-125	C	8	B
AO	MU-GAOX12	51304638-500	51304638-525	C	8	B
AO	MU-GAOX72	51304638-300	51304638-325	CP	8	B
AO	MU-GAOX82	51304638-700	51304638-725	CP	16	B
AO	MU-GHAO11	N/A	51309540-125	C	16	B
DO with LFD	MU-GDOL12	51304736-100	51304736-125	C	16	B
DO with LFD	MU-GDOL82	51304736-300	51304736-325	CP	16	B
GI 24 Vdc DO	MU-GDOD82	51304642-300	51304642-325	CP	16	B
GI HLAI/STI	MU-GAIH83	51304718-300	51304718-325	CP	16	B
HLAI	MU-GAIH12	51304636-100	N/A	C	16	B
HLAI	MU-GAIH22	51304748-100	51304748-125	C	16	B
HLAI	MU-GAIH82	51304636-300	N/A	CP	16	B
HLAI	MU-GAIH92	51304748-300	51304748-325	CP	16	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
HLAI/STI	MU-GAIH13	51304718-100	51304718-125	C	16	B
HLAI/STI	MU-GAIH14	51304730-100	51304730-125	C	16	B
HLAI/STI	MU-GAIH84	51304730-300	51304730-325	CP	16	B
Combiner Panel	MU-GLFD02	51304732-100	51304732-125	- -	- -	- -
Marshalling Panel	MU-GMAR52	51304646-100	51309156-125	- -	- -	- -
Power Distribution Assembly	MU-GPRD02	51304644-100	51304644-125	- -	- -	- -
Galvanically Isolated With Conformal Coating						
24 Vdc DI	MC-GDID12	51304640-150	51304640-175	C	32	B
24 Vdc DI	MC-GDID13	51304728-150	51304728-175	C	32	B
24 Vdc DI	MC-GDID82	51304640-350	51304640-375	CP	32	B
24 Vdc DI	MC-GDID83	51304728-350	51304728-375	C	32	B
24 Vdc DO	MC-GDOD12	51304642-150	51304642-175	C	16	B
AO	MC-GAOX02	51304638-150	51304638-175	C	8	B
AO	MC-GAOX12	51304638-550	51304638-575	C	8	B
AO	MC-GAOX72	51304638-350	51304638-375	CP	8	B

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
AO	MC-GAOX82	51304638-750	51304638-775	CP	16	B
AO	MC-GHAO11	N/A	51309540-175	C	16	B
DO with LFD	MC-GDOL12	51304736-150	51304736-175	C	16	B
DO with LFD	MC-GDOL82	51304736-350	51304736-375	CP	16	B
GI 24 Vdc DO	MC-GDOD82	51304642-350	51304642-375	CP	16	B
GI HLAI/STI	MC-GAIH83	51304718-350	51304718-375	CP	16	B
HLAI	MC-GAIH12	51304636-150	N/A	C	16	B
HLAI	MC-GAIH22	51304748-150	51304748-175	C	16	B
HLAI	MC-GAIH82	51304636-350	N/A	CP	16	B
HLAI	MC-GAIH92	51304748-350	51304748-375	CP	16	B
HLAI/STI	MC-GAIH13	51304718-150	51304718-175	C	16	B
HLAI/STI	MC-GAIH14	51304730-150	51304730-175	C	16	B
HLAI/STI	MC-GAIH84	51304730-350	51304730-375	CP	16	B
Combiner Panel	MC-GLFD02	51304732-150	51304732-175	- -	- -	- -
Marshalling Panel	MC-GMAR52	51304646-150	51309156-175	- -	- -	- -

FTA Type	Model Number	Non-CE Compliant Part Number	CE Compliant Part Number	Terminal Type	Channels	Mounting Size
Power Distribution Assembly	MC-GPRD02	51304644-150	51304644-175	- -	- -	- -

Planning Your Control System Installation

Background

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

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

ATTENTION

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

Enclosures

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

Mounting panels

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

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

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

Chassis mounting and spacing

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

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

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

Remote Termination Panels

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

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

CAUTION

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

Wiring and Cabling

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

Wiring and cabling in a typical enclosure generally consists of:

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

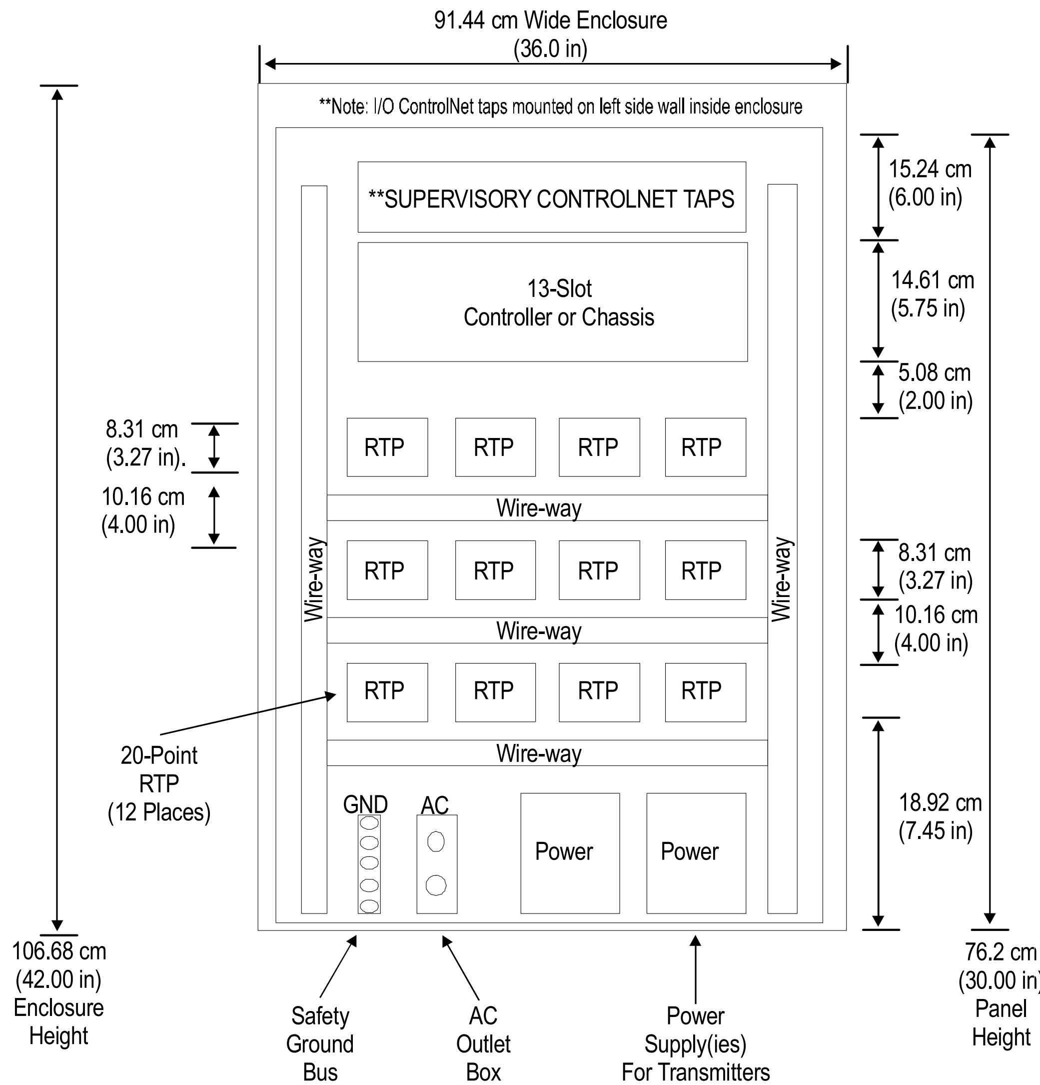
ControlNet network taps

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

Small-scale system enclosure configuration example

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

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

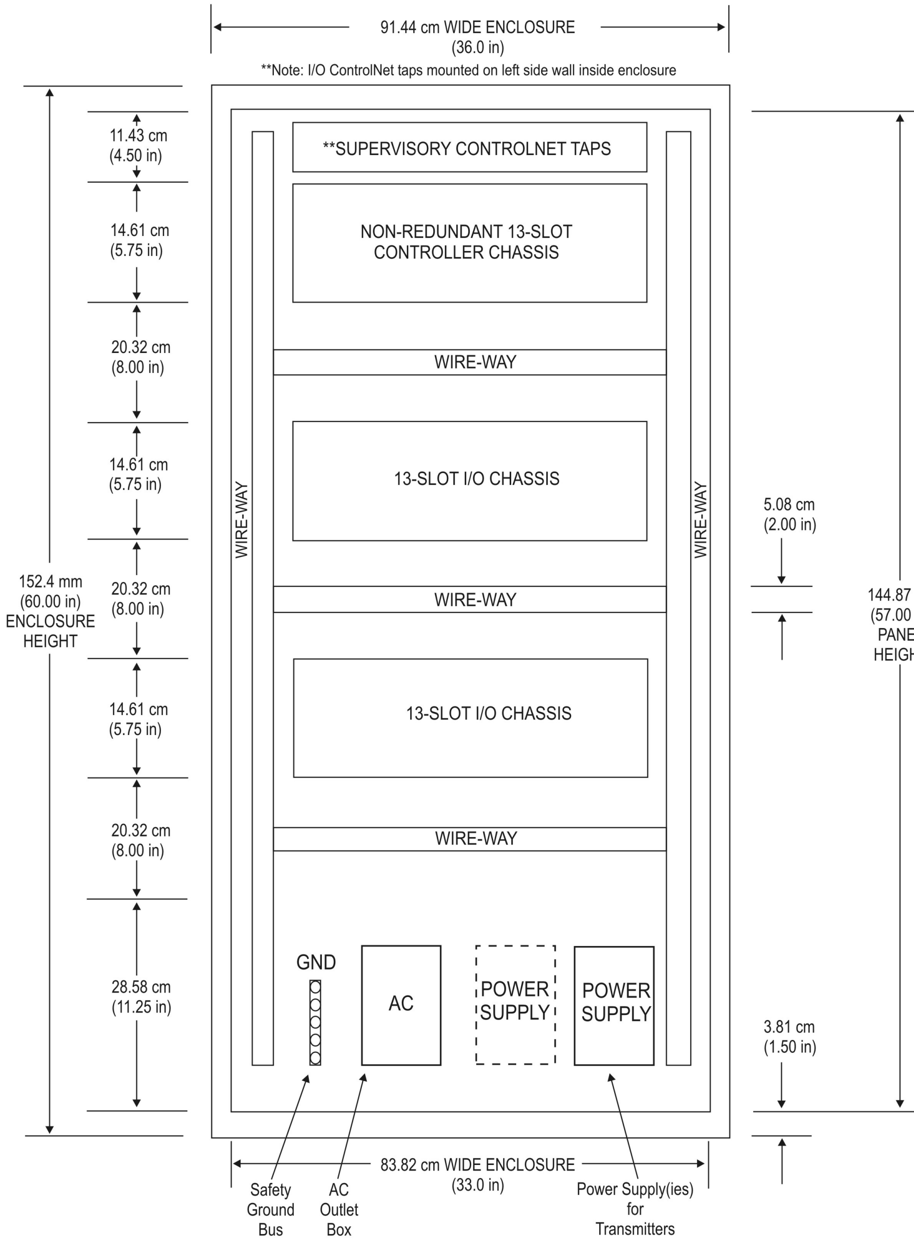


Small-scale system enclosure configuration example

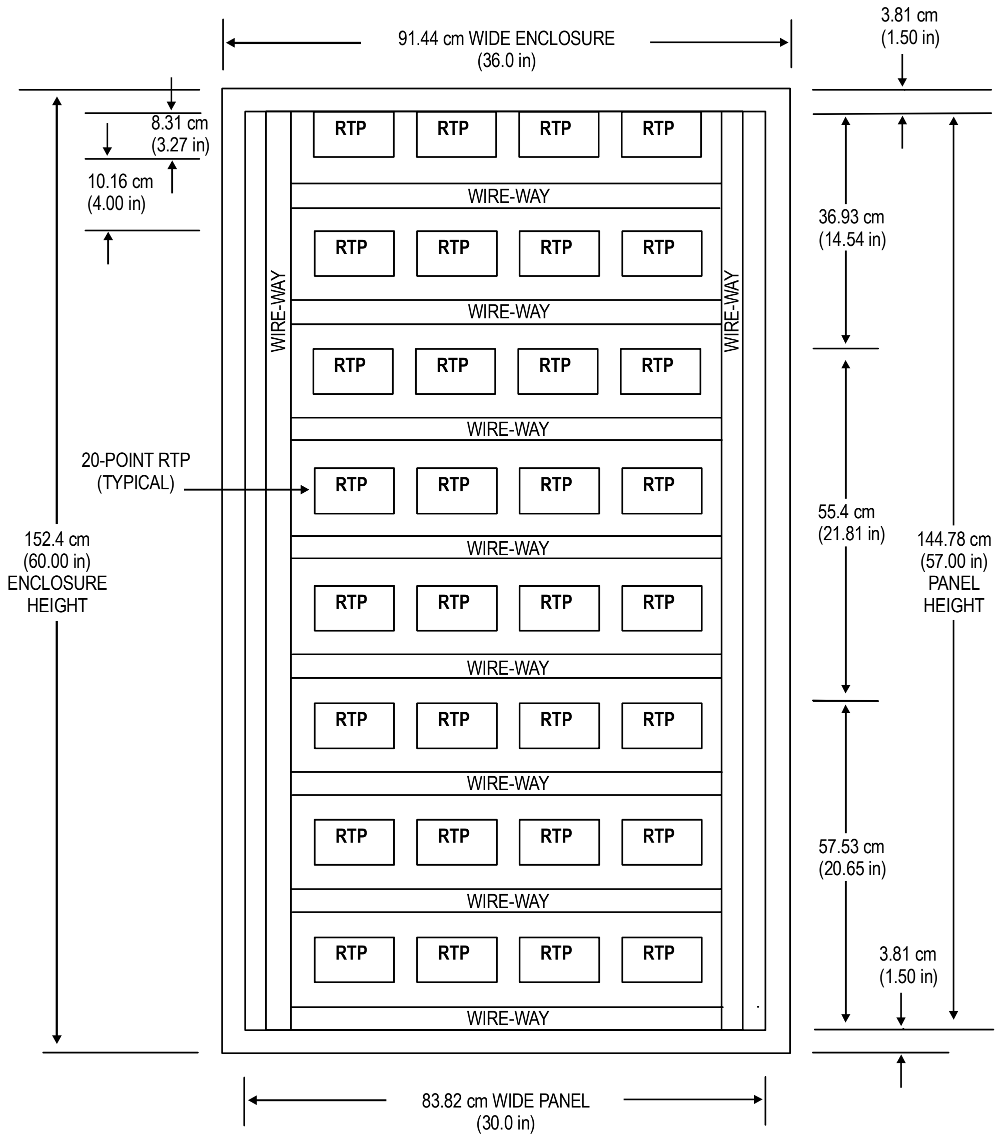
Medium-scale system enclosure configuration example

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

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



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

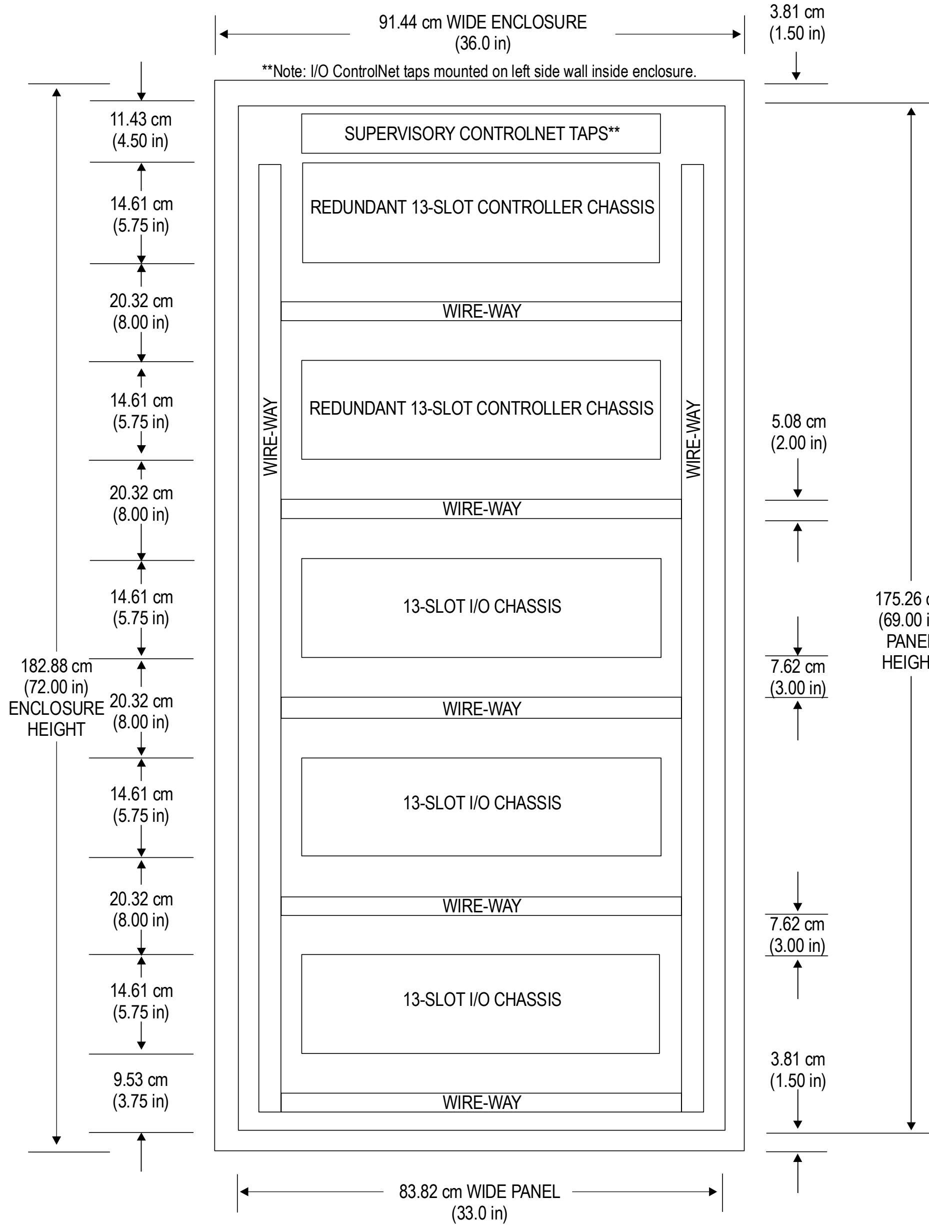


Medium-scale system enclosure configuration example, 2-of-2

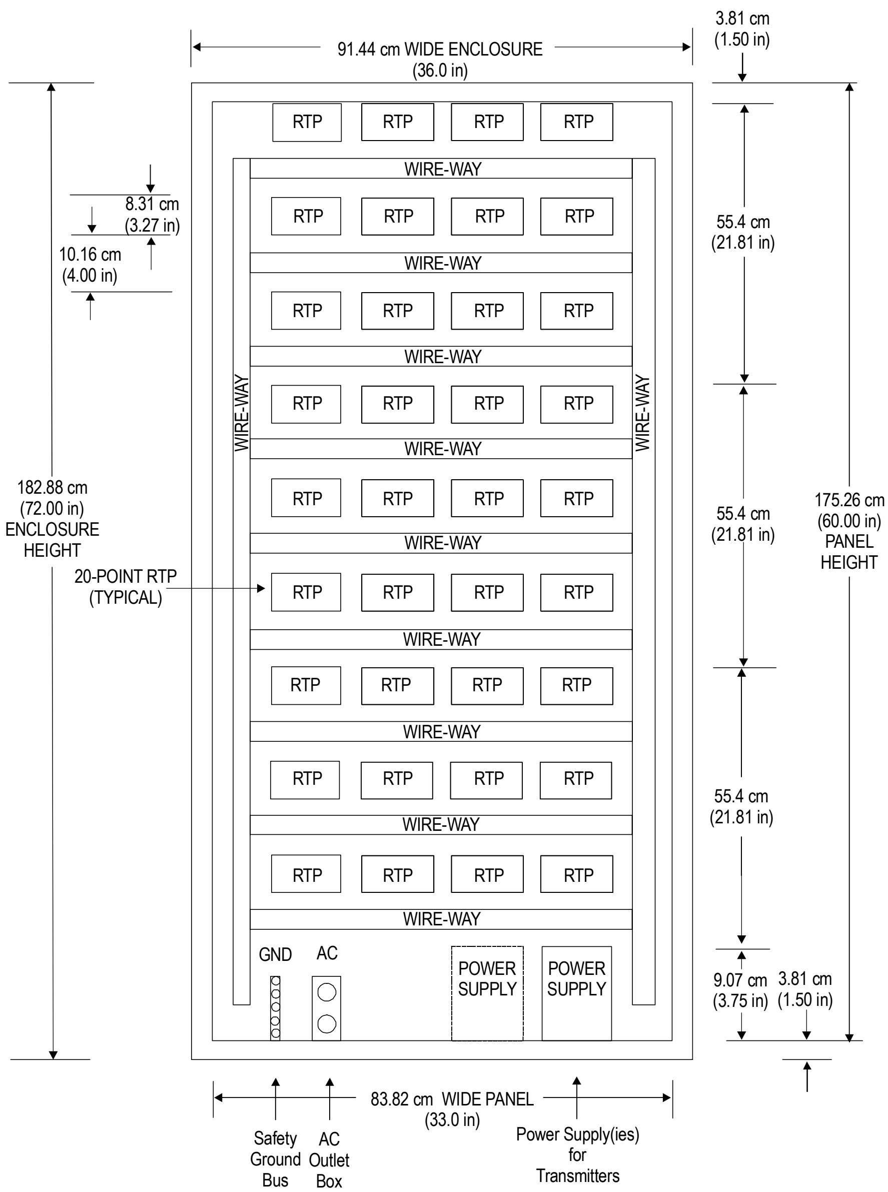
Large-scale system enclosure configuration example

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

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



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

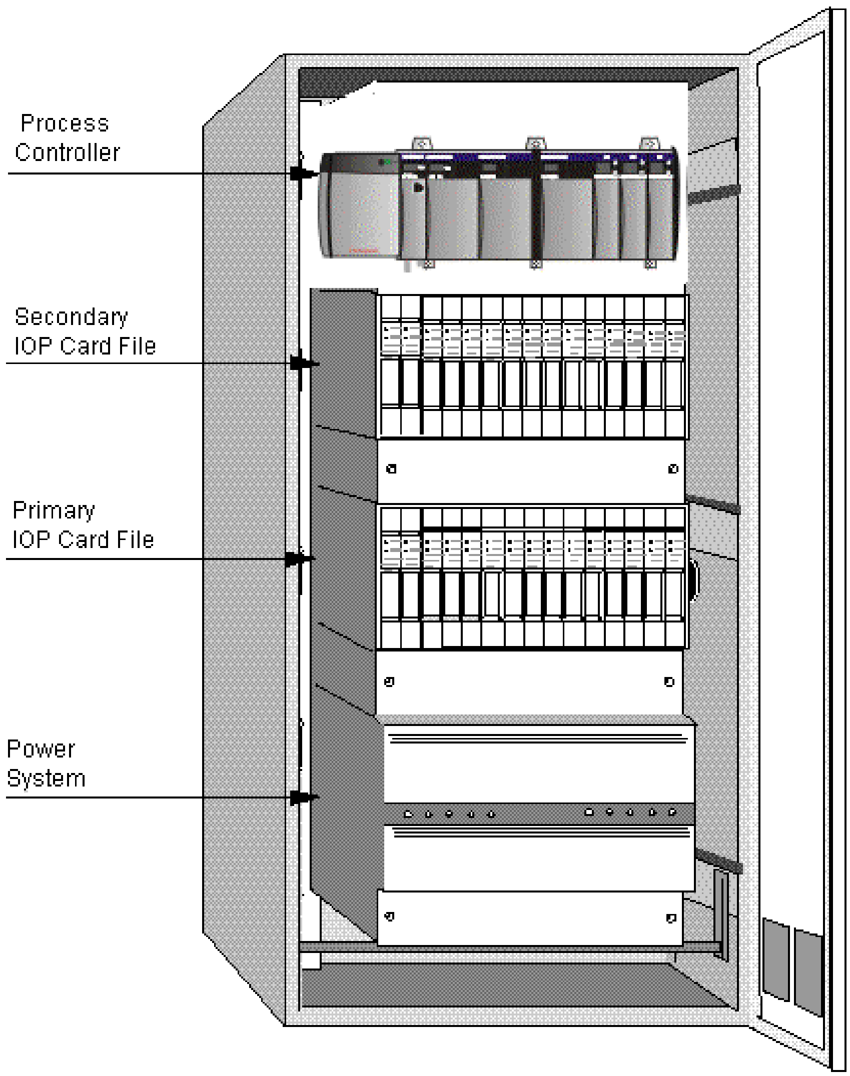


Large-scale system enclosure configuration example, 2-of-2

Single IOP cabinet configuration

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

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

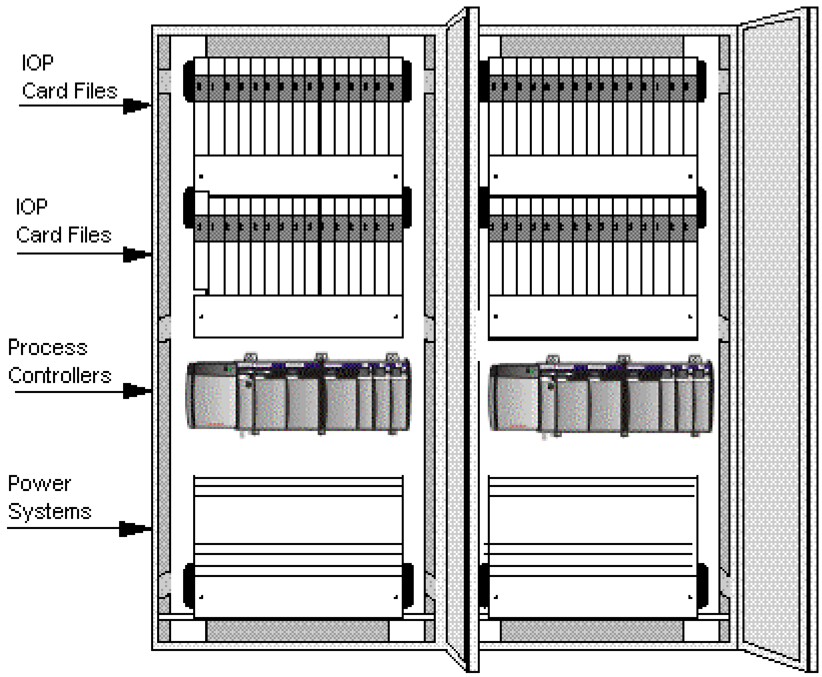

Process
Controller
Secondary
IOP Card File
Primary
IOP Card File
Power
System

ATTENTION

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

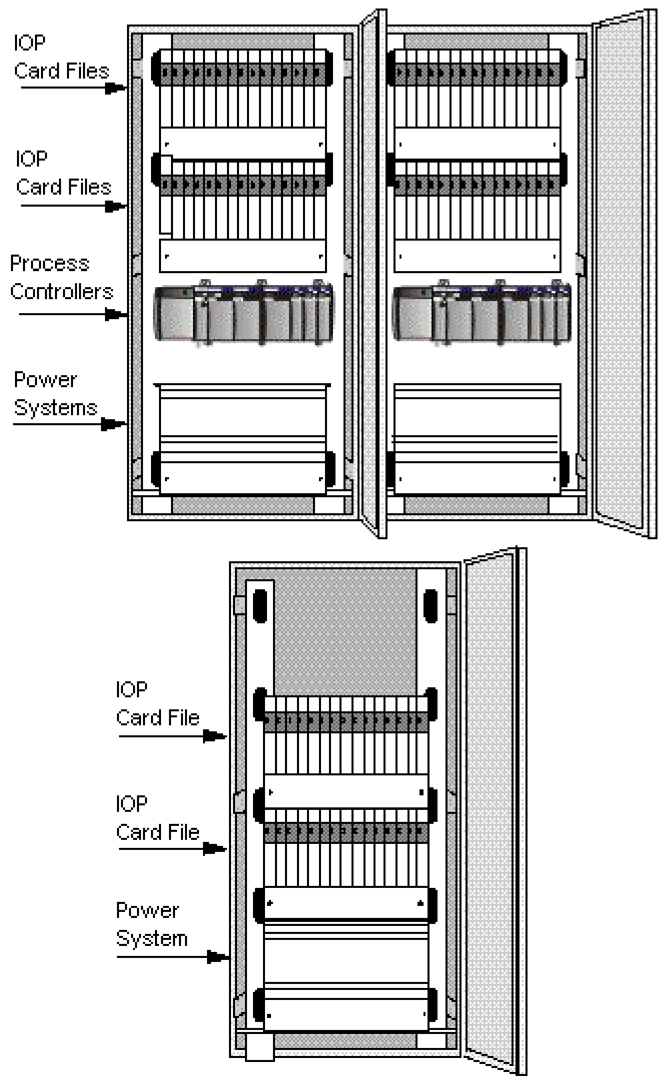
IOP in complexed cabinets with redundant Process Controllers

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



IOP in Complexed and remote cabinets

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



REFERENCE - INTERNAL

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

- Appendix C for cabinet models MU-CBSM01 and MU-CBDM01.
- Appendix D for cabinet models MU-CBSX01 and MU-CBDX01.

ControlNet Configuration

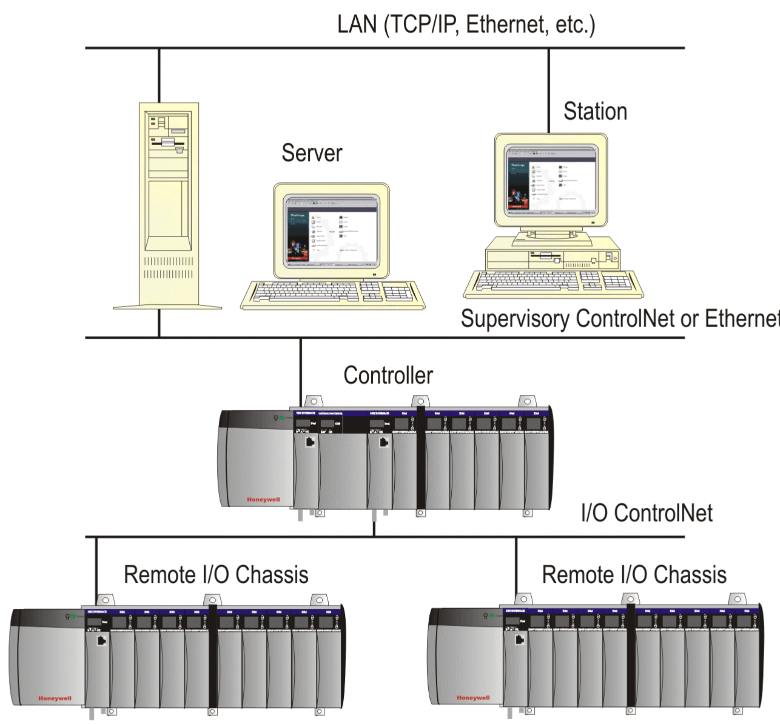
Planning Overview

Background

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

Types of ControlNet networks

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



ControlNet topology

Supervisory ControlNet network

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

ATTENTION

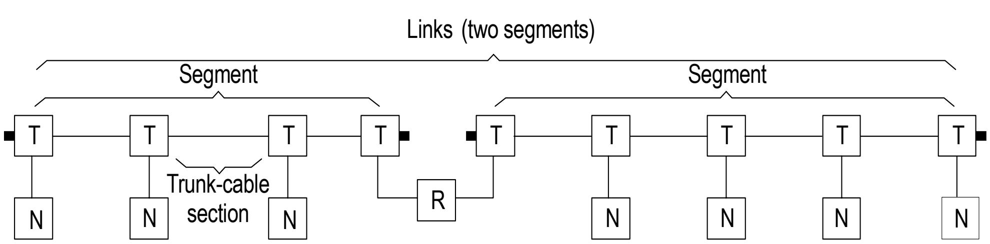
PlantScape clients (operator and engineering stations) connect to the server over an independent Ethernet link and not the Supervisory ControlNet network

I/O ControlNet network

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

High-level ControlNet network overview

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



Network components

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

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

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

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

Quick planning guide

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

Table 3 Quick planning guide

Component	Model #	Guidelines	Quantity
Taps			
• Straight T • Straight Y • Right Angle T • Right Angle Y	• 9904-TPS • 9904-TPYS • 9904-TPR • 9904-TPYR	You need a tap for each connection to the trunk (nodes and repeaters). Each tap kit contains: two BNC connector kits, 1 dust cap, 1 universal mounting bracket and 2 screws.	The number of taps required = the number of repeaters x 2 + number of nodes.

Component	Model #	Guidelines	Quantity
Coaxial Repeaters			
• 85 – 250 Vac 110 – 250 Vdc • 20 – 72 Vdc	• 9904-RPT • 9904-RPTD	You need to use a repeater to: • increase the number of nodes attached. • extend the allowable cable length.	Refer to *Connecting Your Links and Segments*.
Cable Connectors			
• Standard • Bullet • Barrel • Isolated Bulkhead • Right-Angle	• TC-MC1BNC • TC-MC2BNC • TC-MC3BNC • TC-MC5BNC • TC-MC6BNC	Refer to *Planning for Your Cable Connectors*.	As required.
Terminators			
• Tap Dummy Load (TDL)	• 1786-TCAP (includes 5 TDLs)	Terminates a drop cable when the ControlNet node is not connected.	One per unterminated drop cable. (Do not use as Trunk Terminator)
• Trunk Terminator (BNC - 75 ohms)	• TC-TCXBNC (includes 2 terminators)	You need a terminator for each end of each segment.	The number of terminators = the number of segments x 2.
Trunk Cable (reconnectors installed and tested)			
• 1 meter cable • 3 meter cable	• TC-KCCX01 • TC-KCCX03	Refer to *Planning Your Physical Media*.	

Component	Model #	Guidelines	Quantity
• 10 meter cable • 30 meter cable • 50 meter cable • 100 meter cable • 200 meter cable • 500 meter cable	• TC-KCCX10 • TC-KCCX30 • TC-KCCX50 • TC-KCC100 • TC-KCC200 • TC-KCC500		
Tool Kit			
• Coax tool kit	• 9904-CTK	Use the tool kit to modify trunk cable to your specifications	One
Trunk Cable (cable without connectors installed)			
• 275 meter cable	• TC-KCC900	Refer to *Physical Media Planning* Note: TC-KCC900 is raw cable without connectors installed. Use with standard cable connectors TC-MC1BNC.	

ATTENTION

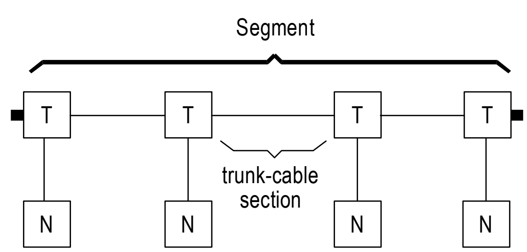
You will need to double your quantities when ordering components for a redundant cable system.

Planning Your Link and Segment Configurations

Background

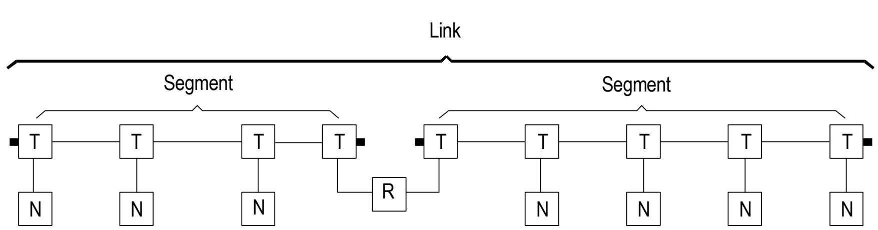
Links and segments are two high-level (yet basic) building blocks of a ControlNet network, each providing a mechanism for distributing your control. Your application and the specifications of each of these network forms will help determine how you will configure your system. When planning your ControlNet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

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



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

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



ATTENTION

Also keep in mind that:

- each node in a link must have a unique address in the range of 1-20.
- The total allowable length of a segment depends upon the number of taps in your segment.
- Repeaters are used to link multiple segments within a single link.

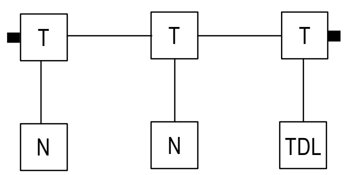
Segment planning considerations

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

WARNING

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

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



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

Link planning considerations

The following are important link planning considerations.

1. A maximum of five coaxial repeaters in series are allowed.
2. A node requires a network address unique to that link and in the range of 1-20 in order to function on the network. A link may contain a maximum of 20 nodes (excluding repeaters).
3. Repeaters require a tap but are not counted as nodes. They are included in the number of devices allowed per segment.
4. Repeaters may be installed at any tap location along a segment.
5. There can only be one path between any two points on a link.
6. The configuration of both sides (A and B) of a redundant link must be the same. ControlNet redundant-cable-compatible hardware should be connected to the A and B networks in the same order and with similar cable lengths.
7. The signal delay along A or B path (including all coaxial and fiber-optic trunk cable and repeaters) between any two nodes in a network must not exceed 120 microseconds
8. The difference in signal delay times along A and B paths (including all coaxial and fiber-optic trunk cables and repeaters) between any two nodes in a redundant-cable ControlNet network must not be greater than 3.2 microseconds, which is about 800 meters of coax cable or about 640 meters of fiber-optic cable, or proportionally between those two values for networks containing both types of cable. [Use 4 microseconds/km for coax and 5 microseconds/km for fiber.]

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

Connecting Your Links and Segments

Background

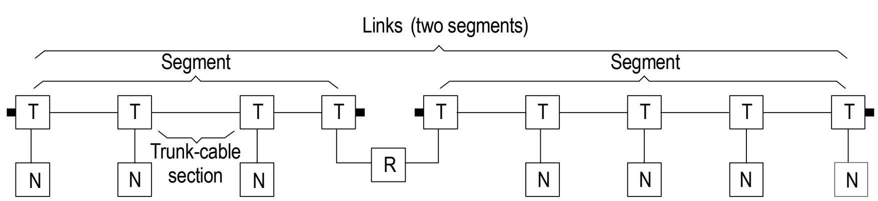
The total number of taps (resulting in additional nodes) and the total length of your ControlNet network can be increased by using repeaters. The entire pathway of contiguous segments and links, through repeaters and bridges, constitutes a single ControlNet network (as illustrated in the following figure).

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

ATTENTION

The maximum number of addressable nodes per link (not counting repeaters) is 20.

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



ControlNet network and the application of repeaters and bridges

Coaxial Repeater options

Table 4 lists your repeater options based on input power.

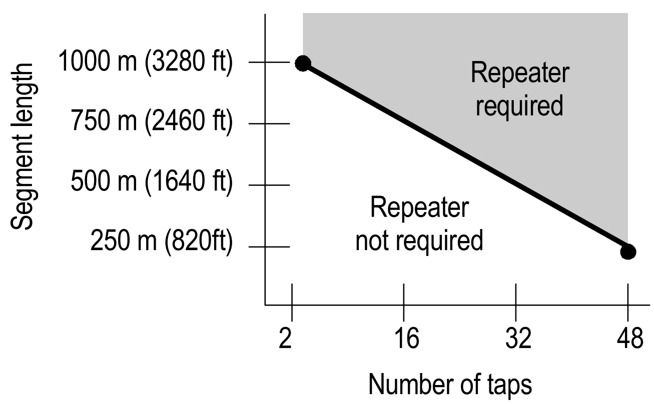
Table 4 Available repeaters

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

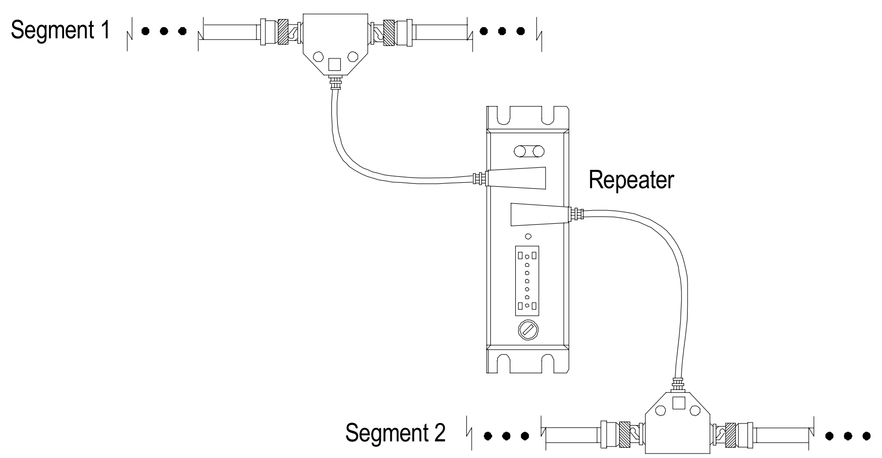
Determining if you need repeaters

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

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



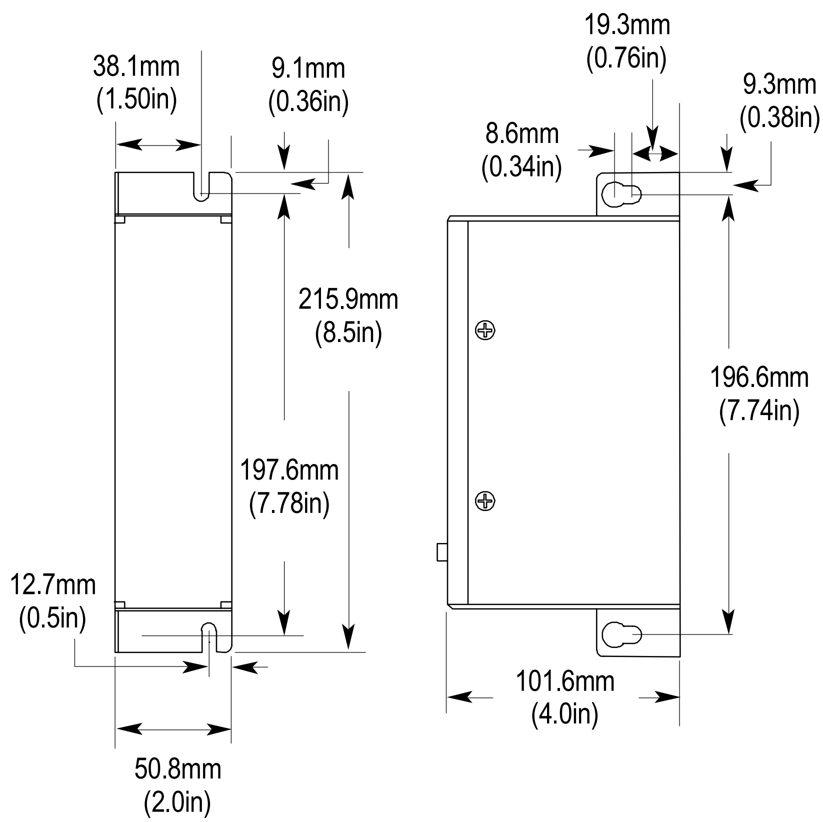
Determining the number of repeaters



Repeater connecting two segments

Mounting dimensions

The following figure illustrates a repeater and its mounting dimensions.



Configuring your link with repeaters

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

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

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

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

Table 5 Maximum number of repeaters per link

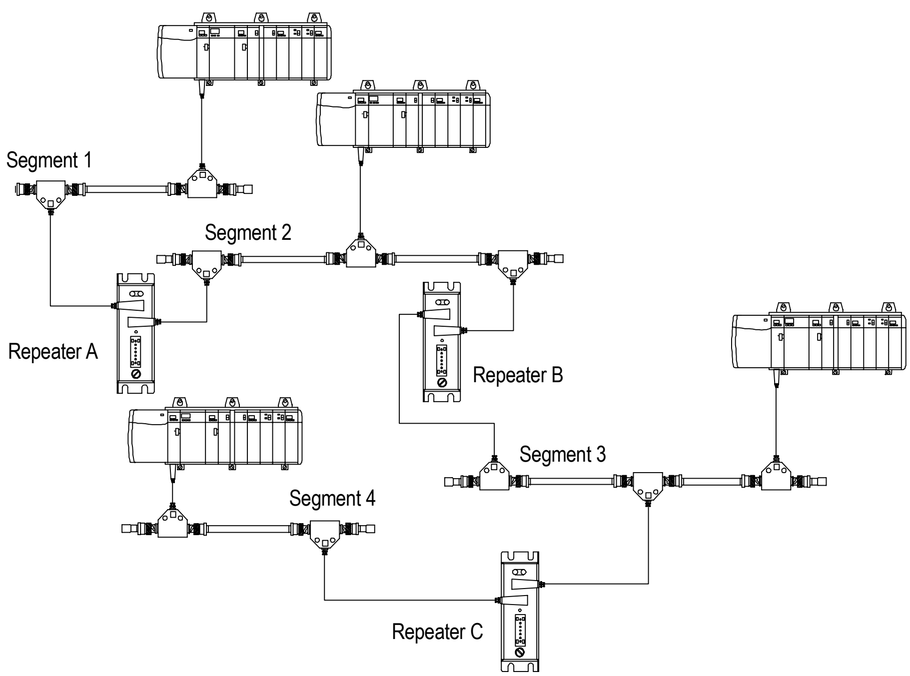
Configuration:	Maximum number of repeaters:
Series	5
Parallel	48
Series/Parallel Combination	5 in Series, and 48 in Parallel

Repeaters in series

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

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

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



Repeaters installed in series

Repeaters in parallel

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

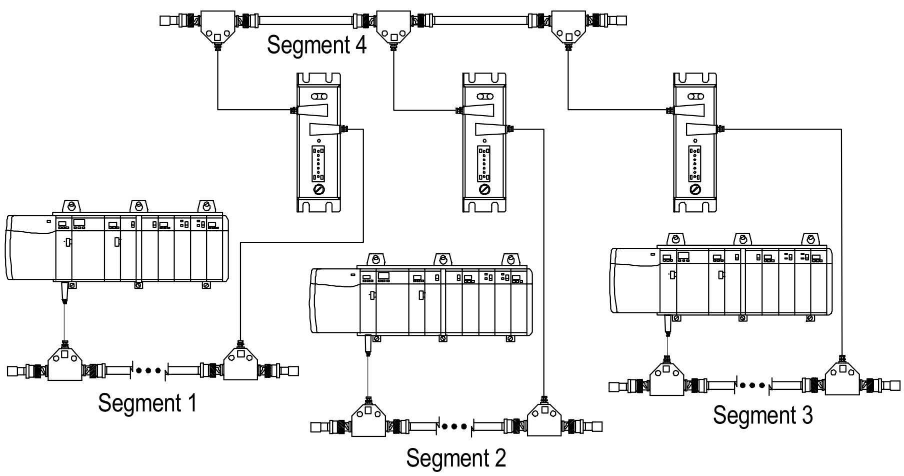
If your link is configured using repeaters in parallel, you count one of the repeater taps for one segment and the other repeater tap for the parallel segment that the repeater is connecting to the backbone network.

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

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

ATTENTION

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



Repeaters installed in parallel

Repeaters in a combination of series and parallel

CAUTION

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

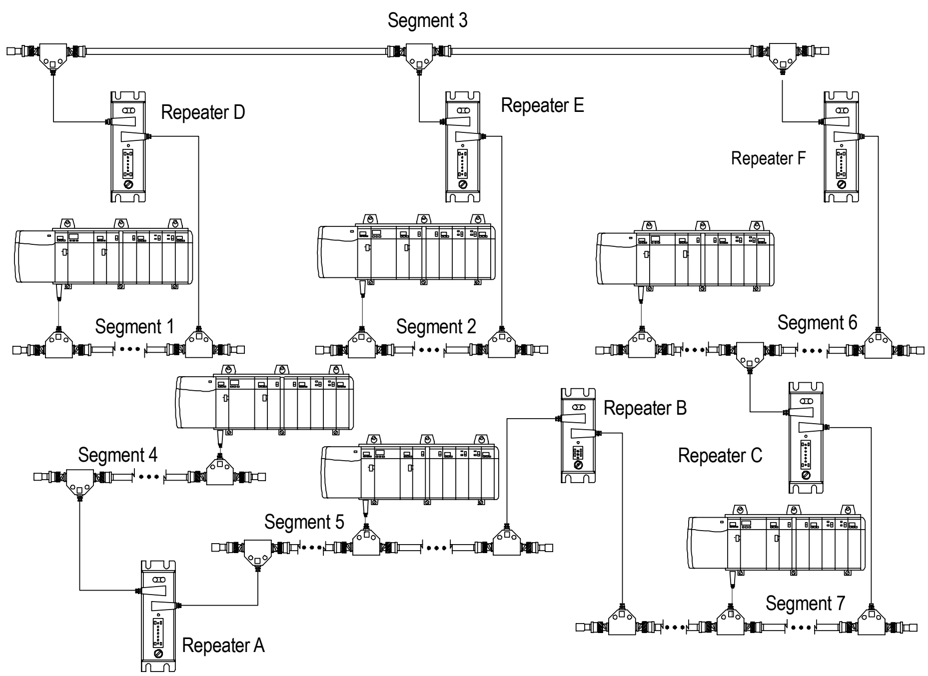
You can install repeaters in a combination of series and parallel connections, following the guidelines listed for each to form a link. For mixed topologies (series and parallel), the maximum number of repeaters between any two nodes is five.

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

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

- segment 3 can contain up to 29 nodes, since it already contains 3 taps.
- segments 1, 2, and 4 can contain up to 31 nodes each, since they already contain one tap for a repeater.

- segments 5, 6, and 7 can contain up to 30 nodes, since they already contain 2 taps for repeaters.
- the maximum number of nodes that can be connected to this link is 48 (not including repeaters).
- there are 5 repeaters in series. This is the maximum number allowed (repeaters A, B, C, F, and D or A, B, C, F, and E).



Repeaters installed in a series/parallel combination

Planning Your Physical Media

Trunk cable

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

Determining what type of cable you need

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

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

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

Table 6 Determining the type of cable you need

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

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

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

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

General Wiring Guidelines

Follow these guidelines for routing any ControlNet coaxial cable:

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

Wiring External to Enclosures

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

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

Wiring Inside Enclosures

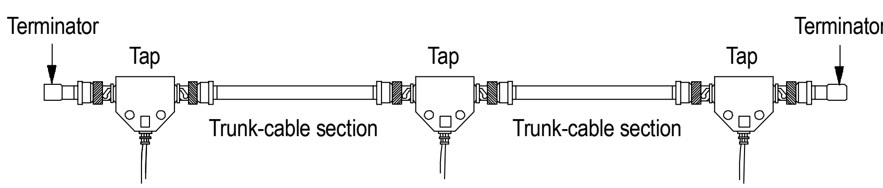
Cable sections that run inside protective equipment enclosures are relatively short. As with wiring external to enclosures, you should maintain maximum separation between your ControlNet cable and Category-1 conductors.

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

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

Trunk sections

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



ControlNet trunk sections

Determining trunk section lengths

ATTENTION

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

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

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

Example

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

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

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

Maintaining PlantScape ControlNet Cabling

WARNING

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

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

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

Faulty CNI modules.

Faulty backplanes or module backplane interfaces.

Excessive electromagnetic interference.

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

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

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

TIP

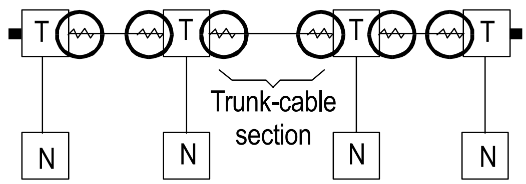
There are currently no tools associated with this PlantScape release that will pinpoint a faulty cabling component. Therefore, recovery from a ControlNet fault involves the organized replacement of cabling components until the problem disappears.

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

Planning for Your Cable Connectors

Background

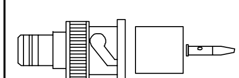
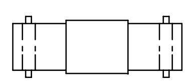
A cable connector (TC-MC1BNC) attaches coax trunk-cable sections to the tap's BNC connector, as illustrated in the following figure.

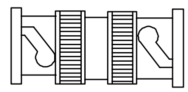
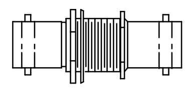
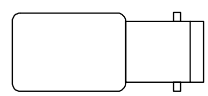
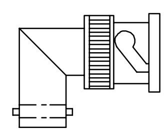


Connector types

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

Table 7 Connector types and their application

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

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

Example of connector type applications

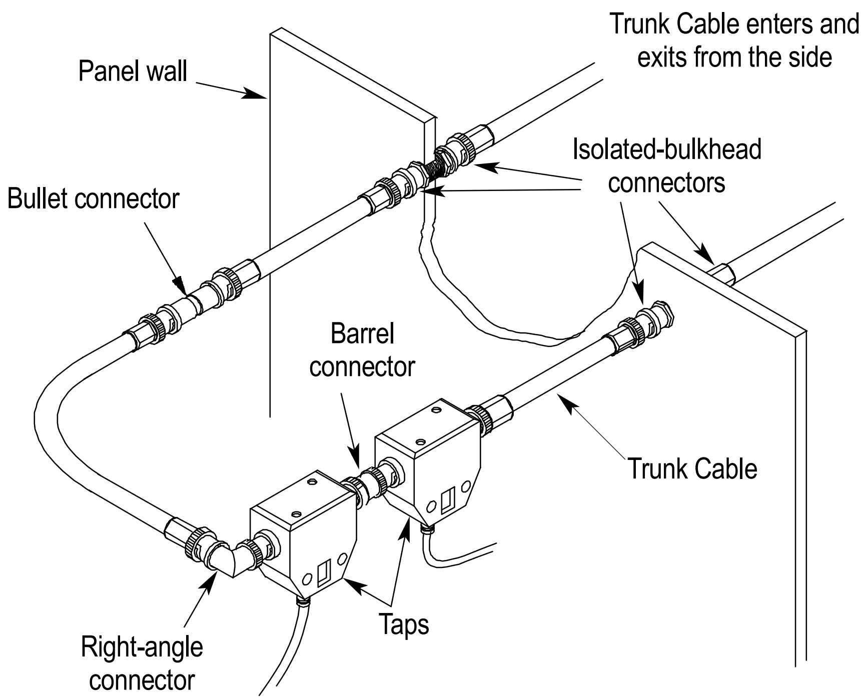
CAUTION

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

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

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

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



Connector application examples

ATTENTION

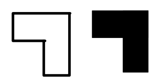
If you are installing a bullet connector for future tap installations, count the bullet as one of the tap allotments on your segment (and decrease the maximum allowable cable length by 16.3 m). This helps you to avoid reconfiguring your network when you install the tap.

Using redundant media (optional)

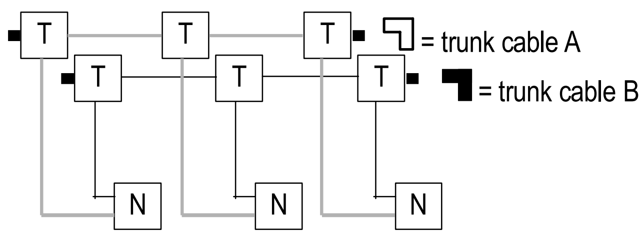
You can run a second trunk cable between your ControlNet nodes for redundant media. With redundant media, nodes send signals on two separate segments. The receiving node compares the quality of the two signals and accepts the better signal to permit use of the best signal. This also provides a backup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

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

Actual ControlNet products are labeled with these icons.



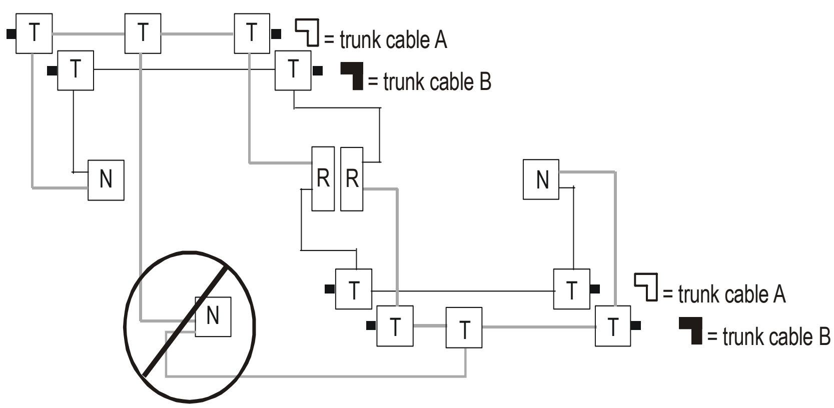
In the following figure, trunk cable B is redundant.



Observe these guidelines when planning a redundant media system.

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

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



ATTENTION

Do not mix redundant and non-redundant nodes.

Planning for Your Taps

CAUTION

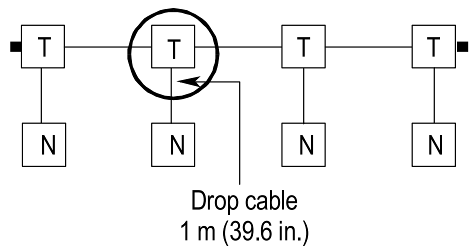
The following cautionary reminders should be observed regarding cable taps.

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

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

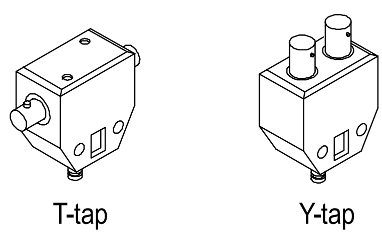
Background

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

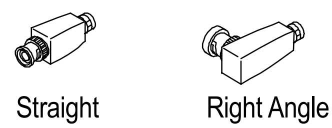


There are four physical versions of taps available with:

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



T and Y taps



Straight and right angle connectors

Determining how many taps you need

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

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

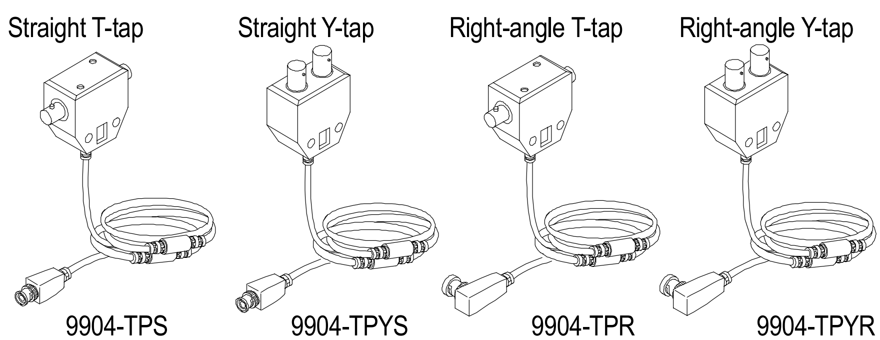
The following table identifies how many taps are allowed on a segment.

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

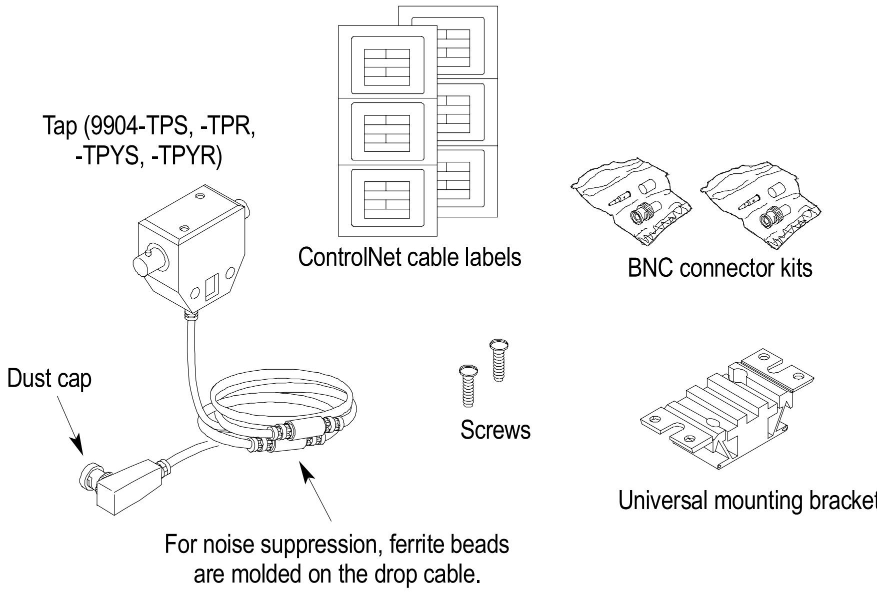
Tap kits

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

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



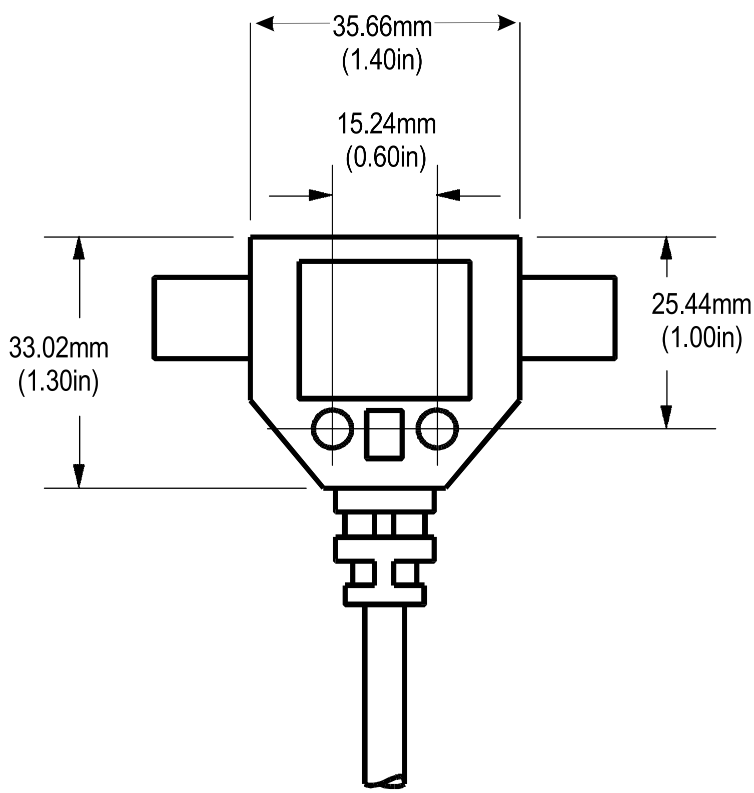
Available tap kits



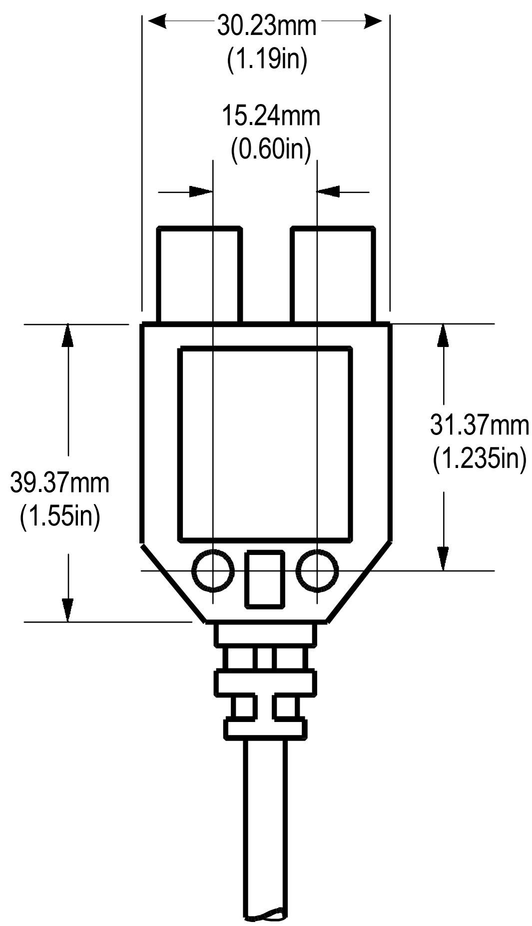
Tap kit contents

Mounting dimensions

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



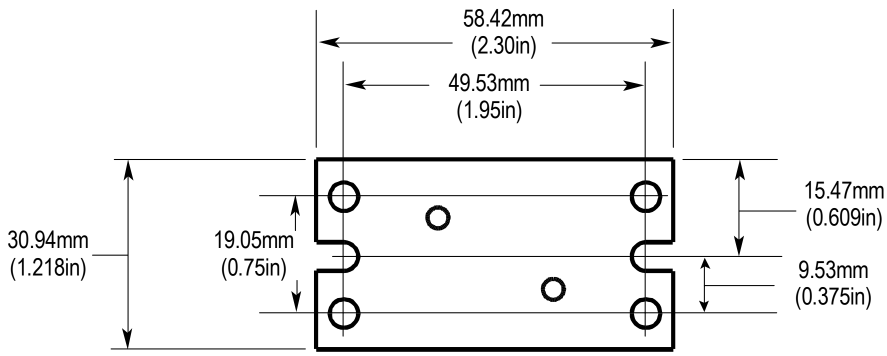
T-tap mounting dimensions



Y-tap mounting dimensions

Universal mounting bracket

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

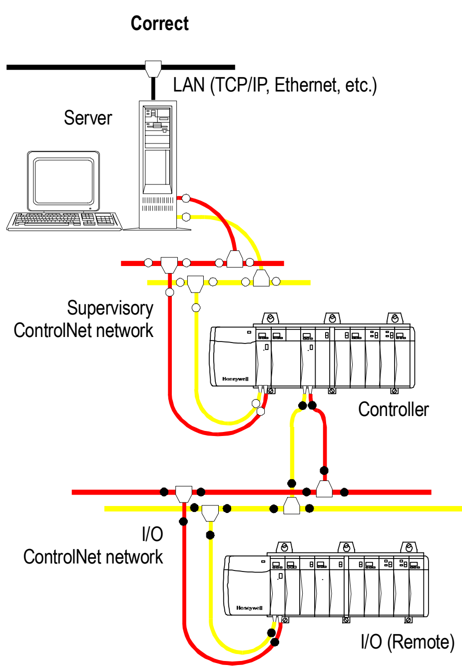


Planning for drop-cable identification

WARNING

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

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



ControlNet drop-link intermixing example

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

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

In this sample identification convention,

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

TIP

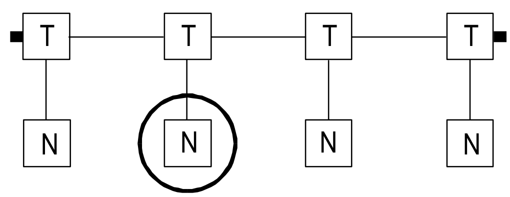
This marking code using one or two red/yellow marks should be extended to module connections, taps, and trunk cables.

Planning Your Nodes

Background

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

- PlantScape servers through the PCIC card (TC-PCIC01), and
- Controller and I/O chassis through ControlNet Interface (CNI) modules (TC-CCN013 and TC-CCR013).



Communications Integrity

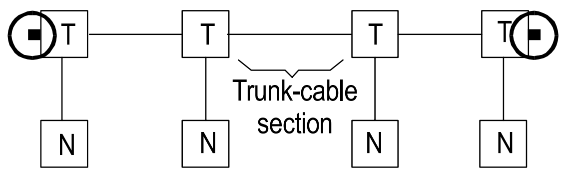
Once a node is configured, PlantScape will attempt to communicate with it. Once communication is established, the network will reach a level of stability. Should a node be physically disconnected from the network after configuration or should a node be configured and never be physically connected to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

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

Planning for Terminators

Background

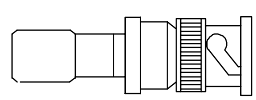
A 75-ohm terminator (TC-TCXBNC) must be installed on the tap at each end of a segment, as illustrated in the following figure.



Determining how many terminators you need

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

You will need two trunk terminators for each cable "A" segment and two for each cable "B" segment.



75 Ohm terminator

Planning Your ControlNet Addressing

Background

Each node on a given Supervisory or I/O ControlNet network must have a unique ControlNet address in the valid range of 1 to 24, established by setting switches in the node hardware according to the guidelines below.

TIP

Each ControlNet Network must have a ControlNet Interface Card configured with a MAC ID of 1 (assigned as the ControlNet moderator) for the ControlNet default override setting to be utilized for the network. It is recommended that for each I/O ControlNet network, the CNI card in the controller chassis that connects to the I/O ControlNet to be assigned as MAC ID = 1. Failure to configure at least one CNI card on a ControlNet network to a MAC ID of 1 may cause erratic connections to remote I/O.

Non-redundant controller addressing

When setting up Supervisory or I/O ControlNet networks in a non-redundant controller configuration, it is recommended that you allocate two consecutive addresses for the controller (i.e., 1 and 2). The lower, or odd number of these two addresses is set on the non-redundant controller's CNI module.

By reserving the next higher address, you will minimize the effort required to upgrade to a redundant controller configuration in the future.

ATTENTION

The MAC Address 1 must appear on each ControlNet Network (Supervisory and I/O) as shown in the following examples.

Redundant controller addressing

When setting up Supervisory or I/O ControlNet in a redundant controller configuration, you must allocate two consecutive addresses for the controller chassis pair.

Redundant controllers connected to the same physical ControlNet must have their address switches set to the same address. Although both partners have the same switch settings, software assigns the primary controller the address from the switches, then assigns the secondary controller the next highest address (the switch setting plus one). This is why you must skip every other address when setting CNI addresses in a controller with multiple CNI cards.

Supervisory ControlNet addressing

On the Supervisory network, each PlantScape server and controller must have a valid ControlNet address. The valid address range is 1 to 24. Following are the recommended settings and guidelines:

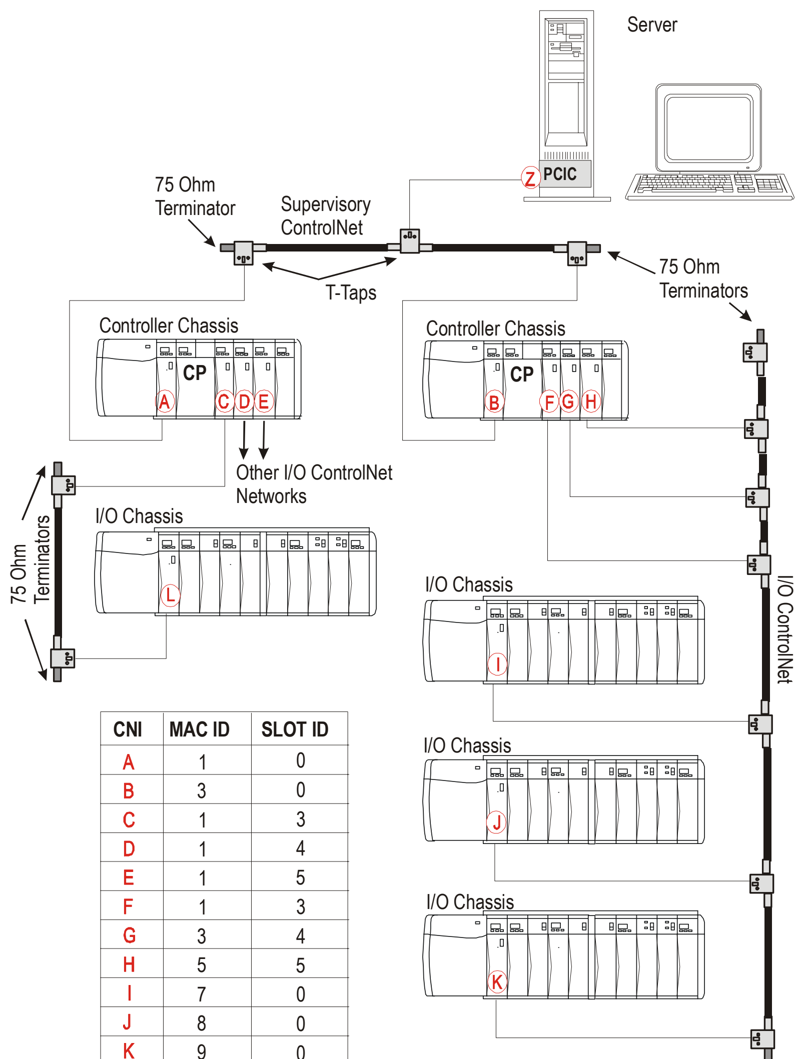
PlantScape Server(s)

- Redundant servers: set the ControlNet address to 23 and 24.
- Non-redundant servers: set the ControlNet address to 23, but reserve address 24 for a possible future upgrade to redundant servers.

Controller Chassis

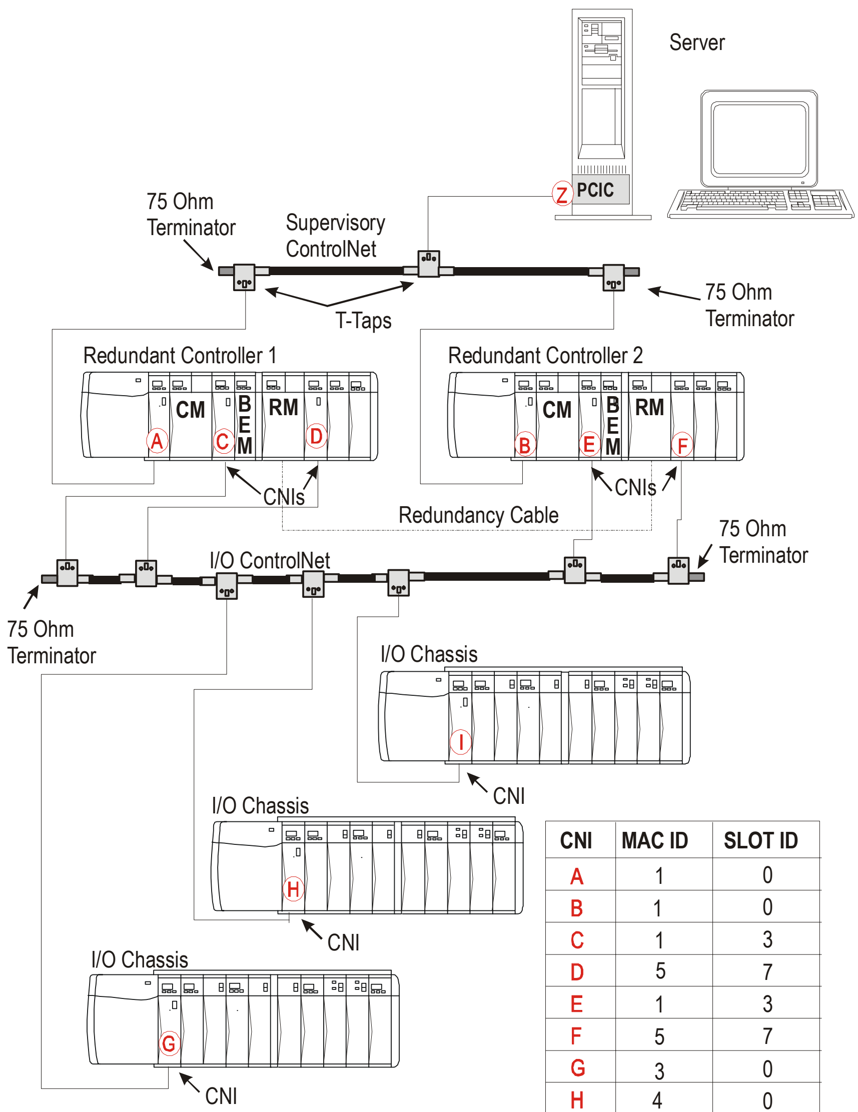
- Set only odd addresses (starting at 1), reserving next higher even-numbered address for use with possible future redundant partner.
- There must be one CNI with an address of 1 within every ControlNet segment, including the I/O ControlNet segments. The CNI node with the MAC ID of 1 controls the NUT timing for the CNIT segment it is in.
- When you assign an address of 1 to an operating CNI in an RCP, do not assign the next higher used address above 2 (in the same physical network) to another CNI in that RCP. Never assign addresses 3 and 4 to CNI in the RCP. Assign addresses 3 and 4 to the CNIs in the first I/O chassis. Failure to follow this addressing scheme can result in lost outputs upon an RCP switchover. You must assign the next higher used address above 2 to a CNI in another Controller chassis, a CNI in a remote I/O chassis, or the PCIC card in the Server in the same physical network. The down link CNI are also Sequential in the example but as the Rule indicates they should be.
- Set both partners of a redundant-controller pair to the same odd address. The system software will assign the next higher, even-numbered address to one of the partners, making an address pair (e.g., you assign 1, the system assigns 2). In the redundant example below, both controller CNI boards are set to a MAC address of 1.
- Skipping even-numbered addresses and using odd-numbered addresses for a series of non-redundant controller chassis allows for easier future addition of redundant partners, with a logical assignment of odd/even address pairs for RCP applications.
- Within the controller chassis, both the Supervisory and I/O CNI addresses can be set to any address, as long as the redundant-partner controller (when present) is set to the same address. This is illustrated in the redundant example where the Supervisory CNI addresses are set to 1 and the I/O CNI addresses are set to 1 and 5 in both controllers. Note how this configuration also satisfies the requirement that each ControlNet network has a CNI addressed to 1 and partners in a redundant system have the same address.

Network Example 1: Two Non-Redundant Controllers (each with remote I/O chassis)



CNI	MAC ID	SLOT ID
A	1	0
B	3	0
C	1	3
D	1	4
E	1	5
F	1	3
G	3	4
H	5	5
I	7	0
J	8	0
K	9	0
L	3	0
Z	23	N/A

Network Example 2: Redundant Controllers with One I/O ControlNet



CNI	MAC ID	SLOT ID
A	1	0
B	1	0
C	1	3
D	5	7
E	1	3
F	5	7
G	3	0
H	4	0
I	7	0
Z	23	N/A

I/O ControlNet addressing

On each physically separate I/O ControlNet network, each PlantScape controller and I/O chassis CNI must have a ControlNet address in the range 1-24. The following is a list of recommended settings and guidelines applicable to each physically separate I/O ControlNet network:

Controller Chassis

- Set the first CNI that connects to a separate physical I/O ControlNet to 1 (Example 1 - Left System). For each additional CNI attached to the same physical I/O ControlNet, use the next odd address (Example 1 - Right System).

I/O Chassis

- Set the first I/O chassis address, starting with the first unused odd address on this I/O ControlNet, and progress sequentially (3, 4, 5, etc.) for each additional I/O chassis connected to the same physical I/O ControlNet.
- Do not skip any addresses (leaving address “gaps”), since ControlNet communications performance is optimized by the absence of gaps between the lowest and highest addresses. I/O chassis are not redundant and do not require address pairs, therefore both odd and even addresses are to be utilized.
- I/O chassis addresses can be set to any unique (mutually exclusive) addresses in the range 1-24, but it is recommended that lower addresses starting at 1 be used.

ATTENTION

The MAC Address 1 must appear on each ControlNet Network (Supervisory and I/O) as shown in the examples provided.

MAC address guidelines summary

The following table summarizes MAC address configuration guidelines for quick reference.

If MAC ID is . . .	Then, this guideline applies . . .
1 (ControlNet Keeper)	• Must be configured on every physical I/O ControlNet segment. • 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.
2	• Must not be assigned to any Node when using Redundant Controller. (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.) • Should be reserved when using non-redundant Controller for future Redundant upgrade.
3	• Must not be assigned to a Downlink CNI in a Controller chassis or Redundant Chassis Pair. • Must be assigned to a Remote I/O chassis CNI or Remote Series A or H Rail Gateway Module or FF Linking Device, in conjunction with each MAC ID number 1 assignment.
4	Should be used by or reserved for additional Remote I/O chassis CNI or Series A or H Rail Gateway or Linking Device.
5 and up	Should be used consecutively from low to high values with the following guidelines: • 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. • After Downlink CNIs are assigned, remaining addresses may be used for additional Remote I/O chassis CNIs or Rail Gateways or Linking Devices.

Network Strategy

ATTENTION

Multiple CNI may be required to support I/O module requirements. Each CNI can handle a limited number of I/O modules. See the system specifications for the maximum allowed I/O modules connected to a single CNI.

The previous section, *Network Example 1: Two Non-Redundant Controllers (each with remote I/O chassis)*, shows a non-redundant system. The system on the left in the example uses a unique I/O ControlNet network for each I/O CNI, and the system on the right uses one ControlNet network for all I/O CNIs. The MAC addressing scheme is different depending on the strategy used.

The single network strategy might be used where all of the I/O chassis are close to each other. The multi-network strategy would be used where the I/O chassis are separated by large distances where using a single network would exceed the maximum allowable distance for a network. The network strategies may be mixed within a single system.

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.

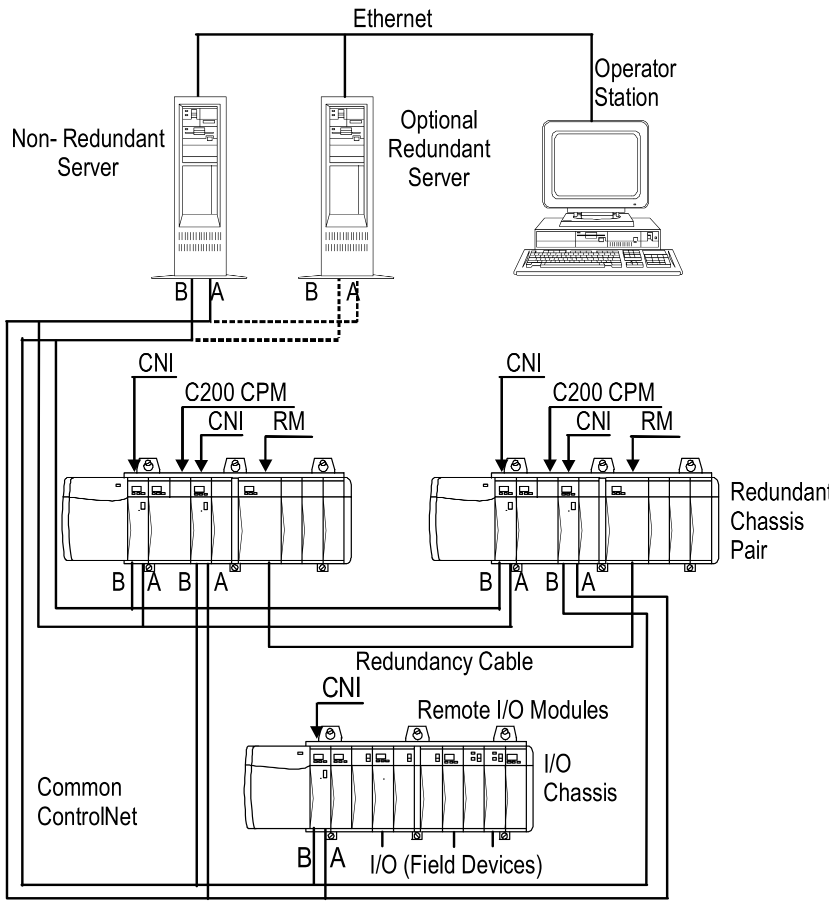
A method to avoid a single ControlNet node from going lonely during RCP switchover is to add another CNI module, or another Series A/H Rail Gateway module, or another Foundation Fieldbus Linking Device to the same ControlNet segment. This additional ControlNet device is commonly known as a "Buddy Node".

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.

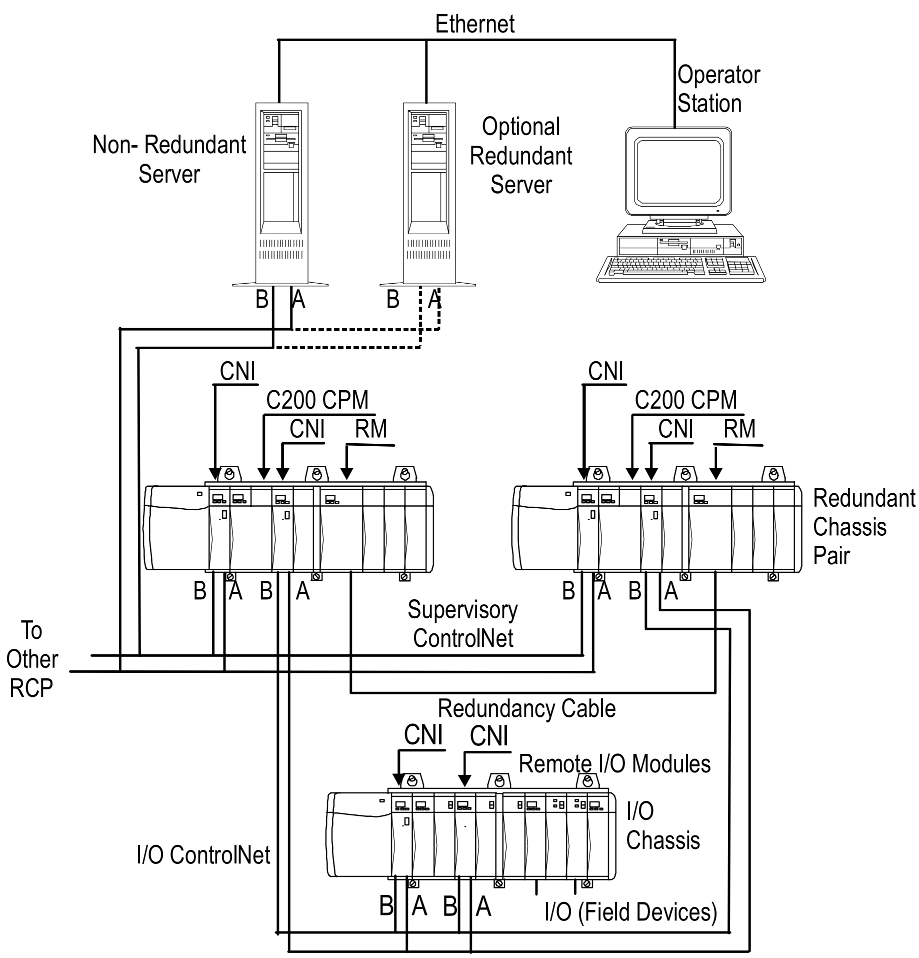
- If your system only consists of a non-redundant Server or redundant Servers, one RCP, and one I/O chassis, you must link the Supervisory ControlNet with the I/O ControlNet though a trunk cable to form a common ControlNet as shown in the figure below. In this case, the default addresses are as follows.
  - 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.)



Site Selection and Planning

Planning for General Considerations

Site selection is an important factor in planning and preparing for the installation of a PlantScape system. Issues that need to be addressed during the site planning are described below.

Location

Location of the system is flexible, given the interconnection of different modules on the ControlNet communications network. Your Manufacturing Engineer is best suited to determine requirements such as cable length, routing, and shielding for these interconnections. Other guidelines include:

- Locate your equipment to obtain the best operating efficiency. Consider such things as proper lighting, noise, and proximity to related work areas.
- Consider accessibility of the site for delivery of equipment and supplies; and allow for access to service the equipment.
- Determine the need (if any) for remote termination panels.

Interim development location

Consider installing the PlantScape equipment in a quiet office environment **(**during the development phase of the installation) before implementing it on the factory floor, where it will have an impact on actual operations.

Facilities

The use of pre-existing facilities speeds installation, reducing costs. Whether the facility is existing or new, however, it must comply with the specifications (e.g., safety, environmental, electrical, and other) described in this manual. Electrical power, grounding, air conditioning, and data communication requirements must all be addressed as part of the site preparation.

Insurance and zoning

Insurance costs may be affected by the type of building construction used and the location of system equipment (in relation to fire hazards and fire-fighting facilities). Zoning regulations may also affect installation plans and future expansion.

Planning for Environmental Considerations

In planning for the environmental conditions for electronic equipment, the following factors should be considered.

Corrosion and dust

Consider both major (usually from process sources) and minor pollutants (often from nonprocess sources). Conformally coated assemblies are recommended for use in areas where corrosive vapors are present.

Fire prevention

Consult with the local fire-prevention authority to select fire extinguishers deemed suitable for electrical fires.

Lightning protection

A Lightning ground system safely dissipates lightning energy, protecting personnel, control system equipment, and the building. The ground system must conform to applicable codes and design construction criteria.

A good earth ground system minimizes the need for individual channel protection. However, if your facility is located in an area that has a history of severe lightning storms or if you have had a problem with lightning induced surges in the past with other instrumentation, you are probably aware of available surge protection devices. Properly sized surge protection devices incorporating solid state voltage limiters should be installed on power lines and all input/output wires associated with the system. You are responsible for evaluating your particular needs based on equipment location and the probability of a direct strike in the immediate area.

Temperature and humidity

The ambient temperature limits are specified in the PlantScape specifications. Relative humidity must be addressed, both in terms of magnitude and rate of change.

The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links.

Ventilation and filtration

An air distribution system is recommended when atmospheric contaminants (from process fumes, road dust, or cooking fumes) are present. To protect the electronics from various fumes and contaminants, arrange an air flow moving towards the source and away from the electronics.

All air flow should be routed through a mechanical (non-electronic) dust filter. The mechanical filter should have a rating of not less than 20% after performing the Bureau of Standards discoloration test. The filter must meet all local fire codes.

Vibration

Flooring, desk tops, and shelves/mounting chassis must be stable and capable of supporting control system hardware in accordance with acceptable vibration levels (as specified in the PlantScape specifications.

The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links.

ATTENTION

Consult your Honeywell Account Manager if any characteristics of your site do not meet the requirements specified in this or any other referenced manuals.

Planning for Installation in Hazardous (Classified) Locations

The PlantScape system is CSA Certified and FM Approved Nonincendive Equipment for installation in Class 1, Division 2, Group A, B, C & D Hazardous (Classified) Locations. It is the user's responsibility to insure that all parts of the PlantScape system, and any other equipment in the Division 2 area, are listed for installation in a Class 1, Division 2 Hazardous (Classified) Location.

Many of the PlantScape system's modules (e.g. I/O, Communications) have been designed to permit removal and insertion under power (RIUP) without damaging the module or interrupting backplane communications. However, the possibility of arching or sparking is present anytime electrical connections are made or broken. For this reason, removal and insertion must not be performed in hazardous locations when the modules are under power.

WARNING

PlantScape's removal and insertion under power (RIUP) feature does not apply to installations that must conform to Division 2, Hazardous Location requirements. Unless the location is known to be non-hazardous **do not**:

- connect or disconnect cables
- connect or disconnect Removable Terminal Blocks (RTBs)
- install or remove modules

REFERENCE

For information relating to RIUP and hazardous environments, refer to:

- Processor Module Insertion/Removal Under Power
- Connecting and Disconnecting Removable Terminal Blocks
- Connecting and Disconnecting ControlNet Cables and Taps

North American Hazardous (Classified) Locations

Installation of electrical equipment within hazardous (classfied) locations in the United States is in accordance with provisions of the National Electrical Code (NEC), ANSI/NFPA 70, Article 500, and within Canada in accordance with the provisions of the Canadian Electrical Code (CEC) C22.1, Part 1, Section 18.

Hazardous (classified) locations, in both the United States and Canada, are divided into three classes:

- Class 1- Presence of flammable gases or vapors may be present in quantities sufficient to produce explosive or ignitable mixtures.
- Class 11- Presence of combustible dusts, powders or grains.
- Class 111- Presence of easily ignitable fibers or flyings.

Hazardous Location Level of Risk

The classes listed above are further categorized based upon the level of risk present:

- Division 1- Locations in which hazardous concentrations of flammable gases or vapors- or combustible dust in suspension- continuously, intermittently or periodically under normal operating conditions.
- Division 2- Locations in which flammable gases or vapors are present, but normally confined within closed containers or systems from which they can escape only under abnormal or fault conditions. Combustible dusts are not normally in suspension nor likely to be thrown in to suspension.

Hazardous Group Classifications

Flammable gases, vapors and ignitable dusts, fibers and flyings are classified into groups according to the energy required to ignite the most easily ignitable mixture within air. Group classifications are:

- Class 1 group classifications-
  - Group A- Atmospheres containing acetylene.
  - Group B- Atmospheres containing hydrogen, fuel and combustible process gases containing more than 30 percent hydrogen by volume or gases or vapors of equivalent hazard.
  - Group C- Atmospheres such as ethyl ether, ethylene, or gasses or vapors of equivalent hazard.
  - Group D- Atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, propane or gases or vapors of equivalent hazard.
  - Group E- Atmospheres containing combustible metal dusts including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics.
  - Group F- Atmospheres containing combustible carbonaceous dusts including carbon black, charcoal, coal or other dusts that have been sensitized by other materials so they present an explosion hazard.
  - Group G- Atmosphere containing combustible dusts no included in Group E or F, including flour wood, grain and other dusts of similarly hazardous characteristics.
- Class 111 group classifications-
  - Class 111/Division 1- A Class 111, Division 1 location is a location in which easily ignitable fibers or material processing combustible flying are handled, manufactured or used.
  - Class 111/Division 11- A Class 111, Division 2 location is a location in which easily ignitable fibers are stored or handled.

Nonincendive FTAs

Wiring to the FTAs that are listed in the following table has been approved as Nonincendive wiring by Factory Mutual Research, Inc. When the wiring is opened, shorted, or grounded and the Controller is in its normal operating state, the wiring cannot release enough energy to cause the ignition of a flammable atmosphere.

FTA Type	FTA Models
24 Vdc Digital Input	MU/MC-TDID11 MU/MC-TDID12 MU/MC-TDID52 MU/MC-TDID72 MU/MC-TDIY22 MU/MC-TDIY62
4-20 mA Analog Output	MU/MC-TAOX01 MU/MC-TAOX02 MU/MC-TAOX12 MU/MC-TAOX52 MU/MC-TAOY22 MU/MC-TAOY23 MU/MC-TAOY52 MU/MC-TAOY53 MU/MC-THAO11 (HART)
High Level Analog Input	MU/MC-TAIH01 MU/MC-TAIH02 MU/MC-TAIH03 MU/MC-TAIH12 MU/MC-TAIH13 MU/MC-TAIH52 MU/MC-TAIH53
Low Level Analog Input	MU/MC-TAIL01 MU/MC-TAIL02 MU/MC-TAIL03
Smart Transmitter Interface Input	MU/MC-TSTX03 MU/MC-TSTX13 MU/MC-TSTX53

ATTENTION

When digital output circuits of a digital output FTA are current and voltage limited to suitable levels by the user, the digital output FTA can also be considered Nonincendive.

Electrical code approval

In general, field wiring in Division 2 hazardous locations must be done according to local codes; however, in some jurisdictions, Nonincendive wires need not conform to the normal Division 2 wiring rules but can use wiring methods that are suitable for ordinary locations.

See ANSI/ISA S12.12, the section *Electrical Equipment For Use In Class I, Division 2 Hazardous [Classified] Locations*.

Current limiting resistor value

The value of the resistors on the listed FTAs were selected to assure worst case short circuit currents in a hazardous area of less than 150 milliamps for normal operating equipment. According to NFPA publication #493, *Intrinsically Safe Apparatus for Use in Division 1 Hazardous Location*s, 150 milliamps from a 24 Vdc source is below the ignition threshold in a resistive circuit for gases in Groups A through D environments.

Cable size and load parameters

To ensure that the circuits are incapable of igniting a specific flammable atmosphere, the size of cable and load parameters must be controlled. The maximum permissible values of the parameters are given in the following table for the listed FTAs.

ATTENTION

The data in the following table is controlled by the Honeywell drawing 51109499 and cannot be changed without the approval of Factory Mutual Research, Inc.

FTA Model Number (MU- or MC-)	TAIL01 TAIL02 TAIL03	TAIH01 TAIH02 TAIH03 TAIH12 TAIH13 TAIH52 TAIH53 TSTX03 TSTX13 TSTX53	TAIH22 TAIH23 TAIH62	TAOX01 TAOX02 TAOX12 TAOX52 TAOY22 TAOY23 TAOY52 TAOY53	TDID12 TDID52 TDID72
V_{OC} — Maximum Open Circuit Voltage	9 Vdc	26 Vdc	26 Vdc	26 Vdc	30 Vdc
I_{SC} — Maximum Short Circuit Current	0.3 mA	186 mA	40 mA	22 mA	152 mA
C_a — Maximum Allowable Connected Cable Capacitance	15 µF	0.4 µF	0.4 µF	0.4 µF	0.25 µF
L_a — Maximum Allowable Cable Inductance	1 H	2.3 mH	35 mH	130 mH	3 mH
C_n — Maximum Allowable Connected Capacitance (Cable + Load)	15 µF	0.4 µF	0.4 µF	0.4 µF	0.25 µF
L_n— Maximum Allowable Connected Inductance (Cable + Load)	1 H	150 mH	150 mH	130 mH	400 mH

Galvanically Isolated FTAs

A family of Field Termination Assemblies (FTAs) are available that accept plug-in Galvanic Isolation Modules. These FTAs are used for connecting input and output signals to field devices in Division 1 (Zone 0 and Zone 1) hazardous areas. The FTAs are compatible with the IOPs that support the companion standard FTAs. See the FTA models section for a complete list of available Galvanically Isolated FTAs.

REFERENCE - INTERNAL

Refer to Appendix F for more information about planning for Galvanically Isolated type FTAs.

Planning for Power and Grounding

Compliance

Guidelines for complying with required electrical codes are listed below:

- All plant wiring (including power and signal cables) must be installed in accordance with the National Electrical Code (NEC), Canadian Electrical Code CEC), and all other local regulations.
- Power wiring must conform to the local electrical code. Use of a qualified contractor and approval by the local wiring inspector ensures compliance to this code
- Power wiring and signal cables installed by Honeywell (an optional service) will conform to the NEC or CEC. Upon your request, Honeywell will institute optional changes that will conform with the code, as well as adhere to local regulations and requirements.
- Always install power wiring in accordance with the *PlantScape Control Hardware Installation Guide:*
  - *Preparing to Install the Power Supply*
  - *Installing the Power Supply*
  - *Preparing for Operation*

Circuit capacities

Circuit capacity limits are governed by the NEC and CEC codes. Refer to these, and any other applicable local codes, to determine circuit capacities.

Outlet capacities

Outlet capacity limits are governed by the NEC and CEC codes. Refer to these, and any other applicable local codes, to determine outlet capacities.

Indicate the number and location of these outlets on your system layout drawing when designing your system. Outlets should be marked so that nothing, other than a system component, is plugged into them.

Multiple systems

Where multiple computer systems are installed, be sure to separate electrical power sources.

Convenience outlets

WARNING

All convenience outlets in the vicinity of this equipment must be grounded. The grounding conductors servicing these receptacles must be connected to earth ground at the service equipment, or at some other acceptable building earth ground (such as the building frame, in the case of a high-rise steel frame structure).

Supply separate and adequate convenience outlets in the PlantScape System area for items such as test equipment, vacuum cleaners, and floor buffers. To prevent noise interference from devices using these receptacles, convenience outlets must be on a circuit that has its transformer isolated from the circuits used for the system. One solution is to supply power for the components of the PlantScape System through an isolation transformer.

Honeywell products

Honeywell offers a line of regulators and power conditioners suitable for any system configuration. Consult your Honeywell Account Manager for further information.

REFERENCE

For detailed information on the power source requirements of the modules and computer systems used in your PlantScape System, refer to the PlantScape specifications

The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links..

Grounding guidelines

WARNING

The grounding system must be installed in accordance with the National Electrical Code (NEC), Canadian Electrical Code (CEC), and any other applicable electrical codes (to include: IEEE-142; Lightning Protection Institute Installation Code LPI-175; NFPA-78 (ANSI); IEEE Std. 142-1972).

A broken or high resistance safety ground creates a potentially lethal situation, especially in equipment that incorporates line filters. The line filters include appreciable line-to-chassis capacitance. As a result, if the green or green/yellow ground wire is not intact, a person touching the equipment and ground can receive a serious and possibly fatal shock.

REFERENCE

For detailed information on equipment grounding, refer to the documents below:

- *PlantScape ControlNet Installation Guide, Introduction*
- *PlantScape Control Hardware Installation Guide, Make ground connections*

Adequate grounding is important for safety considerations and for reducing electromagnetic noise interference. All earth-ground connections must be permanent and provide a continuous low impedance path to earth ground for induced noise currents and fault currents. Refer to the following guidelines when considering the grounding requirements of your system:

- For safe operation of your equipment, a high-integrity grounding system must be installed as part of the building's wiring system.
- Electrical outlets for workstations and any other higher-level computer connected to the ControlNet communications network must be on a separate AC circuit from its peripherals. If the existing installation does not have an equipment grounding conductor in the branch circuits, consult your Honeywell Account Manager. Consult local codes for ground wiring.

- When providing the female receptacles or connectors, consider the following:
  - An equipment ground wire must be enclosed with the circuit conductors (phase and neutral wires),
  - The isolated ground wire must run directly from the outlet to the power source
  - The size of the ground conductor must be the same as, or larger, than the circuit conductors supplying the equipment
  - The ground conductor must be securely bonded to the building-ground electrode
  - Grounding provisions must be in accordance with the NEC, CEC, and any other local codes.

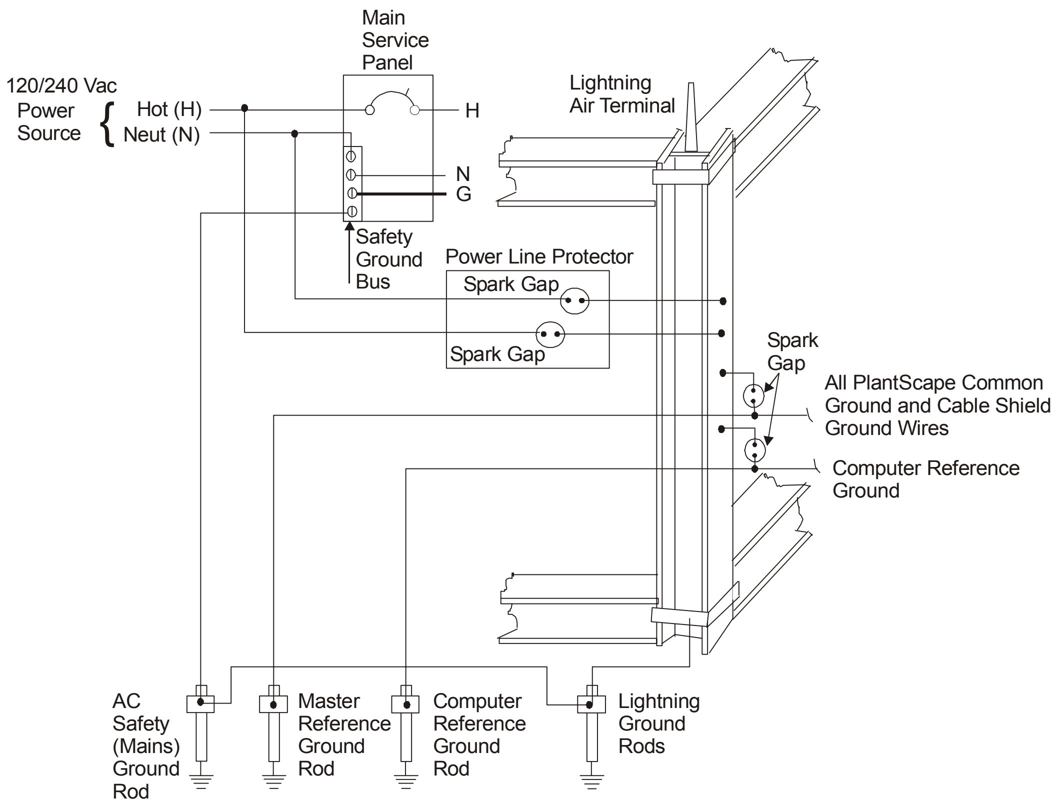
About Lightning Grounds

Lightning grounds must conform to applicable codes such as NFPA No. 78 (ANSI), IEEE Std. 142-1972, Code LPI-175, and other local codes. A typical lightning ground system consists of 10ft (3m) ground rods bonded (connected) to vertical structure members every 100ft (30m) along the building perimeter.

The mains ground is usually bonded to the lightning ground. Master reference grounds must be isolated from all other grounds. Where ground wires are close together in an enclosure, there is always the possibility for arcing (flashover) between ground wires when lightning strikes.

To inhibit this hazardous arcing, some codes require all ground wires to be connected through spark gap devices at the building perimeter. The following example shows the master reference (common) ground and the low-level shield grounds connected to a building vertical steel frame structure that is also connected to the lightning ground rod. Spark gap devices connect all ground wires to avoid an excess voltage difference that may be created by a lightning strike. We recommend 90 Volt, 150KA spark gaps for system grounds.

Lightning Ground Example (General Purpose Area)



Planning for Process Manager I/O Power Requirements

Power system types and features

The following two types of power systems are available to power IOP subsystems.

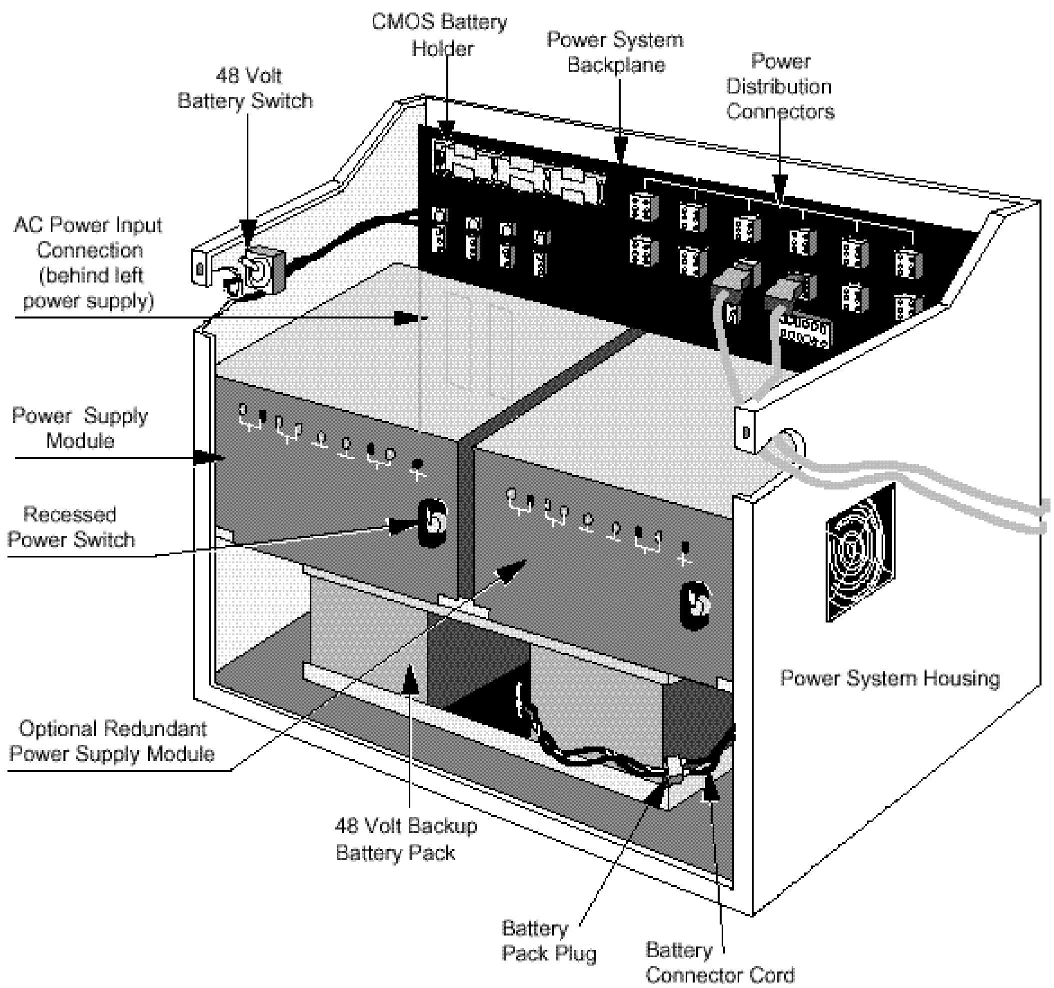
- Standard Power System
- AC Only Power System

Both types provide these features:

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

Standard power system

The Standard Power System, model MU-PSRX04, is available as shown in the following figure. Input power can be either 120 Vac or 240 Vac and provide CMOS memory NiCad battery backup (3.6 Vdc). The model MU-PSRX04 system provides 45 hours of backup with failure detection.



Model MU-PSRX04 Standard Power System

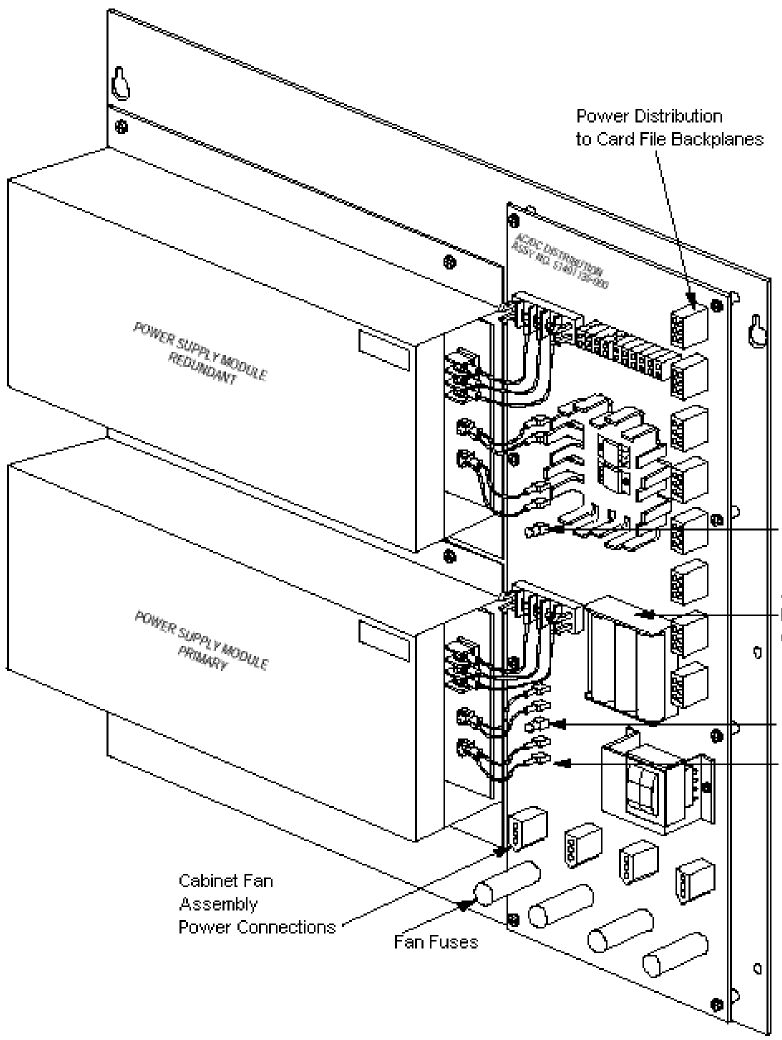
The following optional features are available.

- An optional redundant Power Supply Module.
- A single or dual source of input power can be connected when the optional redundant Power Supply Module option is used.
- An optional 48 Vdc Battery Backup Module with a disconnect switch that backs up the 24 Vdc for 25 minutes.

AC Only Power System

The AC Only Power System shown in the following figure offers optional 8- or 16-ampere redundant Power Supply Modules, but does not offer the optional 48 Vdc Battery Backup module feature and rechargeable NiCad CMOS memory backup power.

Alkaline batteries are used instead of rechargeable NiCad batteries for CMOS data retention.



Typical AC power and ground connections for IOP

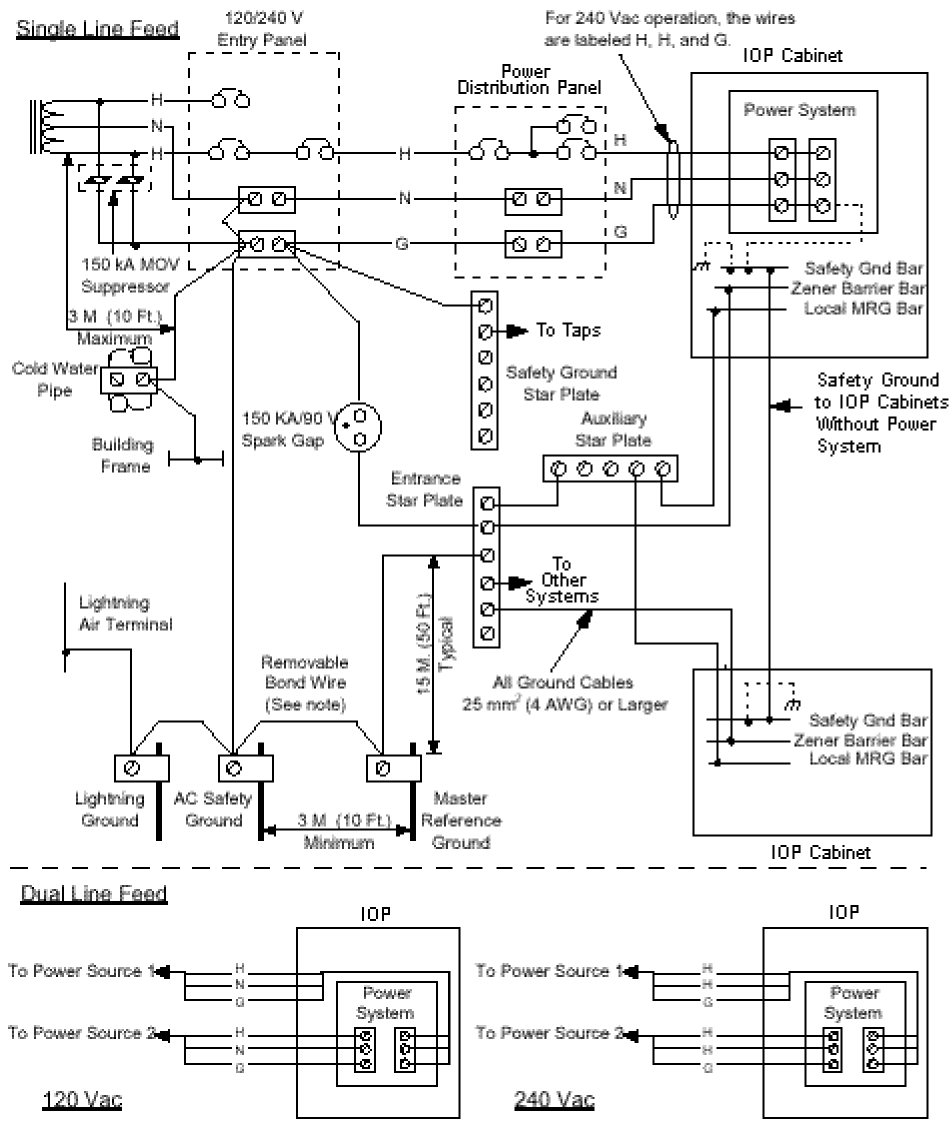
The following figures show typical power and ground connections for the IOP. The two ac feeder sources do not have to be of the same phase, frequency, voltage, or from the same service as long as each meets the following power quality.

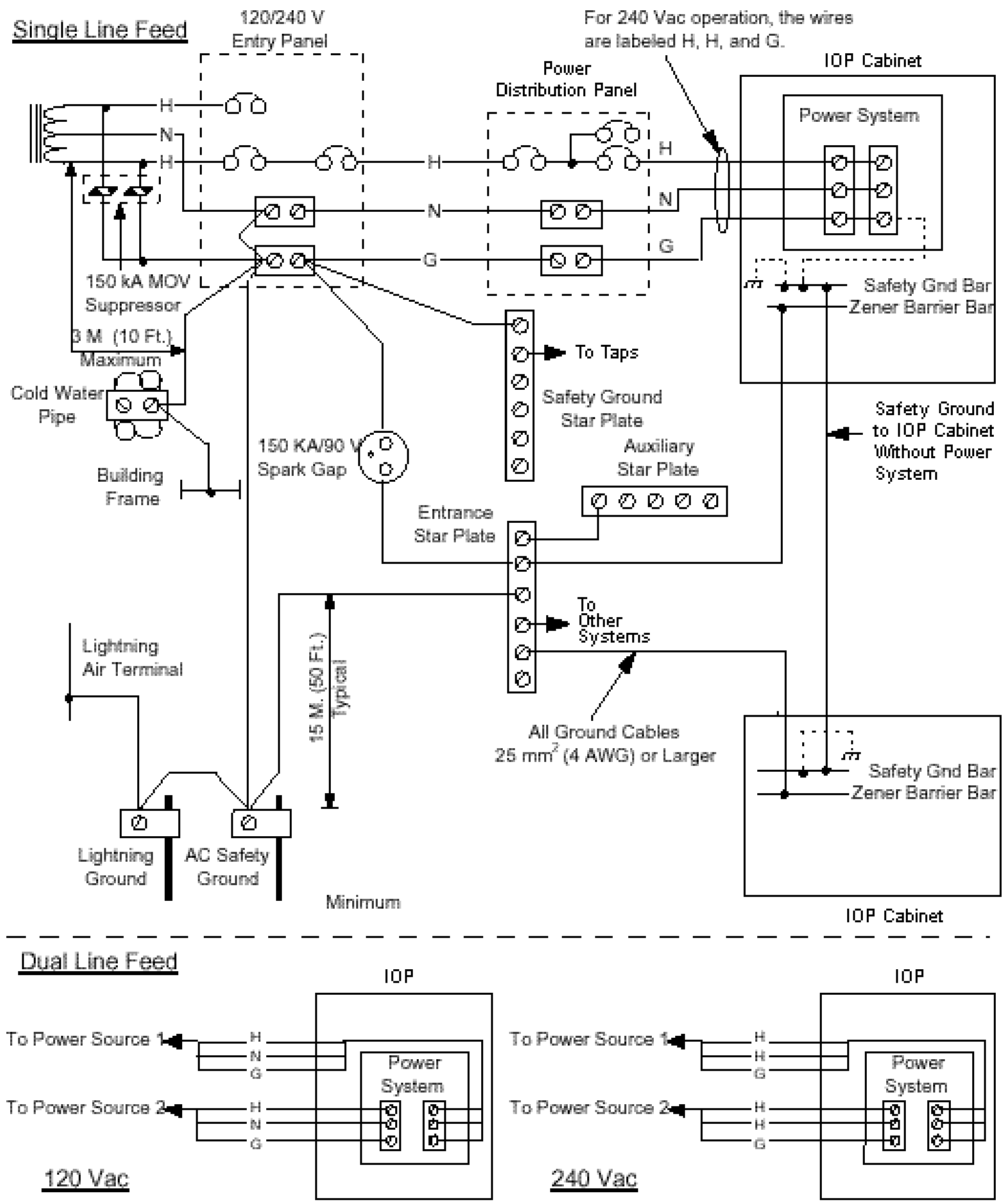
- Voltage: 100-132/187-264 Vac, single phase
- Frequency: 47-63 Hz
- Total Harmonic Distortion (THD): 8 percent maximum

The first figure below shows a typical multi-ground IOP installation that includes Master Reference Ground (MRG). The ground system is non-CE Compliant. The second figure below shows a typical single-ground IOP installation that is designated Safety Ground. The Safety Ground system is CE Compliant.

REFERENCE - INTERNAL

Refer to Appendix E for more information about the power draw for IOP components.


Single Line Feed
120/240 V
Entry Panel
For 240 Vac operation, the wires are labeled H, H, and G.
IOP Cabinet
Power
Distribution Panel
Power System
H
N
H
H
N
G
H
N
G
Safety Gnd Bar
Zener Barrier Bar
Local MRG Bar
150 kA MOV
Suppressor
3 M (10 Ft.)
Maximum
To Taps
Cold Water
Pipe
Safety Ground
Star Plate
Safety Ground
to IOP Cabinets
Without Power
System
150 KA/90 V
Spark Gap
Auxiliary
Star Plate
Building
Frame
Entrance
Star Plate
To
Other
Systems
Lightning
Air Terminal
15 M. (50 Ft.)
Typical
Removable
Bond Wire
(See note)
All Ground Cables
25 mm2 (4 AWG) or Larger
Safety Gnd Bar
Zener Barrier Bar
Local MRG Bar
Lightning
Ground
AC Safety
Ground
3 M (10 Ft.)
Minimum
Master
Reference
Ground
IOP Cabinet
Dual Line Feed
IOP
IOP
To Power Source 1
To Power Source 2
Power
System
To Power Source 1
To Power Source 2
Power
System
120 Vac
240 Vac


Single Line Feed
120/240 V
Entry Panel
For 240 Vac operation, the wires are labeled H, H, and G.
Power
Distribution Panel
IOP Cabinet
Power System
H
N
H
N
G
150 kA MOV
Suppressor
3 M (10 Ft.)
Maximum
Cold Water
Pipe
Building
Frame
Safety Gnd Bar
Zener Barrier Bar
To Taps
Safety Ground
Star Plate
150 KA/90 V
Spark Gap
Auxiliary
Star Plate
Safety Ground
to IOP Cabinet
Without Power
System
Entrance
Star Plate
To
Other
Systems
Lightning
Air Terminal
15 M. (50 Ft.)
Typical
All Ground Cables
25 mm2 (4 AWG) or Larger
Safety Gnd Bar
Zener Barrier Bar
Lightning
Ground
AC Safety
Ground
Minimum
IOP Cabinet
Dual Line Feed
IOP
To Power Source 1
To Power Source 2
Power
System
120 Vac
240 Vac

Power and I/O Link Interface cable for Controller and IOLIM

The following table lists the model numbers for the combination power and I/O link interface cable used to connect the I/O Link Interface Module to the IOP card file and the IOP power system The cable includes leads for connecting 24 Vdc power to the Process Controller chassis power supply.

Cable Length (Meters / Feet)	Model Number
2.0/6	TC-KIOL02
5.0/16	TC-KIOL05
10.0/32	TC-KIOL10

Power cables for IOPs

The following tables list the model and part numbers for power cables that are available for use in an IOP. The power cables that are listed in first two tables have an integral I/O Link protection network attached to the cable. The network protects the I/O Link Interface transceivers from surges when each I/O link Interface cable is routed through a protection network at the card file. The cables that are listed in the third table do not have protection network. For the feature to be effective, all card files in the subsystem (for example, a subsystem being all the IOPcard files that are connected to the IOLIM through the metallic I/O Link Interface cable) must have the I/O Link protection network feature installed.

Non-CE Compliant Subsystem Power Cables

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link Protection Network (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable – Internal or External to Cabinet)
1.0/3	51204126-001	51201397-001
1.5/5	51204126-915	51201397-915
2.0/6	51204126-002	51201397-002

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link Protection Network (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable – Internal or External to Cabinet)
3.0/9	51204126-003	51201397-003
4.0/13	51204126-004	51201397-004
5.0/16	51204126-005	MU-KDPR05
6.0/19	51204126-006	51201397-006
10.0/32	N/A	MU-KDPR10
15.0/49	N/A	MU-KDPR15
20.0/65	N/A	MU-KDPR20
30.0/98	N/A	MU-KDPR30
40.0/131	N/A	MU-KDPR40
50.0/164	N/A	MU-KDPR50

CE Compliant Subsystem Power Cables

Cable Length (Meters / Feet)	Part Number To Card File With I/O Link ProtectionNnetwork (Cable Set)	Model/Part Number To DI or GI Power Distribution Assembly Without I/O Link Protection Network (Single Cable)	
		Internal to Cabinet	***External to Cabinet***
1.0/3	51204138-001	51201397-001	N/A
1.5/5	51204138-915	51201397-915	N/A
2.0/6	51204138-002	51201397-002	N/A
3.0/9	51204138-003	51201397-003	N/A
4.0/13	51204138-004	51201397-004	N/A

5.0/16	51204138-005	MU-KDPR05	MU-KSPR05
6.0/19	51204138-006	51201397-006	N/A
10.0/32	N/A	N/A	MU-KSPR10
15.0/49	N/A	N/A	MU-KSPR15
20.0/65	N/A	N/A	MU-KSPR20
30.0/98	N/A	N/A	MU-KSPR30
40.0/131	N/A	N/A	MU-KSPR40
50.0/164	N/A	N/A	MU-KSPR50

Power Cables without I/O Link Protection Network

Cable Length (Meters / Feet)	Part Number To Card File Without I/O Link Protection Network (Single Cable)
1.0/3	51204138-001
1.5/5	51204138-915
2.0/6	51204138-002
3.0/9	51204138-003
4.0/13	51204138-004
5.0/16	51204138-005
6.0/19	51204138-006

Non-CE Compliant subsystems

In non-CE Compliant subsystems, the 51204126-xxx power cable set must be used to provide power to the card files. These power cables have the integral I/O Link protection network feature.

If a system without I/O Link protection network is being modified, and the feature is desired, all 51201397-xxx power cables must be upgraded by adding a 51204140-100 CE Compliant type I/O Link protection network adapter cable set to the card file end of each power cable set. The appropriate I/O Link Interface cables must then be used with the I/O Link protection network. For the Digital Input and Galvanic Isolation Power Distribution Assemblies that are mounted inside the cabinet, use the 51201397-xxx power cable.

For power distribution to Digital Input and Galvanic Isolation Power Distribution Assemblies that are located external to the cabinet, use the shielded model MU-KSPRxx power cables listed in the tables above.

CE Compliant subsystems

For CE Compliant subsystems, a 51204138-xxx power cable set is required to provide power to a card file. This power cable has the integral I/O Link protection network feature.

If a subsystem without I/O Link protection network is being upgraded, and the feature is desired, all 51201397-xxx power cables must be upgraded by adding CE Compliant type 51204140-100 I/O Link protection network adapter cable sets to the card file ends of the existing power cables. The adapter cables are available as a set of two cables that are labeled Link A and Link B. The appropriate I/O Link Interface cables must then be used with the I/O Link protection network.

For the Digital Input and Galvanic Isolation Power Distribution Assemblies that are mounted inside the cabinet, use the 51201397-xxx power cable. For power distribution to Digital Input and Galvanic Isolation Power Distribution Assemblies that are located external to the cabinet, use the model MU-KSPRxx shielded power cables that are listed in the tables above.

Planning for Bonding and Grounding

After establishing all layouts, you can begin defining the mounting, bonding, and grounding for each chassis.

CAUTION

Do not lay one ground lug directly on top of the other. This type of connection can become loose with the compression of the metal lugs. Sandwich the first lug between a star washer and a nut with a captive star washer. After tightening the nut, sandwich the second with a captive star washer lug between the first and second nut.

Mounting and bonding chassis

You can mount the chassis with either bolts or welded studs. The following figure shows details for:

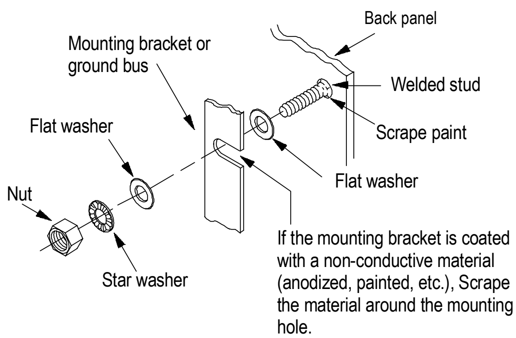
- stud-mounting a ground bus or chassis to the back panel of the enclosure.
- stud-mounting a back panel to the enclosure.
- bolt-mounting a ground bus or chassis to the back panel of the enclosure.

If the mounting brackets of a chassis do not lie flat before the nuts are tightened, use additional washers as shims, so that the chassis does not bend when you tighten the nuts.

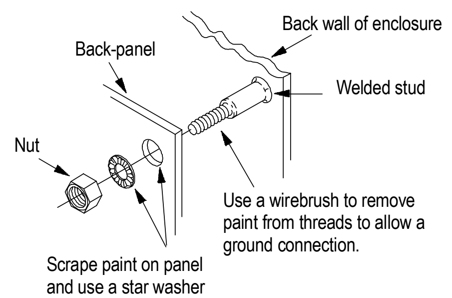
Make good electrical connections between each chassis, back-panel, and enclosure through each mounting bolt or stud. Wherever contact is made, remove paint or other non-conductive finish from around studs or tapped holes.

CAUTION

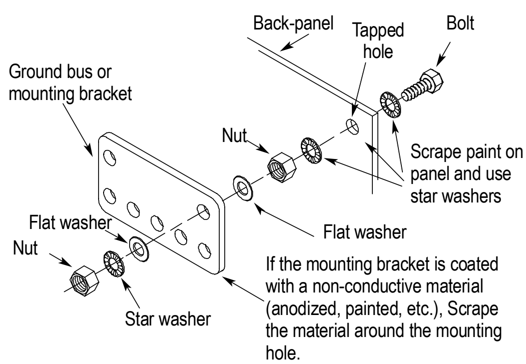
Do not bend the chassis. Bending the chassis might damage the backplane, thus resulting in poor connections.



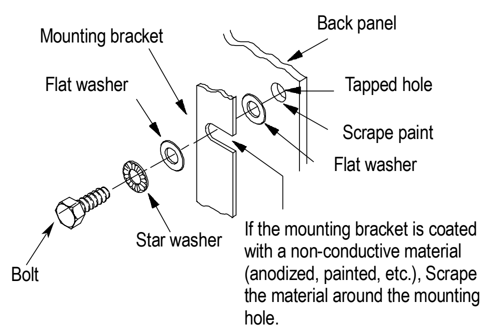
Stud mounting of a ground bus or chassis to the back panel



Stud mounting of the back panel to the enclosure back wall.



Bolt mounting of a ground bus or chassis to the back-panel.



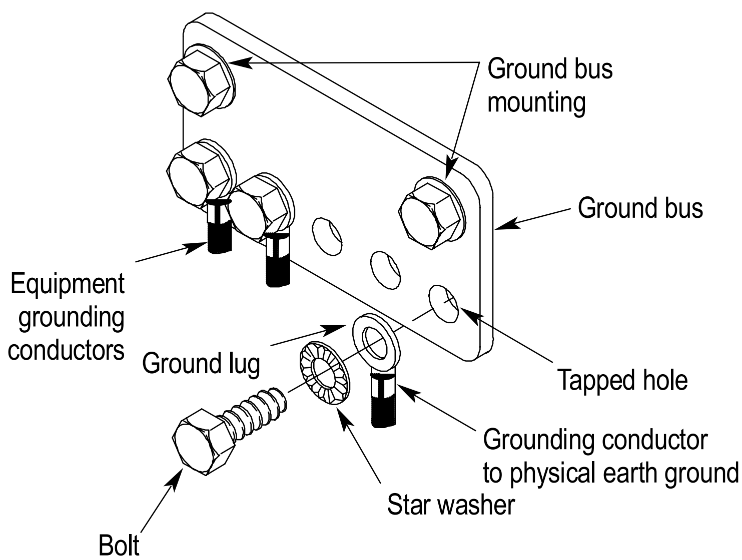
Alternative bolt mounting of chassis to the back panel

Chassis mounting and bonding

Bonding and grounding chassis

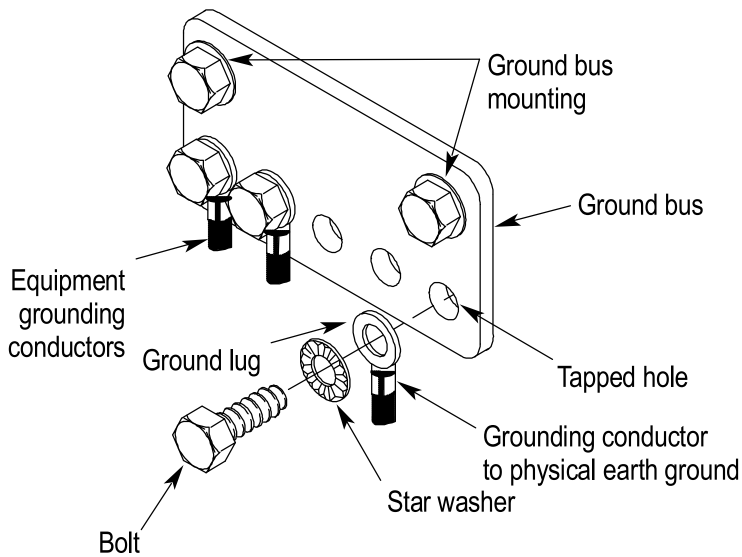
With solid-state controls, proper bonding and grounding helps reduce the effects of EMI. Also, since bonding and grounding are important for safety in electrical installations, national/local codes (e.g., National Electrical Code – NEC) and ordinances dictate which bonding and grounding methods are permissible.

In addition to making good connections through each bolt or stud, use either a 1-inch copper braid or an 8 AWG stranded copper wire to connect each chassis, enclosure and central-ground bus mounted on the backpanel. The following figure shows typical ground-bus connection details.

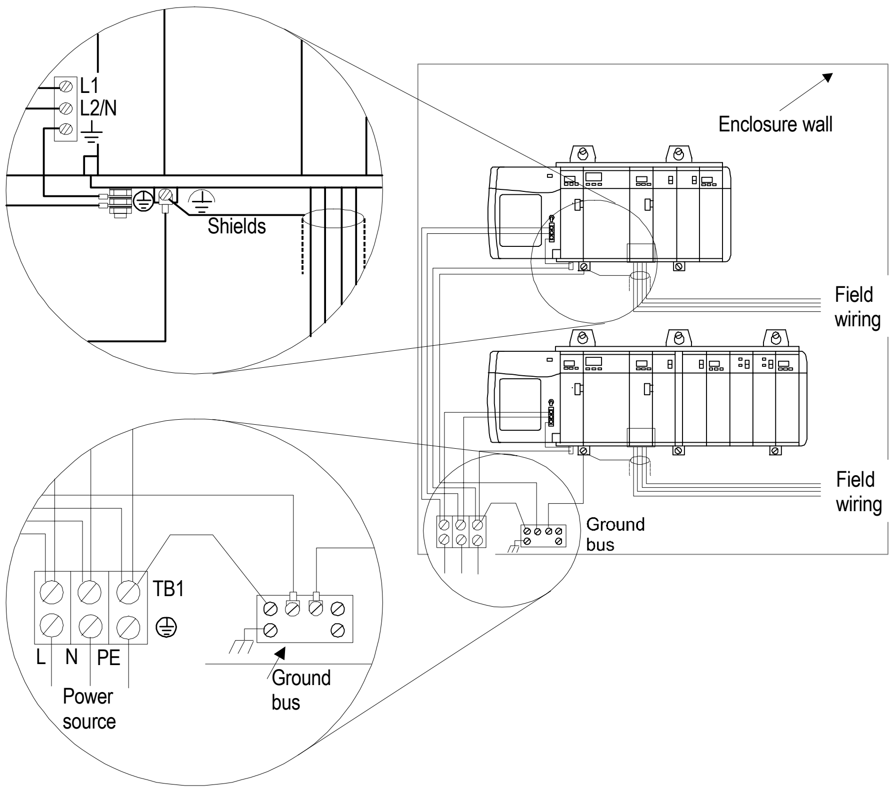


Control cabinet grounding

The following figure shows typical control-cabinet wall-ground connection details. Use a steel enclosure to guard against EMI. If the enclosure door has a viewing window, it should be a laminated screen or a conductive optical substrate to block EMI. Do not rely on the hinge for electrical contact between the door and the enclosure; install a bonding wire.



Typical control cabinet ground connection



Grounding Configuration

Power supply grounding

Each power supply and chassis is grounded by connecting a grounding conductor (grounding pig-tail) from the ground lug on the power supply, to the chassis ground tab, and to the enclosure's ground bus. See the previous figure.

DIN rail mounted component grounding

Some products have no visible groundable chassis and no ground lug or ground terminal, but will mount on a DIN rail. The chassis of these products are grounded only through the DIN rail. For these products, connect an equipment-grounding conductor directly from the mounting bolt on the DIN rail to an individual bolt on the ground bus.

Grounding-electrode conductor

Connect the ground bus to the grounding-electrode system through a grounding-electrode conductor. The grounding-electrode system is at earth-ground potential, and is the central ground for all electrical equipment and ac power within any facility. Use an 8 AWG copper wire minimum for the grounding-electrode conductor to help guard against EMI. The National Electrical Code specifies safety requirements for the grounding-electrode conductor.

Cable shields on process wiring

Certain connections require shielded cables to help reduce the effects of electrical noise coupling. Ground each shield at one end only. A shield grounded at both ends forms a ground loop which can cause a processor to fault.

Ground each shield at the end (specified in the appropriate publication for the product). Never connect a shield to the common side of a logic circuit (this would introduce noise into the logic circuit). Connect each shield directly to a chassis ground.

Avoid breaking shields at junction boxes. Many types of connectors for shielded conductors are available from various manufacturers. If you do break a shield at a junction box, do the following:

- Connect only Category-2 conductors in the junction box.
- Do not strip the shield any further than necessary to make a connection.
- Connect the shields of the two cable segments to ensure continuity along the entire length of the cable.

Planning Your Cabling and Wiring

Cabling and wiring

Table 8 describes procedures for cabling and wiring.

Table 8 Cabling/routing procedures

Step	Action
1	Determine physical installation and routing.
2	Consider cable type, cable distance, and redundant cable run paths.
3	Avoid installing cable through areas of high human traffic and high EMI/RFI.
4	Determine the maximum cable lengths and the number of drops.
5	Prepare a wiring list.
6	Maintain a blueprint with location of wiring.
7	Plan for expansion.
8	Plan for diagnostics such as attachment spots for diagnostic tools (e.g. a protocol analyzer).
9	Address separation issues for power, communications, and signal wiring/cabling.

REFERENCE

Before beginning installation, refer to the *PlantScape ControlNet Installation Guide, Installing Trunk Cable* for detailed instructions.

Planning to Minimize ESD/EMI

Introduction

ATTENTION

This section gives you general guidelines for reducing static discharge and establishing noise immunity within a PlantScape System. While these guidelines apply to the majority of installations, certain electrically harsh environments may require additional precautions.

Use these guidelines as a tool for helping avoid potential electrostatic discharge (ESD), electromagnetic interference (EMI) and transient EMI that could cause problems, such as adapter faults, chassis faults, communication faults, etc. These guidelines are not intended to supersede local electrical codes.

Planning for Static Electricity Minimization

Ways to reduce electric static discharge

Static electricity can influence electronic equipment, and cause equipment malfunctions or damage. The effects may range from momentary “glitches” to outright failures, data loss, and intermittent failures that are difficult to locate and correct. The situation becomes even more acute with high-resistance materials, such as carpets and plastic seat covers, in work areas that are not environmentally controlled.

Devices and techniques that can be used to reduce electrostatic discharge include:

- an increase in the relative humidity — This may be practical in only relatively small, closed work areas.
- conductive overcovering for shoes
- antistatic floor surfaces — These floor surfaces have all the attributes of conventional floor surfaces, except they are conductive to suppress static electricity build-up.
- low-pile antistatic carpets — These carpets are conductive to suppress static electricity. Carpets are available in a wide variety of patterns and colors, can be placed over most existing floor surfaces and some carpets.
- antistatic grounded pads — These pads are for operator work station areas, and can be placed over most existing floor surfaces and carpets. They are meant primarily for the immediate vicinity of the work area, and require proper grounding.
- avoiding synthetic materials — Avoid linoleum and synthetic carpets, and other materials that generate static. If such floor coverings are already in place, antistatic mats can be installed on the floor near the terminals. Refer to Honeywell's *National Distribution Operations Supplies and Accessories Sales Catalog* (Order Number GF60).

Planning for Interference Minimization

General considerations

Before deciding on an installation site, a planning review should be conducted to assess the environment and to determine any special product considerations or installation needs that may be necessary to ensure normal system operation and product protection.

Magnetic interference

Strong magnetic fields generated by some industrial machinery can cause malfunction of electronic equipment and magnetic storage media in shop-located devices. Avoid installing the PlantScape computer equipment close to sources of magnetic disturbance.

Electromagnetic and radio frequency interference

In some situations, the proposed site may experience electromagnetic interference (EMI) or radio frequency interference (RFI). These interference's can result from nearby radio-frequency sources (for example, two-way radios, TV, or radio transmitters) or industrial equipment (such as arc welders, fluorescent lights, or electronic air cleaners). Sources of EMI include electric floor heaters, transformers, and rotating machinery (such as fans or drills) and power distribution lines.

The effects of RFI and EMI can be reduced or eliminated by properly shielding and grounding the cables and equipment chassis, and by routing the cables away from potential interference sources.

Removal and Insertion Under Power (RIUP)

Performing Removal and Insertion Under Power (RIUP) may cause interference on the chassis backplane. Before considering RIUP, refer to the *Control Hardware Installation Guide*, *Removal and Insertion Under Power (RIUP) function guidelines*.

Planning Raceway Layouts

General considerations

The raceway layout of a system is reflective of where the different types of I/O modules are placed in an I/O chassis. Therefore, you should determine I/O-module placement prior to any layout and routing of wires. However, when planning your I/O-module placement, segregate the modules in accordance with the conductor categories (published for each I/O module). These published guidelines specify requirements for the installation of electrical equipment to minimize electrical noise inputs to controllers from external sources in IEEE standard 518-1982.

Categorizing conductors

Segregate all wires and cables into the three categories defined in Table 9.

Table 9 Categorizing conductors for noise immunity

Category	Description
1	Control, ac Power, and High-Power Conductors Control, ac Power, and High-Power conductors are those that are more tolerant of electrical noise than Category 2 conductors, and may also cause more noise picked up from adjacent conductors. Category 1 corresponds to IEEE Levels 3 (low susceptibility) and 4 (power). Examples include: • ac power lines for power supplies and I/O circuits. • high-power digital ac I/O lines connected to ac I/O modules rated for high power and high noise immunity. High-power digital dc I/O lines connected to dc I/O modules rated for high-power, or with input circuits with long time-constant filters for high noise rejection. They typically connect devices such as hard-contact switches, relays, and solenoids.

Category	Description
2	Signal, Communication, and Low-Power Conductors Signal, Communication, and Low-Power Conductors are those that are less tolerant of electrical noise than Category 1 conductors, and should also cause less noise picked up from adjacent conductors. They typically connect to sensors and actuators relatively close to the I/O modules. Category 2 Corresponds to IEEE Levels 1 (high susceptibility) and 2 (medium susceptibility). Examples include: • Analog I/O lines and dc power lines for analog circuits • Low-power digital ac/dc I/O lines connected to I/O modules that are rated for low power, such as low-power contact output modules. • Low-power digital dc I/O lines connected to dc I/O modules that are rated for low power and have input circuits with short time-constant filters to detect short pulses. They typically connect to devices such as proximity switches, photo-electric sensors, TTL devices, and encoders. • Communication cables (Ethernet, Process Control Network, RS-232-C, RS-422, RS-423 cables) connected between processors or to I/O adapter modules, programming terminals, computers, or data terminals.
3	Intra-Cabinet Conductors Intra-cabinet conductors are those that interconnect the system components within a control cabinet or enclosure. Category 3 corresponds to IEEE Levels 1 (high susceptibility) and 2 (medium susceptibility). Examples include: • Low-voltage dc power cables providing backplane power to the system components. • Communication cables connected between system components within the same enclosure.

Routing conductors

CAUTION

Please note that these guidelines are for noise immunity only. Follow all local codes for safety requirements. Also, observe the following cautionary measures:

- Use the spacing given in these general guidelines, with the following exceptions:
  - where connection points (for conductors of different categories) on nodes are closer together than the specified spacing.
  - application-specific configurations, for which the spacing is described in a publication for that specific application.
- These guidelines assume that you follow the surge-suppression guidelines described in this document.

While these guidelines apply to the majority of installations, certain electrically harsh environments may require additional precautions.

To guard against coupling noise from one conductor to another, follow the general guidelines defined in Table 10 when routing wires and cables (both inside and outside of an enclosure).

Table 10 Routing conductors for noise immunity

Category	Description
1	These conductors can be routed in the same cable tray or raceway with machine power conductors of up to 600 Vac (feeding up to 100 hp devices).
2	The following rules must be observed when routing Category 2 conductors: 1. When crossing power feedlines, do so at right angles. 2. Route at least five ft from high-voltage enclosures, or sources of RF and microwave radiation. 3. When using metal wireways or conduits, each segment of that wireway or conduit must be bonded to each adjacent segment (so that it has electrical continuity along its entire length), and must be bonded to the enclosure at the entry point. 4. Properly shield (where applicable) and route in a raceway separate from Category 1 conductors. 5. When using a contiguous metallic wireway or conduit, route at least: – 0.08 m (3 in) from Category-1 conductors of less than 20 A, – 0.15 m (6 in) from ac power lines of 20 A or more, but only up to 100 kVA, and – 0.3 m (1 ft) from ac power lines of greater than 100 kVA. 6. When not using contiguous metallic wireways or conduits, route at least: – 0.15 m (6 in) from Category 1 conductors of less than 20 A – 0.3 m (1 ft) from ac power lines of 20 A or more, but only up to 100 kVA – 0.6 m (2 ft) from ac power lines of greater than 100 kVA.
3	Route conductors outside all raceways in the enclosure or in a raceway separate from any Category-1 conductors with the same spacing listed for Category-2 conductors (where possible).

Planning for Power Distribution

Transformer connections

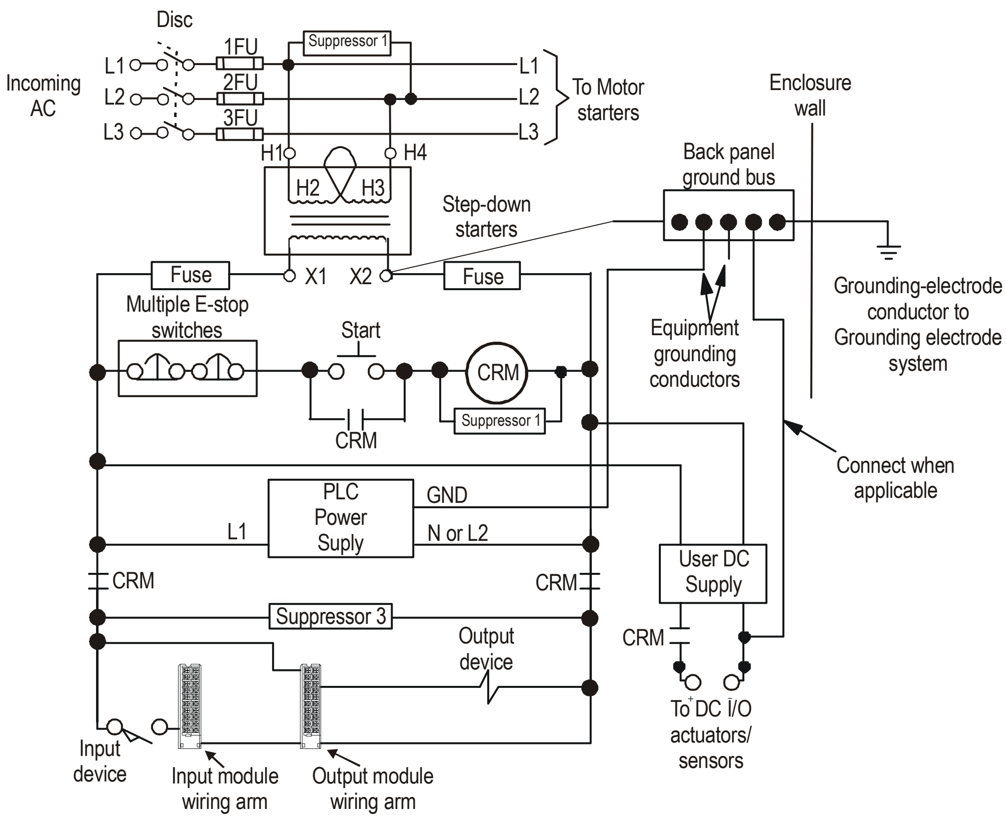
You can minimize noise induced by the power-distribution system by connecting the power supply directly to the secondary of a transformer as shown in the following two figures. The transformer provides dc isolation from other equipment not connected to that transformer secondary.

Connect the transformer primary to the ac source. Connect the high side of the transformer secondary to the L1 terminal of the power supply; connect the low side of the transformer secondary to the neutral (common) terminal of the power supply.

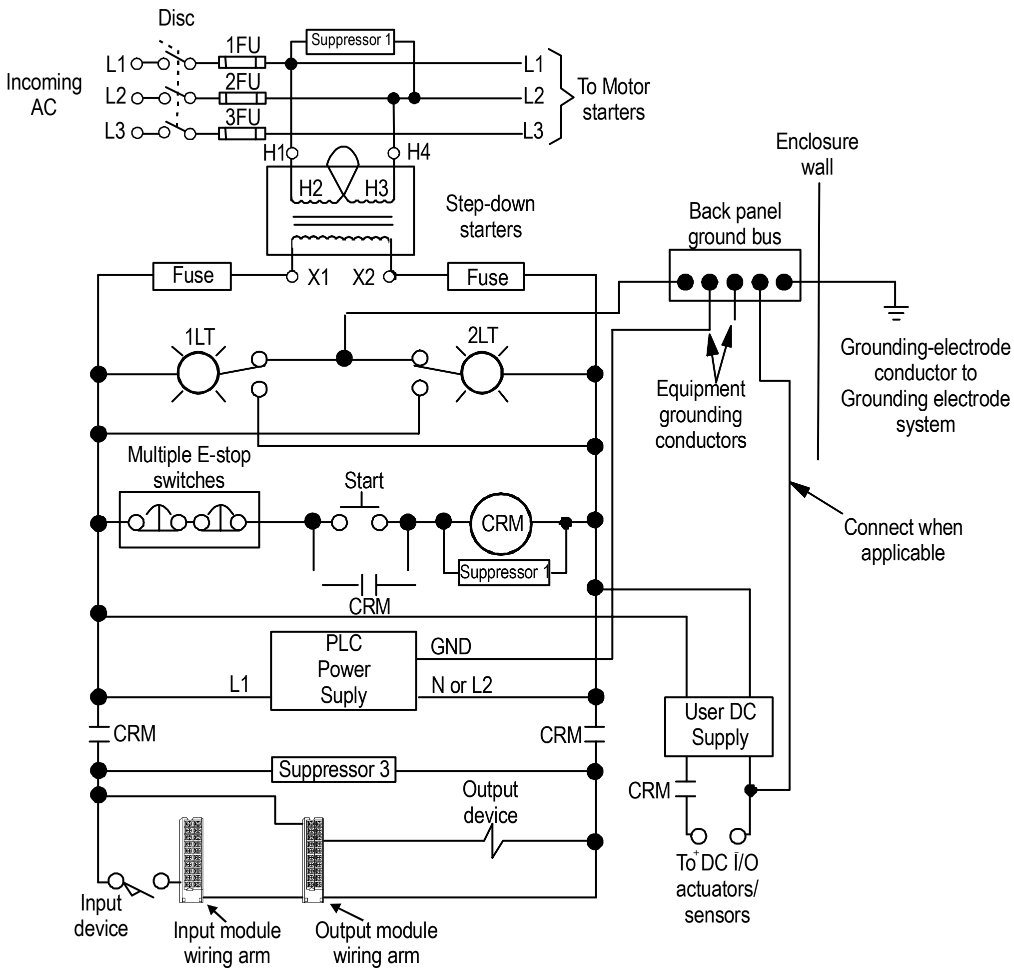
ATTENTION

Three EMI minimization techniques utilized in the following two figures include:

- Connection of a suppressor across an inductive load (such as the CRM coil).
- Inclusion of a second transformer providing power to the input circuits and power supplies, and isolating them from the output circuits.
- Connection of a suppressor to minimize the EMI generation from the net inductive load switched by the CRM contacts.



Grounded ac power distribution system with master-control relay



Ungrounded ac power distribution system with master-control relay

Monitoring the master control relay

The master-control relay can be monitored in your control applications, in order to hold all outputs off anytime its contacts are open. To do this, connect one input directly to the L1 side of the line, on the load side of the CRM contacts as shown in the previous figure and the following figure. In the control application, this input is used to hold off all outputs, anytime the CRM contacts are open.

If you fail to do this, closing the CRM contacts could generate transient EMI because outputs are already activated. To have outputs turned on when CRM contacts are closing, would be analogous to squeezing the trigger on a hand-power tool as you're plugging it in the electrical outlet.

Sizing the transformer

To determine the required rating of the transformer, add the external-transformer load of the power supply and all other power requirements (input circuits, output circuits). The power requirements must take into consideration the surge currents of devices controlled by the processor. Choose a transformer with the closest standard transformer rating above the calculated requirements.

ATTENTION

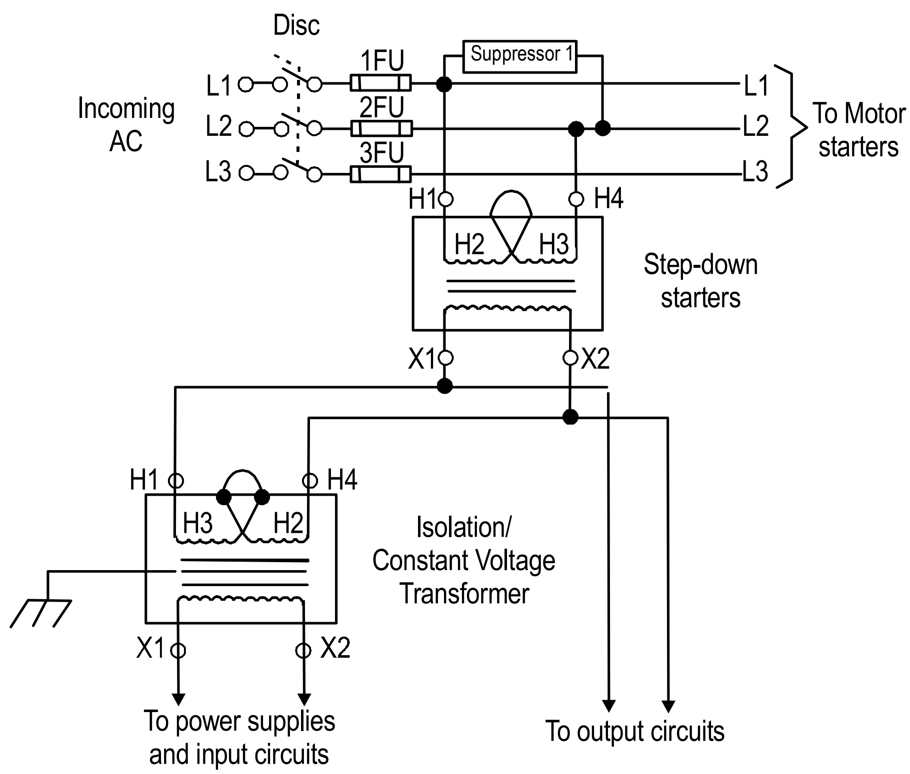
Each power supply with under-voltage shut-down protection generates a shut-down signal on the backplane, whenever the ac line voltage drops below its lower voltage limit. The power supply removes the shut-down signal whenever the line voltage comes back above the lower voltage limit. This shut-down is to guard against invalid data being stored in memory.

Because a capacitive-input power supply converting ac to dc draws power only from the peak of the ac voltage waveform, the external transformer load (in VA) of each power supply is 2.5 times its real power dissipation (in Watts). If the transformer is too small, the peaks of the sine wave are clipped. Even if the voltage is still above the lower voltage limit, the power supply senses the clipped wave as low voltage and sends the shut-down signal.

Transformer separation of power supplies and circuits

PlantScape power supplies have circuits that suppress electromagnetic interference from other equipment. However, you should isolate output circuits from both power supplies and input circuits, this will help prevent output transients from being induced into inputs and power supplies. In many applications, power is provided to the input circuits and power supplies through a separate transformer as shown in the following figure.

Refer to, *Isolation Transformers and Constant-Voltage Transformers* in this document, for information about the use of additional transformers.



Second transformer in a power distribution system

ATTENTION

To minimize transient EMI generation when power is interrupted by the interrupt switch, connect a suppressor across the primary of the transformer (as shown in the figure above).

Isolation transformers

For applications near excessive electrical noise generators, an isolation transformer (for the separate transformer) provides further suppression of electromagnetic interference from other equipment. The output actuators being controlled should draw power from the same ac source as the isolation transformer, but not from the secondary of the isolation transformer.

Constant-voltage transformers

In applications where the ac power source is especially "soft" and subject to unusual variations, a constant-voltage transformer can stabilize the ac power source to the processor and minimize shutdowns. The constant-voltage transformer must be of the harmonic neutralizing type.

If the power supply receives its ac power through:

- constant-voltage transformer, the input sensors connected to the I/O chassis should also receive their ac power from the same constant-voltage transformer.
- another transformer, the ac source voltage could go low enough that erroneous input data enters memory while the constant-voltage transformer prevents the power supply from shutting down the processor.

The output actuators being controlled should draw power from the same ac sources as the constant-voltage transformer, but not from the secondary of the constant-voltage transformer (See the previous figure).

Transformer ground connections

When ac power is supplied as a separately derived system through an isolation/step-down transformer, you can connect it as a grounded ac system or an ungrounded ac system. For a grounded ac system, connect one side of the transformer secondary to the ground bus. For an ungrounded ac system, connect one side of each test switch for the ground-fault-detector lights to the ground bus. We do not recommend an ungrounded system. Follow local codes in determining whether to use a grounded system.

When bringing ac power into the enclosure, do not ground its raceway to the ground bus on the back-panel. Connecting the raceway to the ground bus may cause the processor to fault by introducing EMI into the grounding circuit. Local codes may provide an exception for permitting isolation from the raceway. For example, article 250-75 of the National Electrical Code has an exception that explains the conditions under which this isolation from the raceway is permitted.

Suppressing Power Surges

Why do they occur?

Transient electromagnetic interference (EMI) can be generated whenever inductive loads (such as relays, solenoids, motor starters, or motors) are operated by hard contacts (such as pushbutton or selector switches). The wiring guidelines are based on the assumption that you guard your system against the effects of transient EMI by using surge-suppressors; these will suppress transient EMI at its source. Inductive loads switched by solid-state output devices alone do not require surge-suppression. However, inductive loads of ac output modules (that are in series or parallel with hard contacts) require surge-suppression to protect the module output circuits as well as to suppress transient EMI.

Surge-suppressors

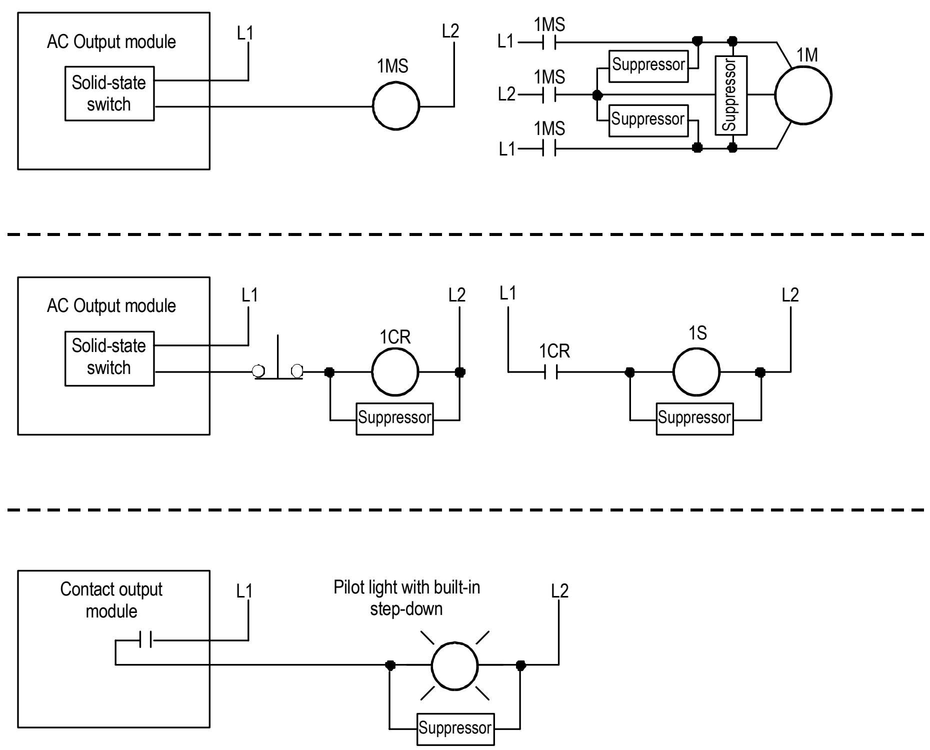
Surge-suppressors are usually most effective when connected at the inductive loads. They are still usable when connected at the switching devices; however, this may be less effective, because the wires connecting the switching devices to the inductive loads act as antennas that radiate EMI. You can see the effectiveness of a particular suppressor by using an oscilloscope to observe the voltage waveform on the line.

Ferrite beads

Ferrite beads can provide additional suppression of transient EMI. Fair-Rite Products Corporation manufactures a ferrite bead (part number 2643626502) which can be slipped over Category-2 and Category-3 conductors. You can secure them with heat-shrink tubing or tie-wraps. With a ferrite bead located near the end of a cable (or cable segment in the case of a daisy-chain or dropline configuration), transient EMI induced onto the cable can be suppressed by the bead before it enters the equipment connected to the end of the cable.

Typical suppression circuitry

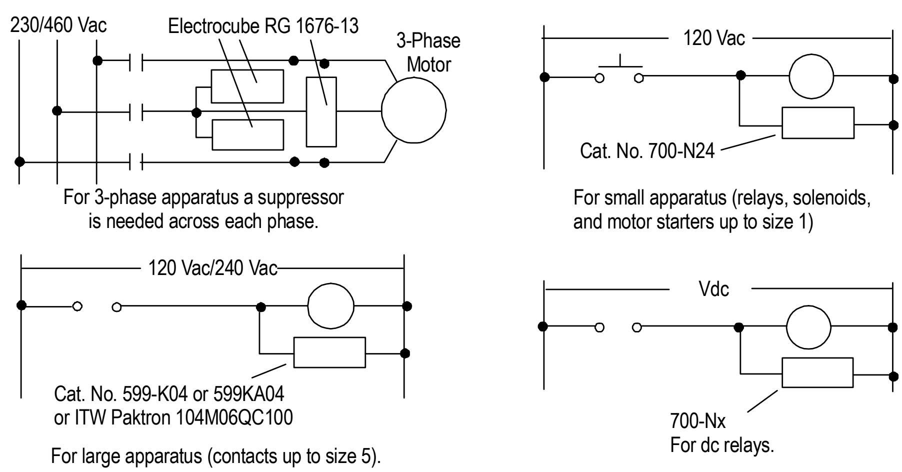
The following shows typical suppression circuitry for different types of loads.



Examples

The following figure shows three examples of where to use suppressors.

- In example 1, although the motor starter-coil is an inductive load, it does not need a suppressor; this is because it is switched by a solid-state device alone.
- In example 2, the relay coil needs a suppressor, because a hard-contact switch is in series with the solid-state switch. However, in both examples 1 and 2, we show a suppressor on the motor and solenoid, because it is an inductive load switched by the hard contacts of the motor starter or relay. Even if they have no interaction with the control system, regularly cycled loads of this type need suppression, if conductors connecting to these loads are:
  - connected to the same separately derived system as that of the control system, or
  - routed near the control system conductors, as per the routing guidelines
- In example 3, the pilot light has a built-in step-down transformer that needs a suppressor because it is an inductive load being switched by the hard contacts of a contact output module; without suppression, the transient EMI would be generated inside the I/O chassis. Lights with built-in step-down transformers that are switched by hard contacts may not need to be suppressed, because the noise spike they can generate may be only approximately one tenth that of a relay or motor starter.



ATTENTION

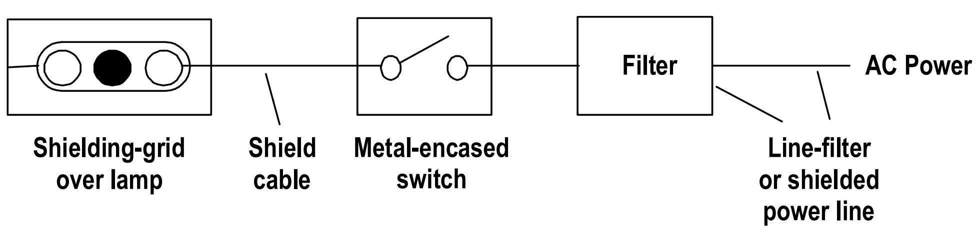
In all cases, the ac power coming into the I/O modules must be switched by the CRM contacts. Therefore, a suppressor is needed across the line at the load side of the CRM contacts. The application (voltage, net load of I/O circuits) dictates the specific suppressor needed across the line at the load side of the CRM contacts.

Planning Enclosure Lighting

Minimizing fluorescent lamp interference

Fluorescent lamps are also sources of EMI. If you must use fluorescent lamps inside an enclosure, the following precautions may help guard against EMI problems, as shown in the following figure:

- Install a shielding grid over the lamp.
- Use shielded cable between the lamp and its switch.
- Use a metal-encased switch.
- Install a filter between the switch and the power line, or shield the power-line cable.
- Do not use dimmers.



Avoiding Unintentional Momentary Turn-on of Outputs

Minimizing the probability

WARNING

Unintentional turn-on of outputs as the power source is connected or disconnected (even if momentary) can result in injury to personnel as well as damage to equipment. The danger is greater with fast-response actuators.

You can help minimize the probability of unintentional momentary turn-on of ac and dc circuits by following each of these guidelines according to your specific application:

- Follow the surge-suppression guidelines in this document.
- Follow the bonding and grounding guidelines in this document.
- Do not unnecessarily disconnect the power source from output circuits.
- Where possible, turn off all outputs before using CRM contacts to interrupt the output circuit power source.
- Hold off all outputs anytime the CRM contacts are open to be certain that they are off as power is reconnected.

Minimizing the effect

Even if unintentional momentary turn-on does occur, the effects can be minimized if:

- actuators have a home position, i.e. defined by a spring return.
- (for latching actuators in the ladder logic), you use non-retentive energize Logic Function Blocks with hold-in (seal-in) paths to maintain the established position, until power turnoff. Leave outputs off initially at power turn-on.
- each input or other load device connected to an output has an input-filter time-constant no lower than necessary for the application.

Testing the minimization

After designing and installing your system following these guidelines to minimize unintentional momentary turn-on and any effects thereof, test the system by de-energizing, and re-energizing the CRM relay.

Control Processing Planning

Control Processor Load Performance

Background

The Control Processor provides a very flexible execution environment for performing all types of control at different execution speeds. To determine how much control can be performed by a Processor, Processor Usage and Memory Usage are considered. The number of modules or blocks a Control Processor can execute is determined by available CPU and memory resources. Other constraints, such as total number of CMs and SCMs, must also be taken into account. The maximum number of function blocks per controller (the cumulative total in all control modules) is 2400.

Load performance calculation example

The following table represents an example control strategy configuration (not necessarily typical) calculations to determine control processor load performance.

REFERENCE

For detailed information regarding processing units and memory units, refer to the PlantScape specifications.

The PlantScape specifications can be found on the Honeywell website: http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial . Just follow the PlantScape product links.

Table 11 Control Processor load performance calculation example

Module Type	No. of Modules	Period, sec	Module PU	Module MU	Total PUs[1]	Total MUs
Analog Data Acquisition CM	10	1	4	9	40	90
Regulatory Control CM	40	0.5	2	4	160	160
Auxiliary Function CM	5	0.5	8	18	80	90
Digital Data Acquisition CM	20	0.1	1	3	200	60
Device Control CM	100	0.1	1	3	1000	300
Logic Control CM	10	0.1	1	3	100	30
Sequence Control Module (SCM)	4	0.1	2	90	80	360
Sequence Control Module (SCM)	32	1	2	90	64	2880
				Total	***1724***	***3970***
				Max	***2000***	***4000***

PU = Processing Unit per Control Cycle; MU = Memory Unit, Kbytes
PUs for any given CM = (PU per Cycle) / (Cycle Time, sec.)

Available Period for all CM and SCM types are 0.05, 0.1, 0.2, 0.5, 1.0 and 2.0 sec.

1. [1] Total PUs = (No. of Modules) x (Module PU) / (Period, sec.) for each CM type.

Process Manager I/O Integration Planning

System Topology and Performance Considerations

System configuration guidelines

- The Input/Output Link Interface Module (IOLIM) must be mounted in a non-redundant or redundant Process Controller chassis.
- The Supervisory network must use the ControlNet media.
- Two (2) is the maximum number of IOLIMs supported per Process Controller chassis.
- Twenty (20) is the maximum number of IOLIMs supported per Server.
- Forty (40) is the maximum number of primary Input/Output Processors (IOPs) supported per IOLIM. A primary and secondary IOP pair is considered as one Input/Output Module (IOM) for system performance calculations. (Note that the maximum number allowed may vary depending on the required sampling period of the IOPs.)
- Sixty-Four (64) is the maximum number of IOPs supported per Control Processor Module (CPM). (Note that each IOP block is the equivalent of one (1) IOM in this calculation.)
- The communication update interval between the IOP points and the function blocks is individually configurable for each IOP device in pre-determined intervals between 50 ms and 2 seconds.

Link Units and I/O Link overruns

The amount of I/O Link bandwidth available for I/O scanning per second is divided into 1000 units called Link Units (LUs). A Link Unit is roughly equivalent to one parameter read or write per second.

If a user configuration exceeds 1000 LUs, an I/O Link Access Overrun can occur. This type of overrun occurs when parameter reads and writes are not completed within their cycle time. This indicates too many parameter access requests were attempted through the I/O Link. The IOLINK block generates an alarm when an I/O Link overrun occurs.

If I/O Link overruns persist, users can reduce the I/O Link traffic by:

- Descreasing the IOP's Scanning Rate parameter [SCANRATE]
- Descreasing the Execution Period of Control Modules containing Output Channel blocks.
- Reducing the number IOPs configured.

See the following table for typical Link Units usage per cycle.

Block Type	Data Processing	Link Units/ Cycle *	Cycle Time
Each Primary and Secondary IOP	Event Collection	1	500 ms
DI, DISOE, DI24V	PV Scanning	1.75	IOP block's SCANRATE
DO, DO32	BACKCALC Scanning	1.25	IOP block's SCANRATE
HLAI, STI, LLMUX, RHMUX	PV Scanning	5	IOP block's SCANRATE
LLAI	PV Scanning	3	IOP block's SCANRATE
AO Channel	BACKCALC Scanning	1	IOP block's SCANRATE
AO Channel	OP Store	1	OP connector's CM Execution Rate
DO Channel (status output)	SO Store	1	SO connector's CM Execution Rate
DO Channel (pwm)	BACKCALC Scanning	1	IOP block's SCANRATE
DO Channel (pwm)	OP Store	1	OP connector's CM Execution Rate

Link Unit versus event collection

The frequently used I/O parameters shown in the following table are automatically scanned by the IOLIM as soon as the IOP block is loaded.

IOP Block	Scanned Parameters
HLAI, STI, LLMUX, RHMUX, STI-MV	PV, PVSTS
DI, DISOE, DI24V	PVFL, BADPVFL
DO, DO32	SO, INITREQ

The number of AI and DI channel blocks used does not increase LU consumption. Note the the DO channel blocks used will not increase LU consumption for Back Calculation scanning, but will increase it for each OP or SO store.

Link Unit versus output stores

Outputs are written to the IOPs only when they change. LU consumption increases with the number of output channel blocks configured in the system.

The cycle time used for calculating LUs is the execution period of the Control Module (CM) containing the block connected to the channel's output (OP).

Link Unit calculations

Use the following spreadsheet as an aid in calculating LU totals.

I/O Processors	Scan Rate (ms)	Cycles	Params per Cycle (PVs)	Params per Sec (PVs)	Link Units (Events)	# IOPs		Link Units per IOP		Link Units
DI, DISOE, DI24V	50	20	1.75	35.00	2		X	37	=	0
DI, DISOE, DI24V	100	10	1.75	17.50	2		X	20	=	0
DI, DISOE, DI24V	250	4	1.75	7.00	2		X	9	=	0
DI, DISOE, DI24V	500	2	1.75	3.50	2		X	6	=	0
DI, DISOE, DI24V	1000	1	1.75	1.75	2		X	4	=	0
DI, DISOE, DI24V	2000	0.5	1.75	0.88	2		X	3	=	0

I/O Processors	Scan Rate (ms)	Cycles	Params per Cycle (PVs)	Params per Sec (PVs)	Link Units (Events)	# IOPs		Link Units per IOP		Link Units
DO, DO32	50	20	1.25	25.00	2		X	27	=	0
DO, DO32	100	10	1.25	12.50	2		X	15	=	0
DO, DO32	250	4	1.25	5.00	2		X	7	=	0
DO, DO32	500	2	1.25	2.50	2		X	5	=	0
DO, DO32	1000	1	1.25	1.25	2		X	3	=	0
DO, DO32	2000	0.5	1.25	0.63	2		X	3	=	0
HLAI, STI, LLMUX, RHMUX	50	20	5	100.0 0	2		X	102	=	0
HLAI, STI, LLMUX, RHMUX	100	10	5	50.00	2		X	52	=	0
HLAI, STI, LLMUX, RHMUX	250	4	5	20.00	2		X	22	=	0
HLAI, STI, LLMUX, RHMUX	500	2	5	10.00	2		X	12	=	0
HLAI, STI, LLMUX, RHMUX	1000	1	5	5.00	2		X	7	=	0
HLAI, STI, LLMUX, RHMUX	2000	0.5	5	2.50	2		X	5	=	0
LLAI	50	20	3	60.00	2		X	62	=	0
LLAI	100	10	3	30.00	2		X	32	=	0
LLAI	250	4	3	12.00	2		X	14	=	0
LLAI	500	2	3	6.00	2		X	8	=	0
LLAI	1000	1	3	3.00	2		X	5	=	0
LLAI	2000	0.5	3	1.50	2		X	4	=	0
AO, AO16	All	1	0	0.00	2		X	2	=	0

I/O Processors	Scan Rate (ms)	Cycles	Params per Cycle (PVs)	Params per Sec (PVs)	Link Units (Events)	# IOPs		Link Units per IOP		Link Units
Any Secondary IOP	All	1	0	0.00	2		X	2	=	0
									Subtotal	***0***

I/O Channels	CM Exec Period (ms)	Cycles	Params per Cycle (PVs)	Params per Sec (PVs)	Link Units (Events)	# IOCs		Link Units per IOP		Link Units
AO Connections	50	20	2	40.00	0		X	40	=	0
AO Connections	100	10	2	20.00	0		X	20	=	0
AO Connections	200	5	2	10.00	0		X	10	=	0
AO Connections	500	2	2	4.00	0		X	4	=	0
AO Connections	1000	1	2	2.00	0		X	2	=	0
AO Connections	2000	0.5	2	1.00	0		X	1	=	0
DO Connections	50	20	1	20.00	0		X	20	=	0
DO Connections	100	10	1	10.00	0		X	10	=	0
DO Connections	200	5	1	5.00	0		X	5	=	0
DO Connections	500	2	1	2.00	0		X	2	=	0
DO Connections	1000	1	1	1.00	0		X	1	=	0
DO Connections	2000	0.5	1	0.50	0		X	1	=	0
									Subtotal	***0***
								Total Link Units	**=**	***0***
								I/O Link Bandwidth Used	**=**	***0%***

Monitoring Network Loading

Viewing the ControlNet Loading

Please refer to the *Control Building guide* for more information.

Viewing the Ethernet Loading

Please refer to the *Installation and Migration* guide for more information.

Planning the System Implementation

Introduction

This section suggests ways to plan the PlantScape system implementation. This task involves identifying the skills of plant personnel, identifying testing requirements, and assigning implementation tasks.

Planning the system implementation carefully is the best way to ensure that the system works effectively.

Identifying Current Resources

When identifying resources, ask:

- What knowledge do the people installing PlantScape need?
- What experience do the plant system administrators have with Windows NT or the other operating systems that may be used?
- Have operators used PlantScape before?

The task of identifying the skills of plant personnel will also reveal gaps in their knowledge and the need for training. For details, see the section *Maintaining and Supporting PlantScape*.

Honeywell engineers are available for services such as design, installation, implementation, and system maintenance.

Assigning Implementation Tasks

After identifying the skills and abilities of plant personnel, assign the implementation tasks. There is usually overlap between these tasks. Use personnel and/or hierarchy charts to help identify the skills and abilities of your plant personnel.

What Next?

For help with:

- Installing controllers.

  For general information about a installing and configuring a controller, refer to the documentation that came with the controller.

- Installing third-party hardware.

  For general installation procedures, refer to the documentation that came with the hardware.

- Connecting to the PlantScape server.

  For PlantScape specific details on configuring hardware devices for communications with the server, refer to the *PlantScape Server & Client Installation Guide*.

  For server configuration details, see the *PlantScape Server Configuration Guide* or the Quick Builder on-line help.

- Installing PlantScape Server software and options.

  For details on PlantScape Server and Client software installation issues, refer to the *PlantScape Server & Client Installation Guide* or the *PlantScape Process Software Installation and Upgrade Guide.*

- Configuring PlantScape.

  For details on configuring the PlantScape server, including the options, refer to the *PlantScape Server and Client Configuration Guide*.

  For details on using Quick Builder, refer to the *PlantScape Server and Client Configuration Guide* and Quick Builder on-line help.

  For details on using PlantScape Control Builder to configure points for PlantScape Control Processors, see the *PlantScape Control Building Guide*

  For details on using Display Builder, refer to the *PlantScape Display Building Guide*.

- Using PlantScape.

  For details on using the Station software, refer to the *PlantScape Operators Guide*.

  For details on using Microsoft Excel Data Exchange, refer to the PlantScape *Operators Guide*.

  For details on using the Application Development Library and Network API, refer to the *PlantScape Application Development Guide*.

Maintaining and Supporting PlantScape

This section suggests ways to maintain and support PlantScape.

Maintaining the System

Maintaining the PlantScape system includes tasks like:

- Administering users (adding, changing, or deleting user information)
- Determining the amount of free disk space
- Saving and restoring files and archived events
- Performing regular backups
- Recovering from a hard disk failure
- Gathering troubleshooting information

For details on these tasks, refer to the *PlantScape Administration Guide*.

Determining the Need for Training

Training requirements differ widely from plant to plant. To determine the need for training at your plant, ask:

- Will new employees be using PlantScape?
- Which operating systems do the system supervisors have experience with?
- Which kind of PlantScape options (if any) are going to be implemented, and what experience do plant personnel have with these options?
- What is the best time to conduct training?
- Will training be held on the plant premises or at another location?
- What will be the content of the training?

Training helps to:

- Keep plant personnel up to date on new plant equipment
- Produce qualified personnel to keep different plant shifts running
- Familiarize new personnel with PlantScape
- Educate personnel about new PlantScape features
- Produce interest in PlantScape and elicit feedback about the implementation of the system at the plant
- Gain acceptance of PlantScape from users

If your plant is upgrading from an earlier version of PlantScape, your training requirements will be different than if PlantScape is being implemented for the first time. Plant personnel may need training on new features.

Contact your Honeywell representative for information about training classes at a Honeywell Training Center nearest to you.

Application Licensing Considerations

Licensing Overview

When the user tries to launch an Engineering Tool (for example, Control Builder), the license availability is checked and the tool is launched only if license is available. If the number of that particular Engineering Tool applications exceeds the maximum number permitted, then an error will be reported to the user and an error message will be logged into the Engineering Tools error log.

<Error Message><Description>

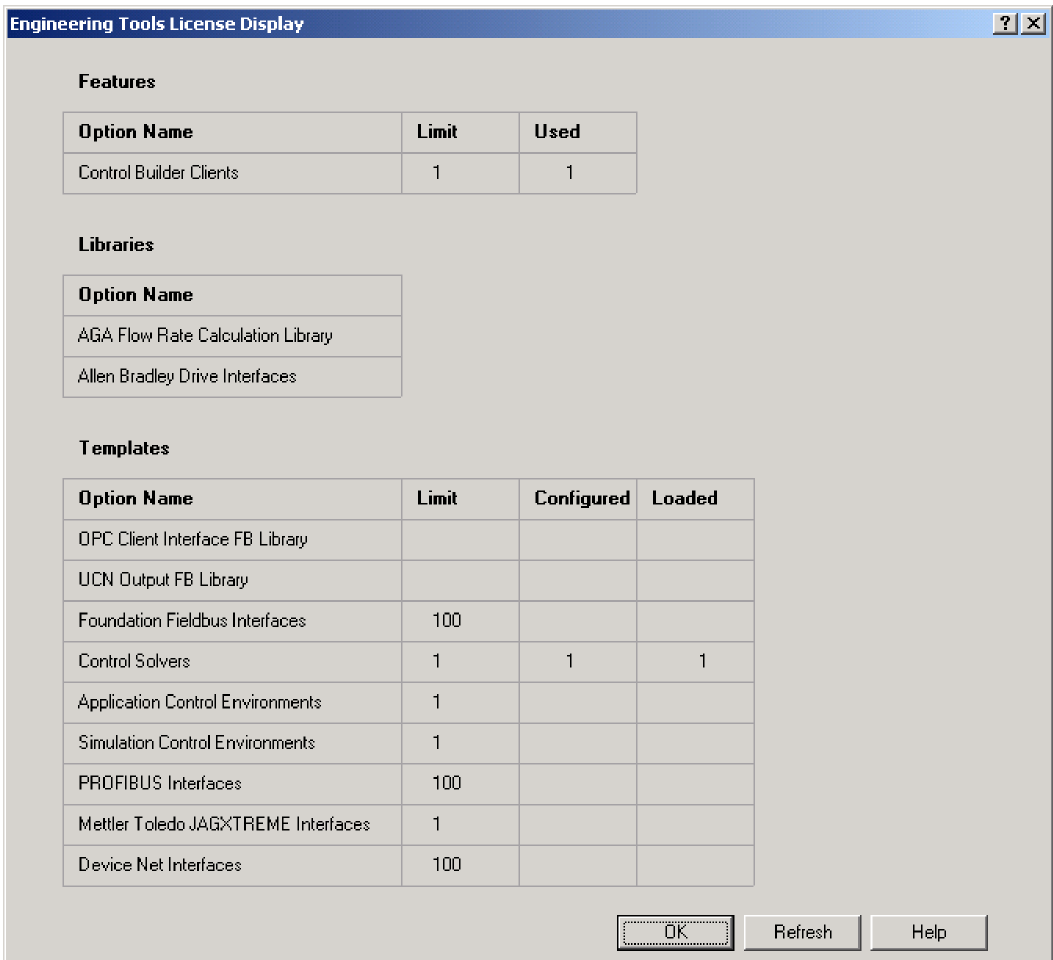
For Example,

PS_E_<Applcation Name>LAUNCHLICLIMITERROR <Application Name> can not be launched. Maximum Licensed number <Number> exceeded.

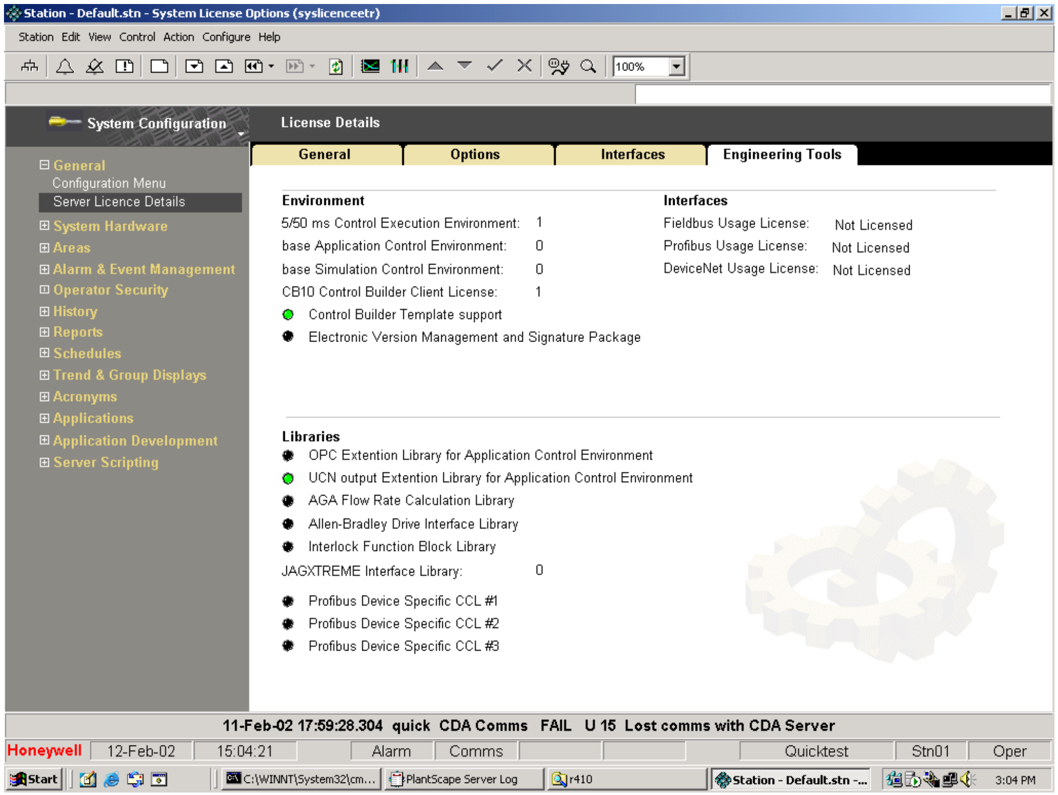
Licensing will be checked when:	Possible result:
• Launching Control Builder	• Error
• Configuring Function Blocks	• Warning
• Loading Function Blocks	• Error

Viewing Licenses

- To view licenses in Control Bulder, select Tools -> License Display.



- To view licenses in Station, select Configure -> Server License Details. Select the Engineering Tools tab.



Whenever the license information of any of the options changes, the Refresh button must be used.

License Validation

Licensing at Configuration time

During Configuration, warnings will be generated if the user configures a block that exceeds the licensed capability. The user will be allowed to continue or cancel the configuration. Basic Block warnings will be generated when the chart is closed. Warnings for tagged objects are generated at Instantiation time. Warnings will be logged into the Engineering Tools error log, using standard error reporting interfaces.

The Warning Dialog is given below,

<Warning Message> < Description >

For Example,

PS_E_<ET Name>_<FB Name. Member name>LICLIMITWARNING <FB name> configuration exceeded the maximum licensed limit <number>

Licensing at Load time

During load time, an error message will be displayed if a block load is attempted that exceeds the licensed capabilities. The function block will not be loaded, and the error will also be logged to the Engineering Tools error log, using standard error reporting interfaces.

The Error Dialog is given below,

<Error Message> < Description >

For Example,

PS_E_<ET Name><Template Name>LOADFAILERROR <FB name.membername> Load exceeded the maximum licensed limit <number>

PS_E_<ETName>BLKLOADFAIL <FB Name> Load failed.

There are three ways of loading a function block:

Load from Project:	License checks will be applied.
Load from Snapshot:	License checks will not be applied.
Load from Monitoring:	License checks will not be applied.

Multiple Block Load scenario

In case of multiple block load scenarios, where the user loads more than one block at a time, the load can continue even if there is an error. The blocks exceeding the licensed capabilities will not be loaded, and all other blocks will be loaded to the controller. An Error will be reported and logged to the error log indicating the blocks not loaded.

Attempting to launch an Engineering Tool when the license limit is reached

The license availability is checked and an error is reported to the user that the number of simultaneous applications exceeded the licensed number. The severity will be indicated by a stop icon in the error message box. The user will not be able to launch that application. And an error message will be logged into the PlantScape Engineering tools error log.

Handling Application failures

Whenever a new application is launched, an attempt will be made to communicate with the other instances of the tool to ensure that they are still running. If there is a communication failure or communication time out due to crashing of any of the application, that particular application will not be included in license checks.

Maintaining Licensing Information

License information is refreshed upon SR Service startup.

Appendix A

Corrosion Protection Planning

Conformal coating versus corrosion

Corrosion is one of the leading causes of electronic printed circuit assembly board failure in harsh environments. One method used to protect printed circuit boards used in harsh environments is to conformally coat them with a thin layer of a special plastic material. The conformal coating is resistant to the corrosive effects of humidity and most chemical gases to extend the life of the printed circuit assemblies.

The following table recommends the minimum equipment requirement that is based on environmental classification tests at the site where the equipment is installed.

Environment Classification Minimum	Equipment Requirement
Mild (G1)	No conformal coating
Moderate (G2)	Conformal coating
Harsh (G3)	Conformal coating
Severe (Gx)	Conformal coating and installation in an environmentally hardened enclosure

G3 rating

All coated assemblies will withstand the effects of a G3 (harsh) rated environment. Uncoated boards are rated for mild (G1) environments. A harsh environment is defined by ANSI/ISA-S71.04-1985, “Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminates.”

The following table defines environmental harshness levels for airborne contaminates as defined by ANSI/ISA-S71.04-1985.

Severity Level	G1 (Mild)	G2 (Moderate)	G3 (Harsh)	Gx (Severe)
Copper Reactivity Level (Angstroms/Month)	Less than 300	Less than 1000	Less than 2000	Greater than or equal to 2000
Contaminant Gas	***Concentration (Parts/Billion)***			
Group A H_2S	Less than 3	Less than 10	Less than 50	Greater than or equal to 50

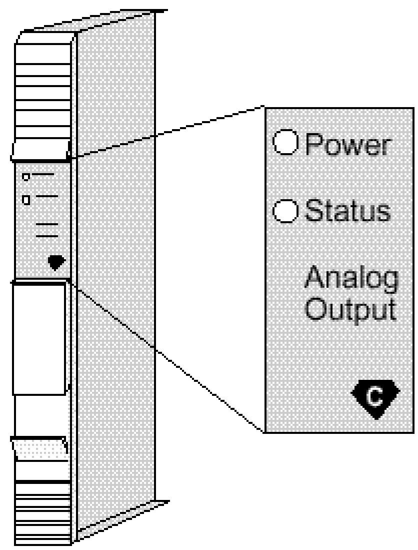
Severity Level	G1 (Mild)	G2 (Moderate)	G3 (Harsh)	Gx (Severe)
SO_2, SO_3	Less than 10	Less than 100	Less than 300	Greater than or equal to 300
Cl_2	Less than 1	Less than 2	Less than 10	Greater than or equal to 10
NO_X	Less than 50	Less than 125	Less than 1250	Greater than or equal to 1250
Group B HF	Less than 1	Less than 2	Less than 10	Greater than or equal to 10
NH_3	Less than 500	Less than 10,000	Less than 25,000	Greater than or equal to 25,000
O_3	Less than 2	Less than 25	Less than 100	Greater than or equal to 100

Gas concentrations

Gas concentrations are for reference purposes only and are believed to approximate the reactivity levels, assuming relative humidity is less than 50 percent. For each 10 percent increase in relative humidity above 50 percent, or change in relative humidity by greater than 6 percent/hour, the severity level can be expected to increase by one

Conformal coating symbol

Conformally coated assemblies can be easily identified by a distinctive symbol located on the assembly. The symbol consists of a “C” that is surrounded by a solid diamond. The diamond universally symbolizes hardness. The symbol is intended to represent the hardened protection against harsh environments that conformal coating provides. The following figure shows the symbol on the faceplate of an Analog Output IOP.



Harsh Environment Enclosure

If the IOPs must be located in a severe environment, Honeywell offers a harsh environment enclosure that is capable of withstanding a Gx rated atmosphere. This enclosure features a sealed NEMA 4x stainless steel cabinet, a special 7-Slot card file with fans for air circulation to house conformally coated IOP and I/O Link Extender cards, and a 24 Vdc Power System that uses components found in the AC Only Power System. There is no active external cooling required for external ambient temperatures of up to 60°C (140°F). The IOPs interface with the local IOP in the control room by fiber optic I/O Link Extender. Standard IOP to FTA cables that are enclosed in sealed conduit provide the IOP to associated FTA interface. The FTAs are mounted in sealed NEMA 4x stainless steel cabinet that is provided by the user.

Model and assembly numbering schemes for conformal coating

Model numbers for conformally coated assemblies and upgrade kits are identified by a "MC" prefix, instead of the normal "MU" prefix for a noncoated assembly. For example, the model number for a Low Level Analog Input IOP with conformal coating is MC-PAIL02 and the model number for the same IOP without conformal coating is MU-PAIL02.

Typically, the part number's tab for a conformally coated assembly has the format "x5x" (non-CE Compliant) or "x7x" (CE Compliant), where "x" can be any number, 1 through 9. This provides a standard method of identifying conformally coated assemblies.

Appendix B

Fiber Optic Cable Routing

Routing methods

You can route Fiber optic cable underground (with direct burial cable), through the air (with outdoor aerial cable), or in cable and electrical wiring trays. Fiber optic cable is immune to interference from electromagnetic fields or transmissions. Fiber optic cable is safe to route through intrinsically safe areas with no danger of explosion.

Cable A and B separation

Route the A and B fiber links to the destination by different routes to avoid simultaneously damaging or cutting both cables.

ATTENTION

The difference in the total length of the routed Link A and Link B cables must be less than 500 meters (1640 feet) to limit the communications delay difference.

Direct burial hazards

You can bury heavy-duty cables directly in the ground. Use cable with a durable polyethylene.jacket material and an inner layer of steel armor to provide some protection from the effects for the following conditions -

- Freezing water,
- Heaving of rocks caused by the ground freezing,
- Ground disruption because of construction, and
- Rodents.

You can also choose to bury conduit or polyethylene pipe and run cable through it.

Aerial lashing methods

Aerial Lashing methods are similar to those used for electrical cables. Most cables are compatible with helical lashing, clamping, or tied mounting.

Vertical cable clamping

You must firmly clamp cable in vertical trays, raceways, or shafts at frequent intervals to support cable weight evenly. Clamping intervals can be as short as one meter (3.3 feet) outdoors to prevent wind slapping and minimize ice loading, or as long as 15 meters (49.2 feet) in interior locations.

Vertical fiber migration consideration

Fiber in vertical installations does not break because of its own weight; however, for vertical runs of 15 meters (49.2 feet), and greater, excess fiber can migrate downward. The crowding of excess fiber at the bottom can cause an increase in attenuation.

You can reduce this downward migration of fiber in vertical runs by placing loops in the cable, approximately 0.3 to 0.5 meter (1 to 1.5 feet) in diameter, at the top, bottom, and at 15-meter (50-feet) intervals.

Cable jacket indoor building code restrictions

Building code requirements frequently do not allow cables with polyethylene jackets to be used indoors. Jackets of polyvinyl chloride are frequently restricted to conduits, while floropolymer or other approved jacket material is required for use in cable trays and air plenums. Cable with suitable jacket material must be selected for the application.

Loose buffered cable usage

Where ambient temperature variations are 20°C (68°F) or greater on a daily basis, the life of the fibers can be significantly reduced. In applications where the ambient temperature is not controlled, loose buffered cable must be specified.

Loose buffered cable is available in polyethylene jacket material only. Fire codes may dictate that the indoor portion of the cable installation be in metal conduit, or if the temperature is controlled, a splice may be required to convert to a tight buffer cable with a PVC or Fluoride Co-Polymer jacket material.

Multiple-fiber cable requirements

Two fibers are required for one link, one for transmit and one for receive. Fiber loss is measured at 22°C (72°F) ±3° and is usually stated as a mean value. Individual fiber losses may be as much as 25 percent greater than the mean.

As insurance against future damage, such as fiber breakage, or encountering excessive loss in any one fiber, consider the inclusion of spare fibers. This is especially important for cables that have high installation cost.

Indoor cable bend restrictions

Fiber optic cable is easily damaged by over bending or kinking the cable, so a minimum bend radius is established for each different cable size and cable construction. Indoor cable is the most flexible and outdoor direct burial cable is the least flexible. The following table specifies the minimum bend radius for indoor cable.

In the table, short term minimum bend radius refers to the minimum bend radius that is safe during installation. Long term minimum bend radius refers to the minimum bend radius that is safe after the cable installation is completed and settled.

Fibers Per Cable	Minimum Bend Radius (Short Term)	Minimum Bend Radius (Long Term)
2	17.0 cm (6.7 in.)	13.0 cm (5.1 in.)
4	22.0 cm (8.7 in.)	16.5 cm (6.6 in.)
6	26.0 cm (6.7 in.)	20.0 cm (7.9 in.)
8	30.0 cm (6.7 in.)	23.0 cm (9.0 in.)

Cable Construction and Installation

Fiber optic cable selection

The selection of fiber optic cable is dependent upon satisfying installation and environmental requirements without exceeding the maximum optical losses. The factors to be considered when selecting the cable are:

- The total fiber optic cable losses,
- The cable requirements caused by the desired routing. Routing requirements can include direct burial, conduits, trays, raceways, plenums, etc., and
- The construction code requirements

62.5 micron cables

Use of 62.5 micron cable is controlled by Honeywell purchase specification 51190918 for indoor cable and Honeywell purchase specification 51190919 for outdoor cable. Indoor cables are available with 2, 4, or 6 fibers. Outdoor aerial and direct burial cables are available with 4, 6, or 8 fibers.

Installation precautions

The installation procedures for placement of fiber optic cables are the same as for electrical wires. Be sure to avoid yanking, flipping, or wrapping that can result in unnecessary tightening of the fibers. Do subject fiber optic cables to foot traffic or crushing forces. Avoid sharp bending and scraping at entrances and covers.

ATTENTION

We recommend that the fiber optic cable be installed by professional installation contractors. The installers will provide the cable, install the cable, attach ST-type connectors, and do the OTDR test.

Cable Splices and Connections

Cabling design considerations

When planning a system installation, design the cabling to have the minimum number of splices. For example, convert outdoor cable to indoor cable when entering a cabinet where the bend radius of outdoor cable will not fit in the cabinet. Where this splicing must be made, sufficient cable length must be provided for a splice loop. Thirty to 45 centimeters (12 to 18 inches) on each cable end is the usual allowance for a service loop. Also, when entering the equipment cabinet, sufficient cable length must be allowed for breakout (stripping and fanning out) and termination of the individual fibers.

Cable splice protection

Completed splices cannot withstand tensile forces and must be housed in a strain relief assembly. Moisture entry into the splice can cause degradation of performance; therefore, the splice enclosure must be sealed, and if necessary, the splice encapsulated to minimize moisture entry.

Cable breakout

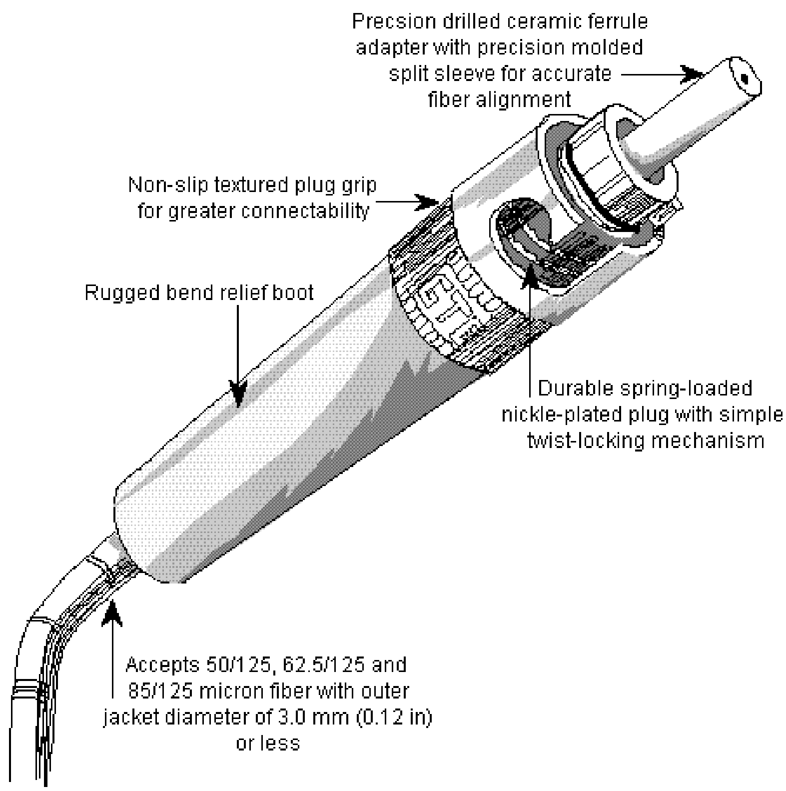
Breakout eliminates the outer sheath, leaving the more flexible individual fibers for routing within the cabinet. Tight buffer indoor cables provide strength members with each fiber, eliminating the need to use breakout kits to add strength members for each fiber.

Use of a breakout kit

In outdoor loose-buffered, gel-filled cable designs, there is no strength member or protective jacket for the individual fibers. To terminate and use this type of cable requires the use of a breakout or fan-out kit. The kit provides strength members with flexible jackets that are placed over the fibers after the outer jacket is removed. These kits can be installed over fibers as much as ten meters (33 feet) in length. The kit provides fiber protection for in-cabinet routing and termination.

Cables with connectors preinstalled

If the cable length is accurately determined and the cable does not have to be pulled through a conduit, the cables can be ordered with connectors installed on the ends. This requires less field skill and installation time. ST-type connectors, as shown in the following figure, can also be used as a means of splicing two cables; however, to minimize losses at or near maximum cable lengths, professional installation is required using fusion splices.



Signal Loss Budget

Calculation

The fiber cable signal loss budget is the difference between the transmit power and the minimum receiver sensitivity, minus the desired signal loss margin. The basic calculation formula is as follows.

Transmit Power - Receiver Sensitivity = Budgeted Losses

The values used differ for the standard type I/O Link Extender and the long distance type I/O Link Extender as follows.

Component	Standard Type Extender dB Level	Long Distance Type Extender dB Level.
Transmitter (62.5 micron fiber)	-16.0	-18.0
Receiver	(-) -24.0 / 8.0	(-) -31.5 / 13.5
Less power loss over time	(-) 2.5 / power in next row	(-) 4.5 / power in next row
Available optical cable power	5.5	9.0

ATTENTION

Because the maximum transmitter output level is -7 dB, and the maximum receiver input level is -10 dB, the receiver may be overdriven on a short link and may require a 3 dB attenuator. Connector allowances for the transmitter and receiver are included in the above power declaration.

Types of splices

The two types of splices are:

- Mechanical, and
- Fusion.

The mechanical-type of splice consists of a glass tube into which the fiber is secured by ultra violet (UV) curable epoxy.

The fusion-type splice is produced by carefully aligning the fibers and then fusing them together by heating the fibers.

In both cases, the signal loss in the resulting splice is very dependent upon the skill of the installer. The losses at all splices and cable installations need to be certified and recorded at the time of installation for future reference.

The following tables list typical cable and power losses for the standard and long distance type I/O Link Extenders based on the type of splice and cable used. .

Type of Splice	Average Power Loss (dB)	Maximum Power Loss (dB)
Fusion	0.2	0.3
Mechanical	0.3	0.5
ST - Connector	0.5	0.9

Type of Cable	Average Cable Loss (dB)		Maximum Cable Loss (dB)	
	Standard Extender (@ 850 nm)	***Long Distance Extender (@ 1300 nm)***	***Standard Extender (@ 850 nm)***	***Long Distance Extender (@ 1300 nm)***
High Performance	3.75	1.5	4.0	2.0
Premium	3.50	1.0	4.0	2.0

Cable distance calculation

Use one of the following formulas to calculate the maximum distance the cable can reliably span for a standard type or long distance type I/O Link Extender, respectively.

Standard Type:	5.5 - (losses in Splices) / Maximum cable loss in dB/km	= D, the distance
Long Distance Type:	9.0 - (losses in Splices) / Maximum cable loss in dB/km	= D, the distance

Example: the maximum distance for a Premium Performance cable with two fusion splices can be calculated as follows using power and cable loss values from the previous tables for a given I/O Link Extender type.

Standard Type:	5.5 - (2 x 0.3) / 4	= 1.2 km
Long Distance Type:	9.0 - (2 x 0.3) / 2	= 4.2 km

Example: the maximum distance for High Performance cable with two mechanical splices can be calculated as follows using power and cable loss values from the previous tables for a given I/O Link Extender type.

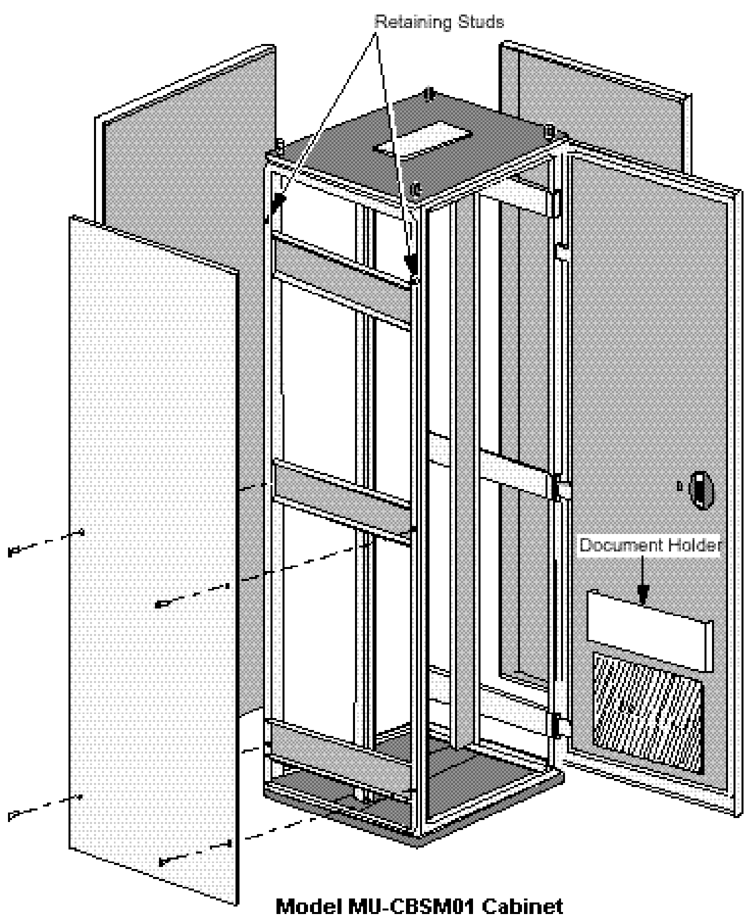
Standard Type:	5.5 - (2 x 0.5) / 4	= 1.12 km
Long Distance Type:	9.0 - (2 x 0.5) / 2	= 4.0 km

Appendix C

Model MU-CBSM01/MU-CBDM01 Cabinets

Model MU-CBSM01 Single-access cabinet

The single-access cabinet has one equipment entry point and that is in the front of the cabinet through a single door. The IOP card files, Power System, and the FTA Mounting Channels are installed inside the single-access door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBSM01 single-access cabinet.

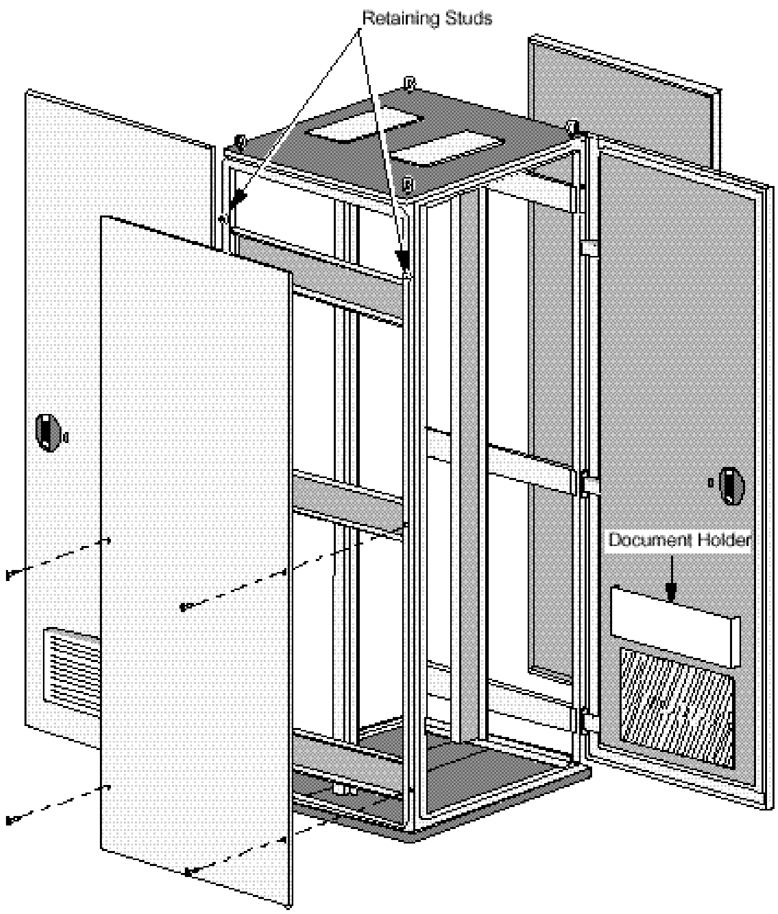


Model MU-CBSM01 Cabinet

Dimension	Width	Depth	Height
Single Access	.8 m/31.5 in.	.55 m/21.75	2.1 m/81.5 in.

Model MU-CBDM01 Dual-access cabinet

The dual-access cabinet has two entry doors. The IOP card files and the Power System are mounted inside the front access door. The FTA Mounting Channels are normally installed inside the rear door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBDM01 dual-access cabinet.



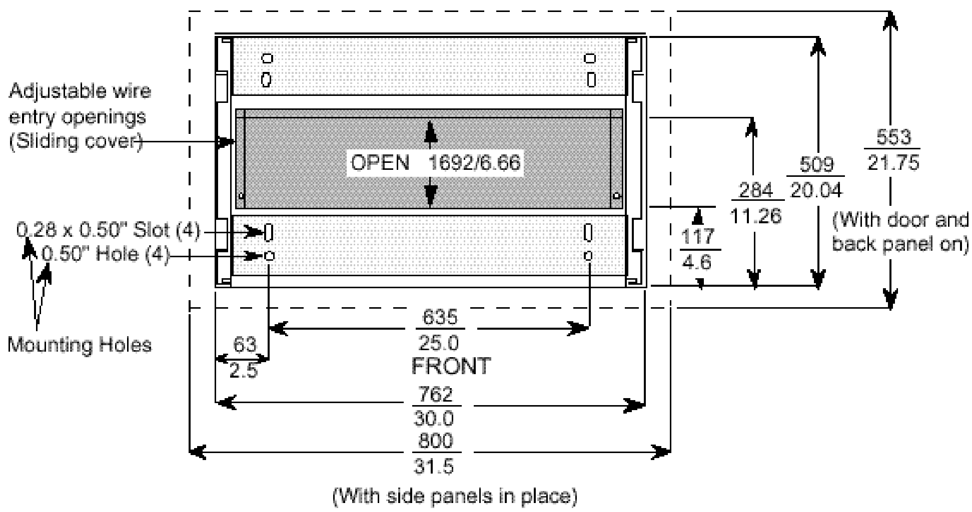
Model MU-CBDM01 Cabinet

Dimensions	Width	Depth	Height
Dual Access	.8 m/31.5 in.	.8 m/31.5 in.	2.1 m/81.5 in.

Top and bottom cabinet entry

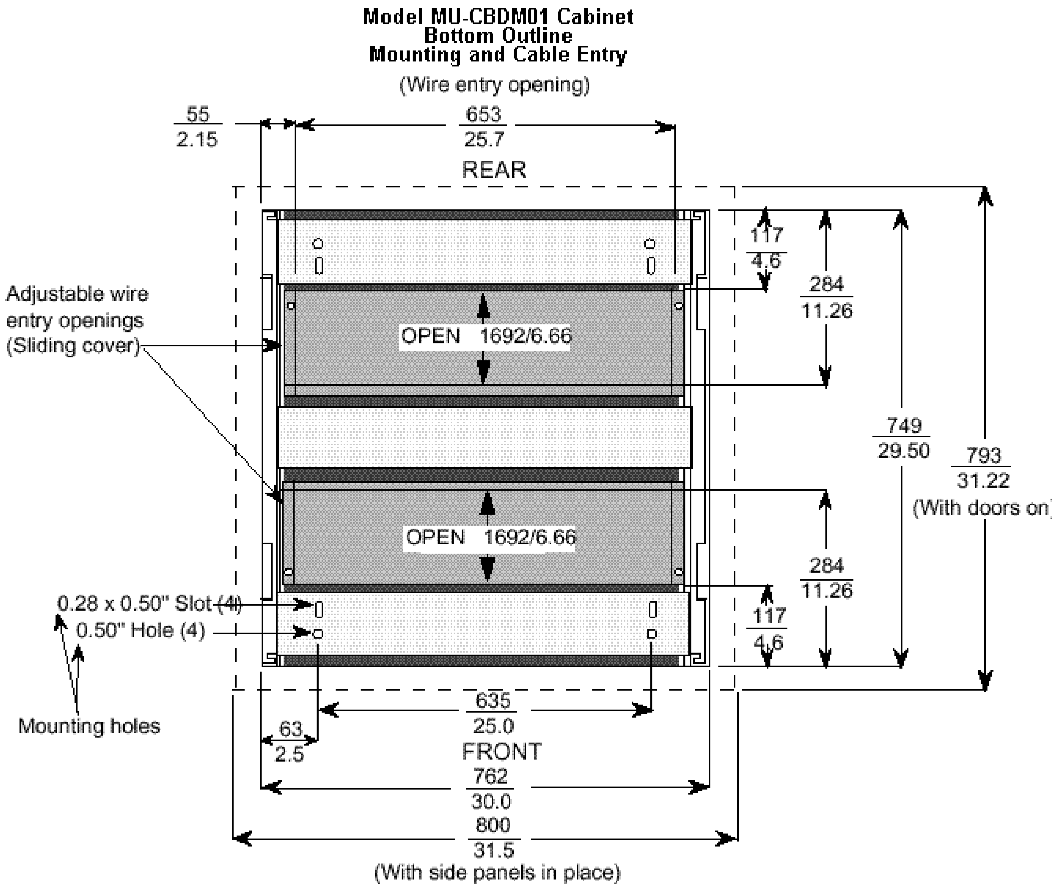
Both cabinets are NEMA 1 rated and support top and bottom entry for process control wiring. Top entry requires removal of the top panel(s), and/or associated fan assemblies, before entry holes can be punched in the panel. Honeywell will prepunch the holes if specified when ordering the cabinet. The following figures are illustrations of the bottom cable entry slots for the single and dual cabinets, respectively.

Model MU-CBSM01 Cabinet
Bottom Outline
Mounting and Cable Entry



Foot print ⟹ 800 x 572 mm/31.5 x 22.5 " (External dimensions - door and panels installed)

Note: Dimensions are in millimeters/inches.



Foot print ⟹ 800 x 800 mm/31.5 x 31.5 " (External dimensions - doors and panels installed)

Note: Dimensions are in millimeters/inches.

Independent cabinet entry

The dual-access cabinet has two independent entry doors. A single access cabinet has only one entry side. Card files and the Power System, or FTA Mounting Channels can be installed in either side of the cabinet without being constrained by the equipment installed in the other side of the cabinet. The cabinet can be ordered with doors hinged on either the left or right side. The door latch is recessed and lockable.

Cabinet complexing

A maximum of four cabinets can be complexed together without intervening side panels by a complexing kit, Honeywell part number 51109532-200 (single access cabinet) or 51109532-100 (dual access cabinet).

NEMA 12

NEMA 12 rated cabinets can be ordered from Honeywell.

Cabinet cooling

Cabinet cooling is accomplished by the use of one or more fan assemblies that are mounted over appropriate cutouts in the cabinet top. Use of a fan assembly is mandatory for a cabinet entry side containing card files or a Power System. Because of power dissipation, the cabinet configuration determines if a fan assembly is required for a cabinet entry side containing Field Termination Assemblies (FTAs). A fan assembly is mandatory when Galvanically Isolated FTAs are installed. Fan assemblies are available for voltages and frequencies noted below:

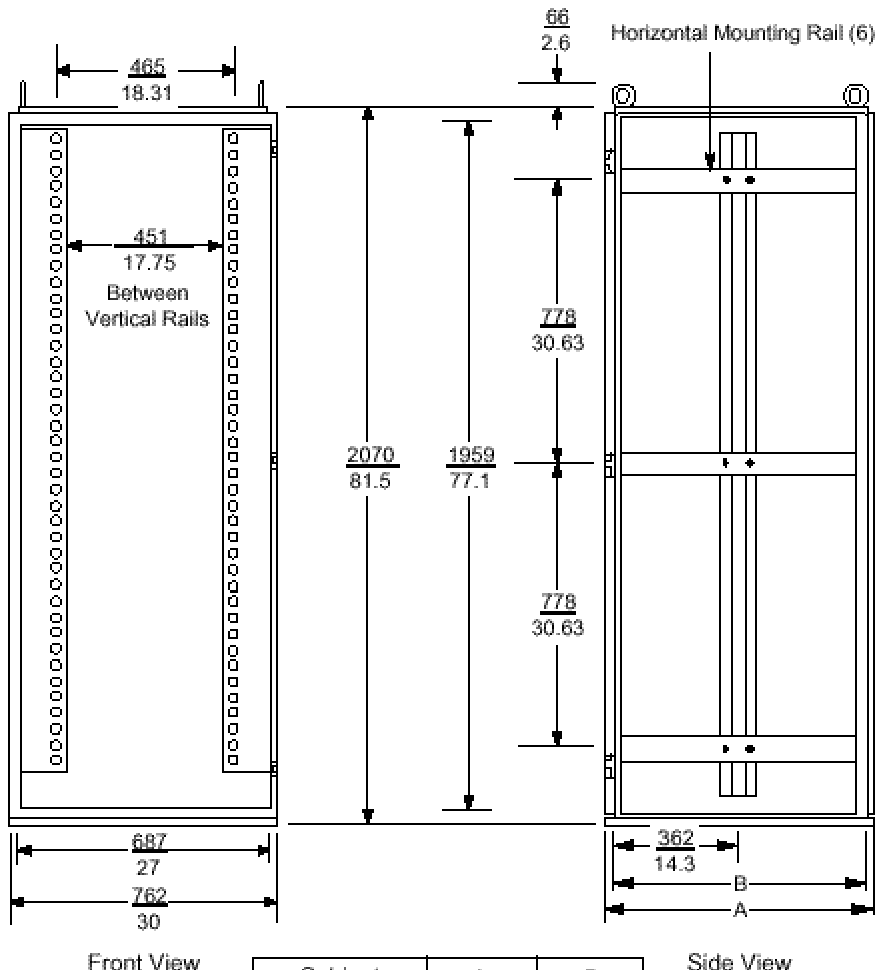
- Cabinet Fan Assembly (240 Vac, 50/60 Hz)
- Cabinet Fan Assembly (120 Vac, 50/60 Hz)

A blank plate is available to cover the hole(s) in the top of the cabinet in the event a fan assembly is not needed. The fan opening cabinet top cover plate is Honeywell part number 51304098-200.

Cabinet internal structure

As shown in the following figure, the cabinet is provided with an internal structure (“infrastructure”) that is capable of accepting a 10-slot Process Controller chassis or a 13-slot one with cabinet modifications, card file assemblies, Power Systems, and FTA Mounting Channels. When installing FTAs, you must specify the FTA Mounting Channels as discussed in the following *FTA Mounting Channel Descriptions* section in this Appendix.

Model MU-CBSM01/MU-CBDM01 Cabinet Interior Dimensions



Cabinet	A	B
Dual Access	793 31.2	749 29.5
Single Access	552 21.7	508 20

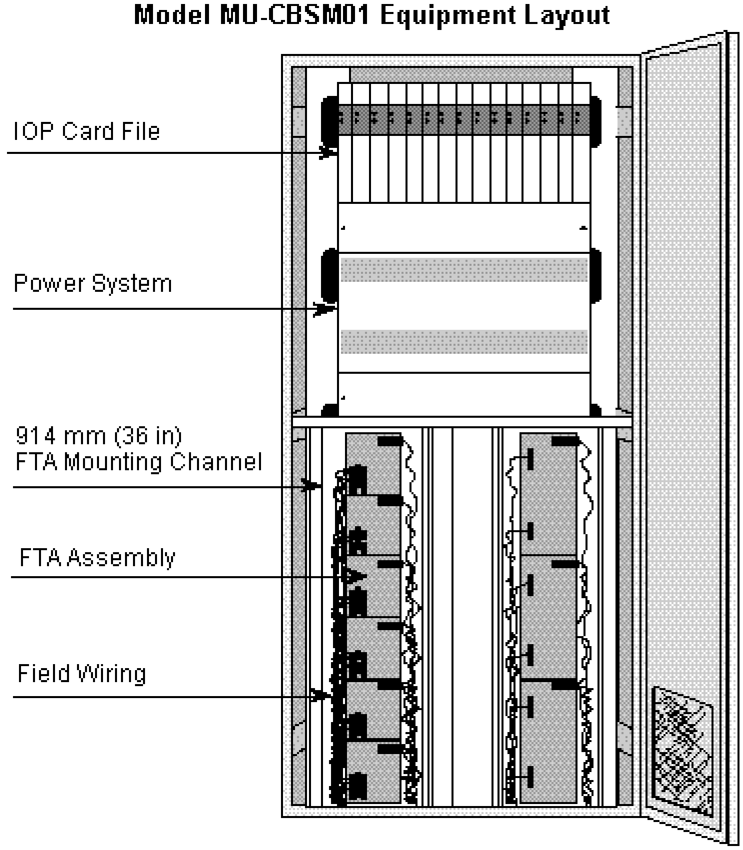
Note: Dimensions are in millimeters/inches.

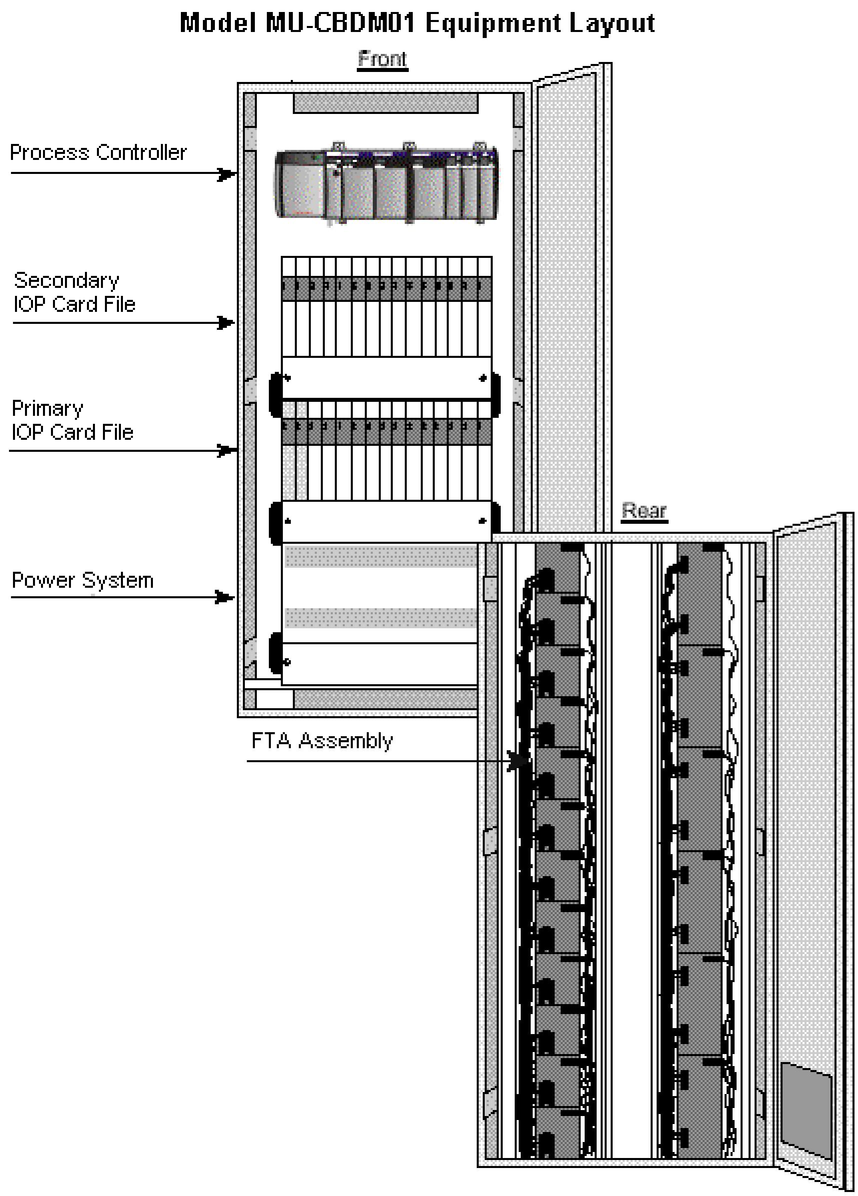
Equipment Configurations

Cabinet equipment layout

The Process Controller chassis, IOP card files, Power System, and FTA Mounting Channels install in the single- and dual-access cabinets as shown in following figures.

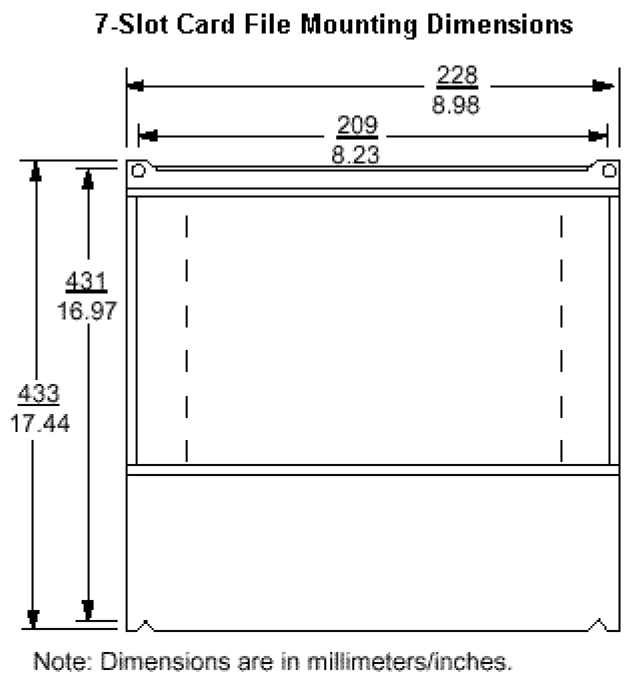
Model MU-CBSM01 Equipment Layout



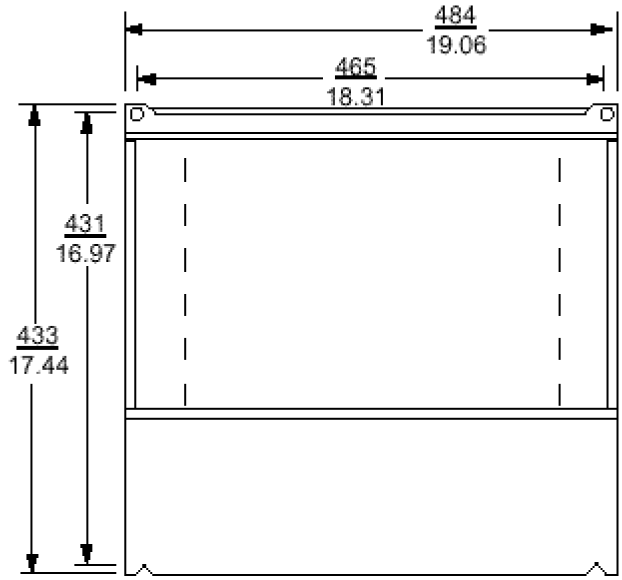

Model MU-CBDM01 Equipment Layout
Front
Process Controller
Secondary
IOP Card File
Primary
IOP Card File
Power System
Rear
FTA Assembly

Equipment dimension references

The following figures show the mounting dimensions for 7-slot and 15-slot card files and the power system for reference. Please see the *Chassis-Mounting Dimensions* section in the Control Hardware Installation Guide in Knowledge builder for Process Controller mounting dimensions.

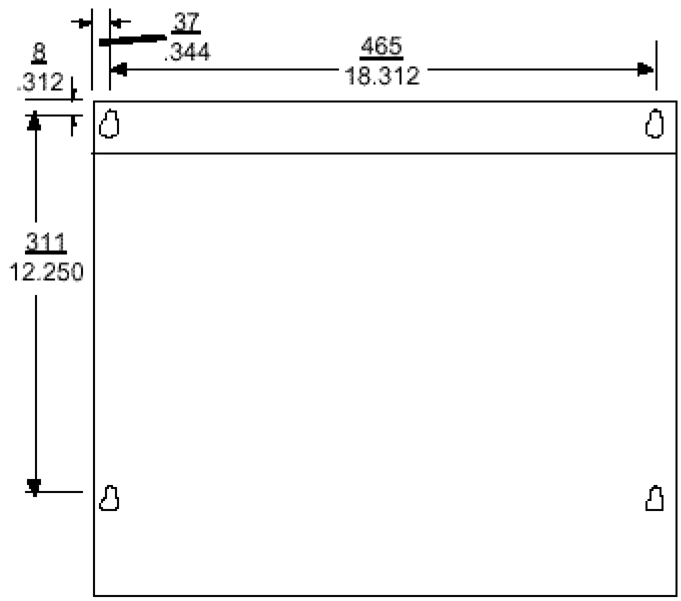


15-Slot Card File Mounting Dimensions



Note: Dimensions are in millimeters/inches.

Power System Mounting Dimensions

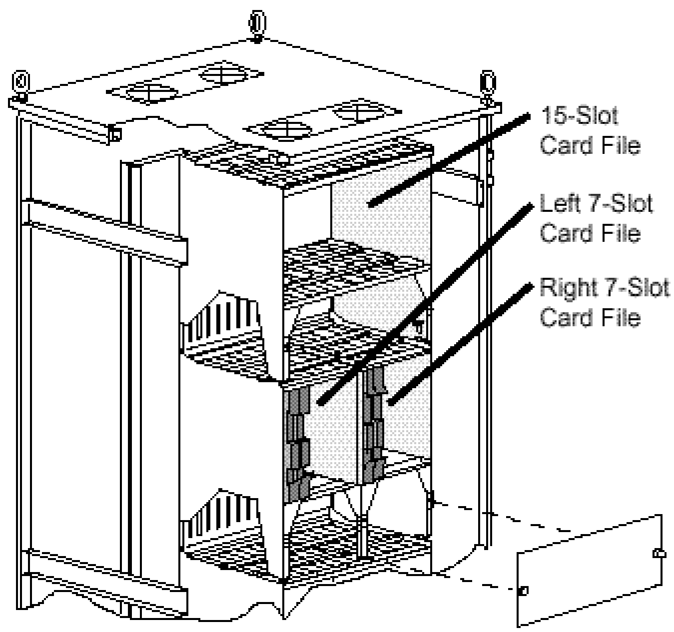


Note: Dimensions are in millimeters/inches.

7-Slot and 15-Slot card files installation

There are three types of card file assemblies, Left 7-Slot, Right 7-Slot, and 15-Slot. The Left and Right 7-Slot card files are the same size and are intended to be mounted adjacent to each other on the cabinet's 19-inch RETMA mounting infrastructure by using appropriate hardware. The 15-Slot card file mounts alone on the 19-inch RETMA mounting infrastructure. The following figure illustrates the installation of Left and Right 7-Slot and 15-Slot card files in a side-by-side configuration.

Typical 7-Slot and 15-Slot Card File Installation



FTA Mounting Channel Configurations

Vertical FTA Mounting Channel layout

ATTENTION

- It was previously a requirement that Galvanically Isolated, Intrinsically Safe (GI/IS) FTAs had to be mounted on horizontally oriented FTA Mounting Channels in an IOP cabinet. This is no longer a requirement due to component and design improvements.
- Galvanically Isolated FTAs can now be mounted on vertically oriented FTA Mounting Channels; however, there is still a requirement that Galvanically Isolated FTAs and standard (non-Galvantically Isolated) FTAs, and the wiring to them, be properly separated in the cabinet.

The vertical FTA Mounting Channel length, approximately 93 centimeters (36 inches) is approximately half the height of the cabinet. The FTA Mounting Channels can be mounted adjacent to each other in this vertical area. The FTA mounting configurations will allow:

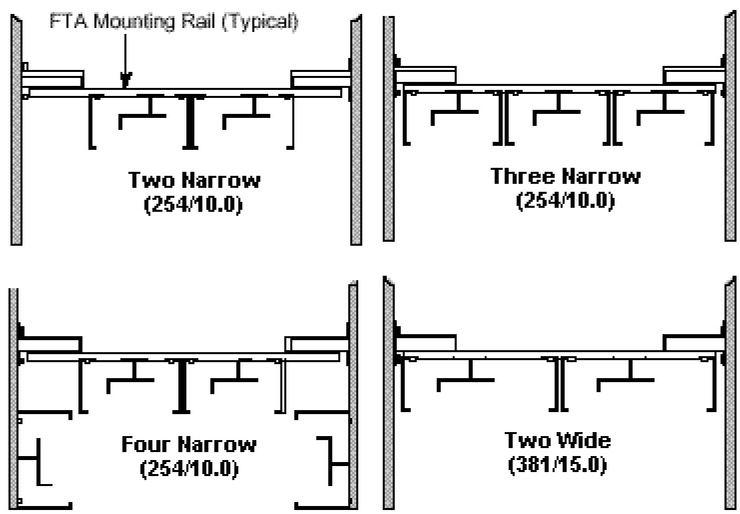
- up to four narrow channels or
- up to three wide channels.

The FTA Mounting Channels can be mounted adjacent to each other in the area below the Power System in a single-access cabinet as shown in the previous cabinet layout figures.

In the dual-access cabinet, one FTA Mounting Channel is normally installed above another, adjacently in pairs, as shown in the previous cabinet layout figures.

Normal Vertical FTA Mounting Channel orientation

When Standard type FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “normal” position where field wiring enters the left channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the right channel of the FTA Mounting Channel. The following figure shows the normal orientations for four typical vertical FTA Mounting Channel layouts in a cabinet.



Note: Dimensions are in millimeters/inches.

Inverted Vertical FTA Mounting Channel orientation

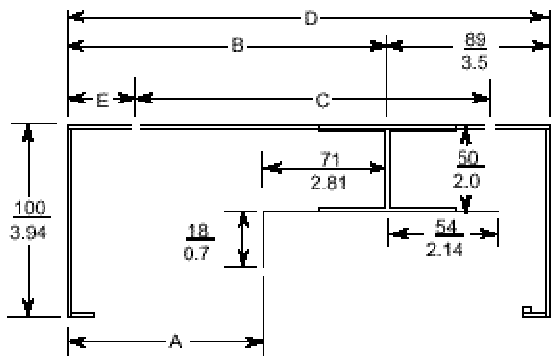
When Galvanically Isolated FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “inverted” position where field wiring enters the right channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the left channel of the FTA Mounting Channel.

CAUTION

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

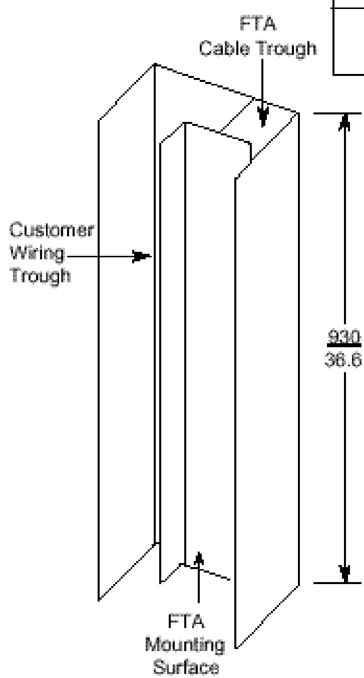
FTA Mounting Channel dimensions

Vertical FTA Mounting Channels are available in narrow and wide widths as shown in the following figure.



Cross Section View

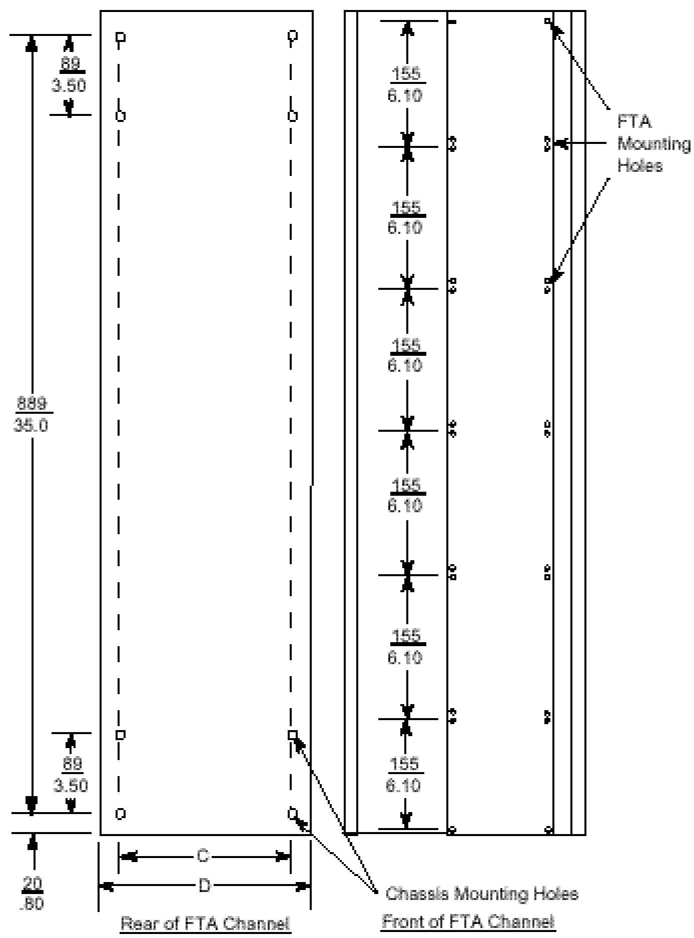
Channel Size	A	B	C	D	E
Wide	220 / 8.7	292 / 11.5	305 / 12.0	381 / 15.0	64 / 2.5
Narrow	94 / 3.7	165 / 6.5	178 / 7.0	254 / 10.0	64 / 2.5



Note: Dimensions are in millimeters/inches.

FTA installation hole locations

The following figure shows the locations of the FTA mounting holes on the FTA Mounting Channel and the holes used to install the FTA Mounting Channel.



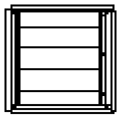
Note: See the previous figure for C and D dimensions.
Dimensions are in millimeters/inches.

IOP Cabinet Floor Planning

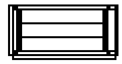
Floor template

The following figure is a cabinet floor template that will help you in planning your facility layout when installing IOP cabinets. The following notes pertain to the template in the following figure.

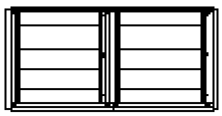
- Cabinet scale is 0.25 inch (6 millimeters) = 1 foot (0.3 meter).
- A dual access cabinet is approximately 30 inches (0.7 meter) by 30 inches (0.7 meter). The side and door panels add 1.5 inches (38 millimeters) to each cabinet dimension. When cabinets are complexed, 1.5 inches (38 millimeters) is added to the total complex dimensions.
- A single access cabinet is approximately 30 inches (0.7 meter) wide and 21 inches (0.5 meter) deep. The side panels and the single door panel add 0.75 inch (19 millimeters) to the cabinet depth and1.5 inches (38 millimeters) to the cabinet width. When cabinets are complexed, 0.75 inch (19 millimeters) is addedto the complex depth and 1.5 inches (38 millimeters) is added to the total complex width.



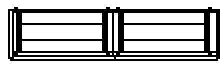
Single Dual Access Cabinet



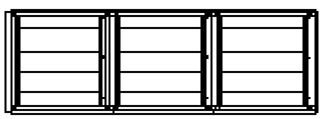
Single Single Access Cabinet



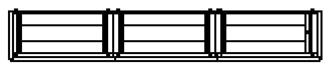
Dual Dual Access Cabinet Complex



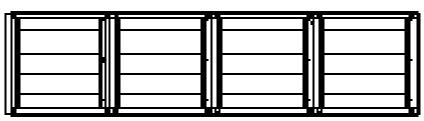
Dual Single Access Cabinet Complex



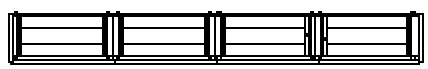
Triple Dual Access Cabinet Complex



Triple Single Access Cabinet Complex



Quad Dual Access Cabinet Complex



Quad Single Access Cabinet Complex

Appendix D

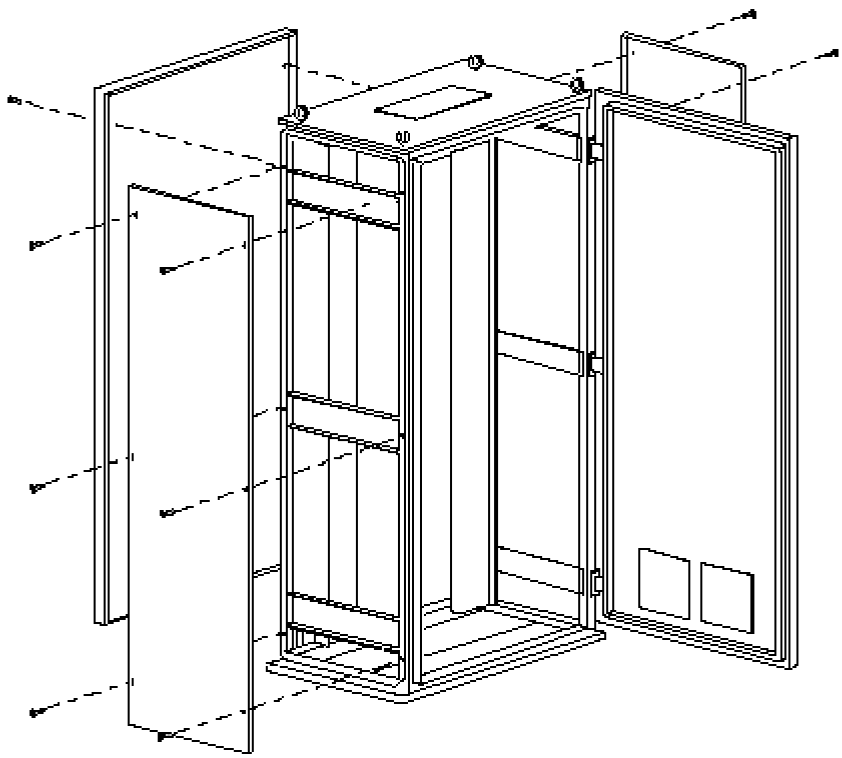
Model MU-CBSX01/MU-CBDX01 Cabinets

CE Compliant

The model MU-CBSX01 and MU-CBDX01 cabinets are CE Compliant. These cabinets are also referred to as Rittal cabinets because Rittal is the manufacturer.

Model MU-CBSX01 Single-access cabinet

The single-access cabinet has one equipment entry point and that is in the front of the cabinet through a single door. The IOP card files, Power System, and the FTA Mounting Channels are installed inside the single-access door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBSX01 single-access cabinet.

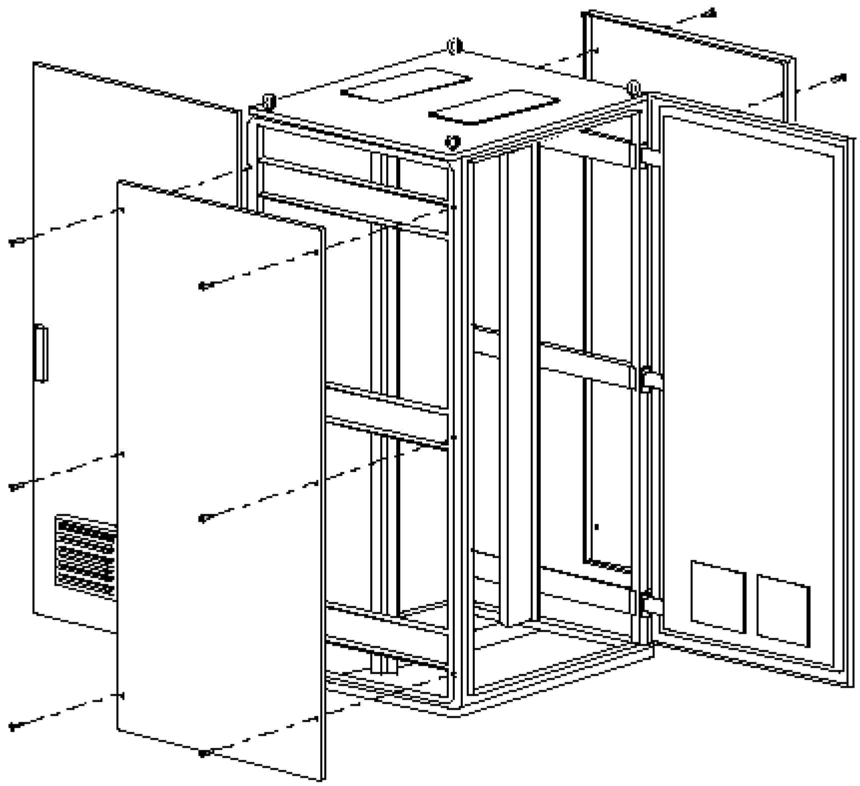


Model MU-CBSX01 Cabinet

Dimension	Width	Depth	Height
Single Access	0.8 m/31.49 in.	0.5 m/19.68 in.	2 m/78.9 in.

Model MU-CBDX01 Dual-access cabinet

The dual-access cabinet has two entry doors. The IOP card files and the Power System are mounted inside the front access door. The FTA Mounting Channels are normally installed inside the rear door. The cabinet side panels can be removed for access. The following figure is an illustration of a model MU-CBDX01 dual-access cabinet.



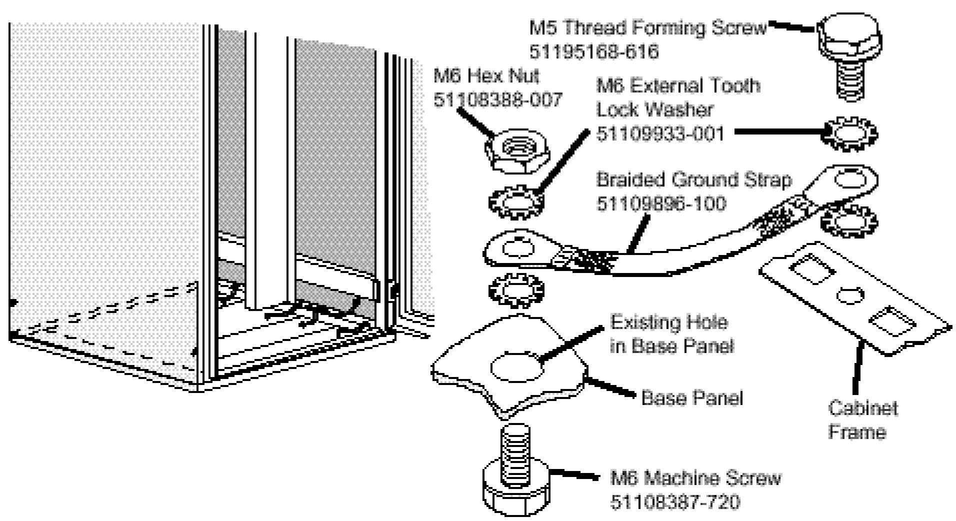
Model MU-CBDX01 Cabinet

Dimensions	Width	Depth	Height
Dual Access	0.8 m/31.49 in.	0.8 m/31.49 in.	2 m/78.9 in.

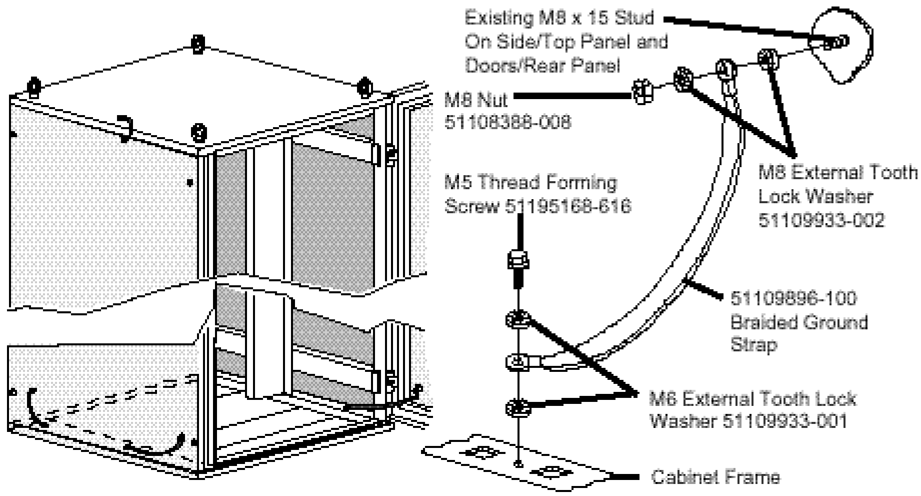
Cabinet grounding methods

CE Compliance versions of the cabinet are identified by the abundance of grounding straps inside the cabinet. All panels and doors are grounded to the cabinet frame by the straps. The following figures show the methods used to ground the cabinet panels and doors.

Cabinet Base Panel Grounding Method



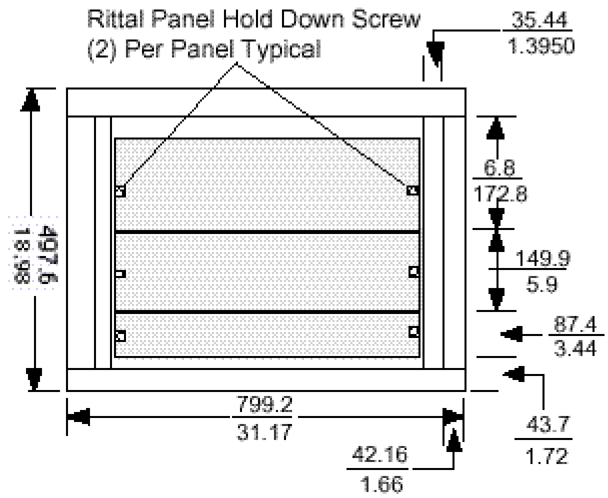
Cabinet Panel and Door Grounding Method



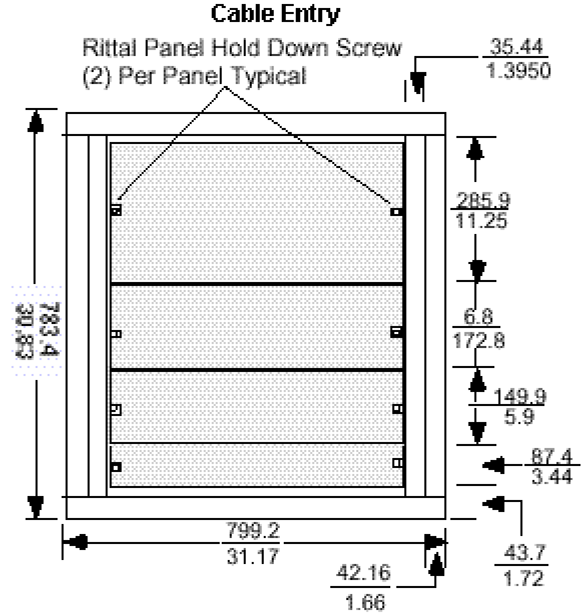
Top and bottom cabinet entry

Both cabinets are NEMA 1 rated and support top and bottom entry for process control wiring. Top entry requires removal of the top panel(s), and/or associated fan assemblies, before entry holes can be punched in the panel. Honeywell will prepunch the holes if specified when ordering the cabinet. The following figures are illustrations of the bottom cable entry slots for the single and dual cabinets, respectively.

Model MU-CBSX01
Bottom Outline
Cable Entry



Model MU-CBDX01
Bottom Outline
Cable Entry



Independent cabinet entry

The dual-access cabinet has two independent entry doors. A single access cabinet has only one entry side. Card files and the Power System, or FTA Mounting Channels can be installed in either side of the cabinet without being constrained by the equipment installed in the other side of the cabinet. The cabinet can be ordered with doors hinged on either the left or right side.

Cabinet complexing

A maximum of four cabinets can be complexed together without intervening side panels by a complexing kit, Honeywell part number 51109524-200 (single access cabinet) or 51109524-100 (dual access cabinet).

NEMA 12

NEMA 12 rated cabinets can be ordered from Honeywell.

Cabinet cooling

Cabinet cooling is accomplished by the use of one or more fan assemblies that are mounted over appropriate cutouts in the cabinet top. Use of a fan assembly is mandatory for a cabinet entry side containing card files or a Power System. Because of power dissipation, the cabinet configuration determines if a fan assembly is required for a cabinet entry side containing Field Termination Assemblies (FTAs). A fan assembly is mandatory when Galvanically Isolated FTAs are installed. Fan assemblies are available for voltages and frequencies noted below:

- Cabinet Fan Assembly (240 Vac, 50/60 Hz)
- Cabinet Fan Assembly (120 Vac, 50/60 Hz)

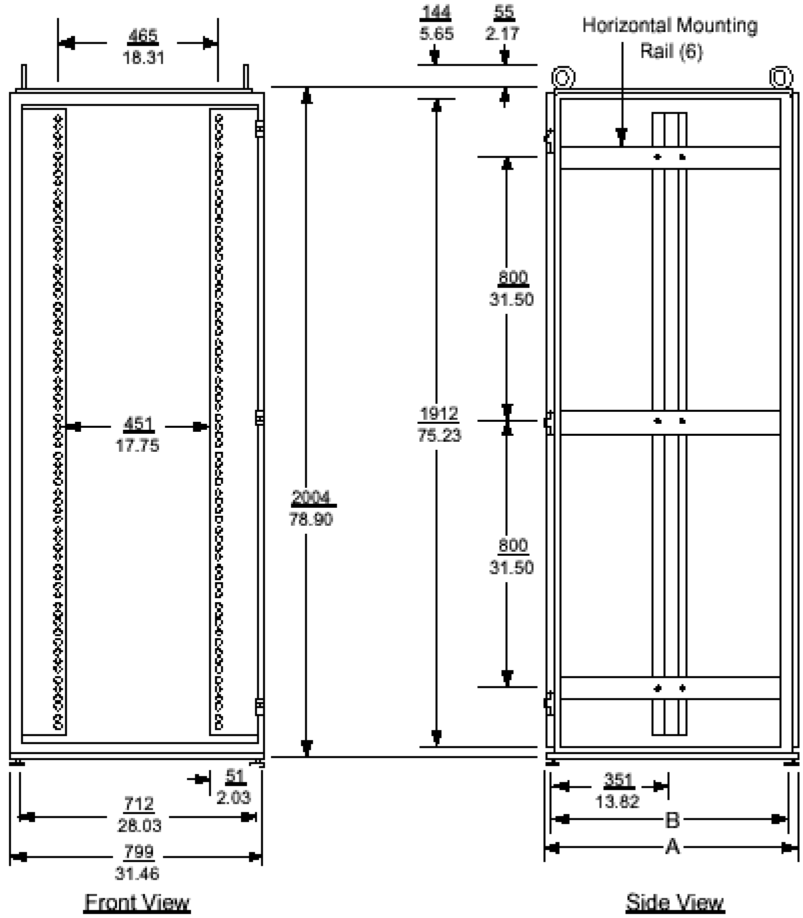
A blank plate is available to cover the hole(s) in the top of the cabinet in the event a fan assembly is not needed. The fan opening cabinet top cover plate is Honeywell part number 51304098-200.

Cabinet internal structure

As shown in the following figure, the cabinet is provided with an internal structure ("infrastructure") that is capable of accepting a 10-slot Process Controller chassis or a 13-slot one with cabinet modifications, card file assemblies, Power Systems, and FTA Mounting Channels. When installing FTAs, you must specify the FTA Mounting

Channels as discussed in the following *FTA Mounting Channel Descriptions* section in this Appendix.

Model MU-CBSX01/MU-CBDX01 Cabinet Interior Dimensions



Cabinet	A	B
Dual Access	789 31.06	702 27.64
Single Access	489 19.25	402 15.83

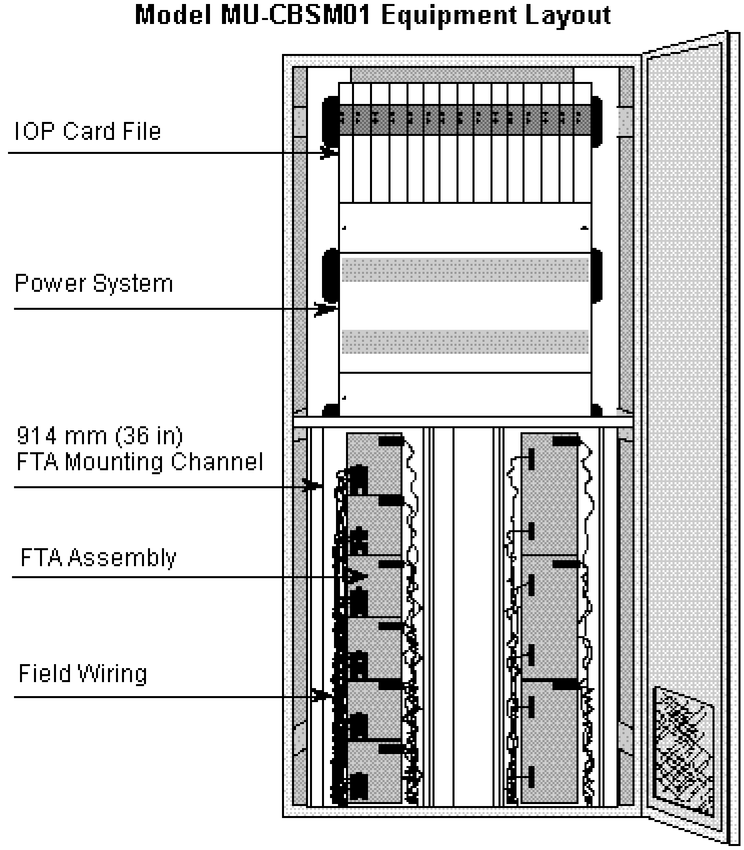
Note: Dimensions are in millimeters/inches.

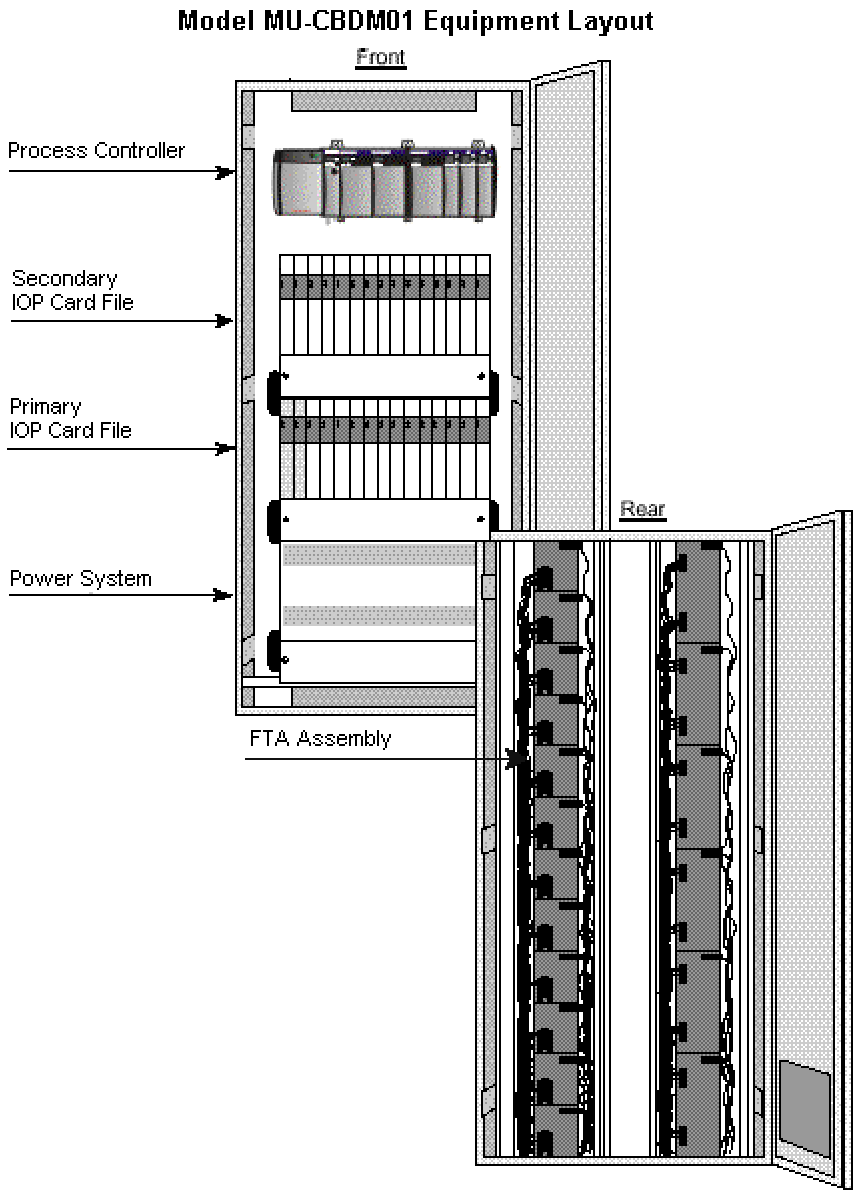
Equipment Configurations

Cabinet equipment layout

The Process Controller chassis, IOP card files, Power System, and FTA Mounting Channels install in the single- and dual-access cabinets as shown in following figures.

Model MU-CBSM01 Equipment Layout

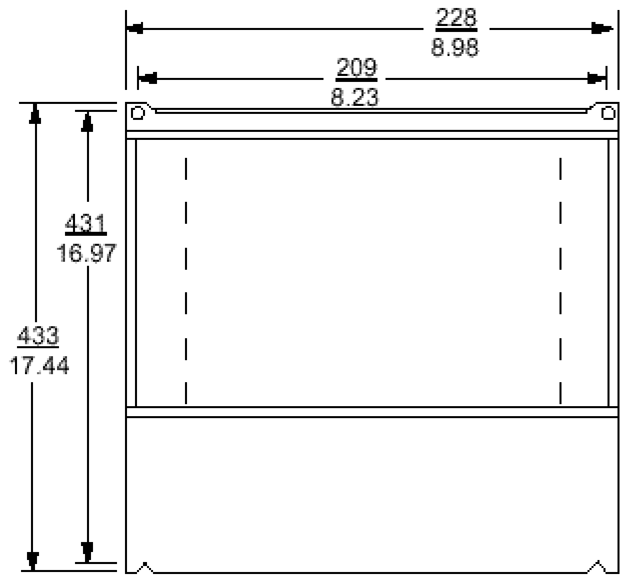



Model MU-CBDM01 Equipment Layout
Front
Process Controller
Secondary
IOP Card File
Primary
IOP Card File
Power System
Rear
FTA Assembly

Equipment dimension references

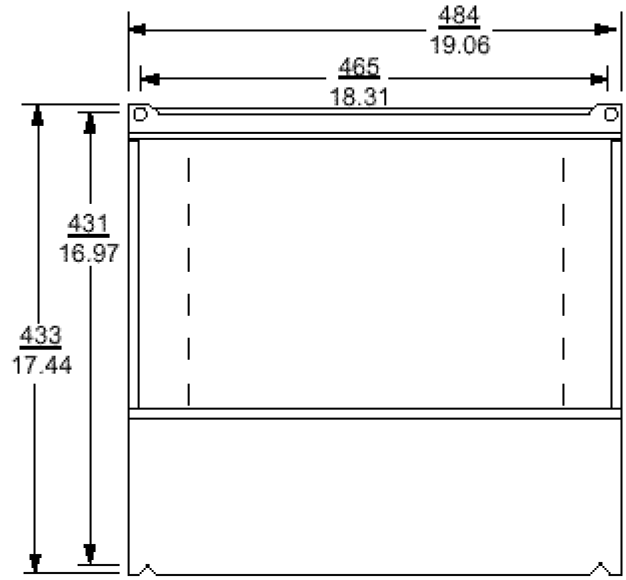
The following figures show the mounting dimensions for 7-slot and 15-slot card files and the power system for reference. Please see the *Chassis-Mounting Dimensions* section in the Control Hardware Installation Guide in Knowledge builder for Process Controller mounting dimensions.

7-Slot Card File Mounting Dimensions



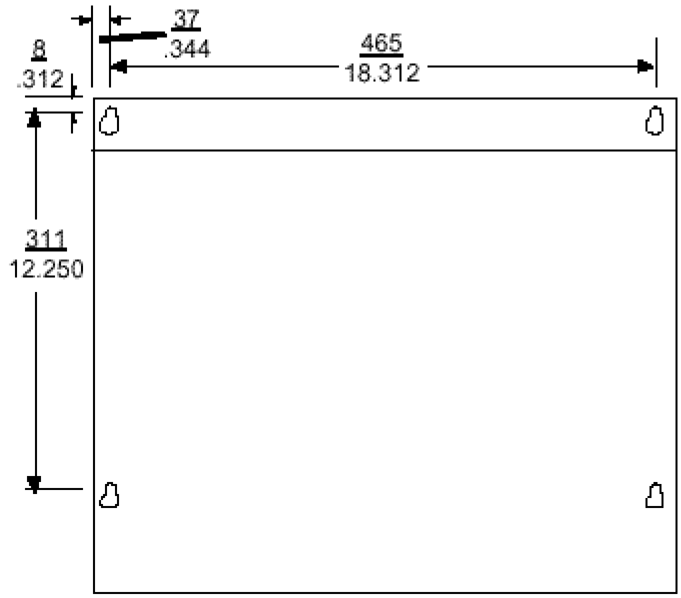
Note: Dimensions are in millimeters/inches.

15-Slot Card File Mounting Dimensions



Note: Dimensions are in millimeters/inches.

Power System Mounting Dimensions

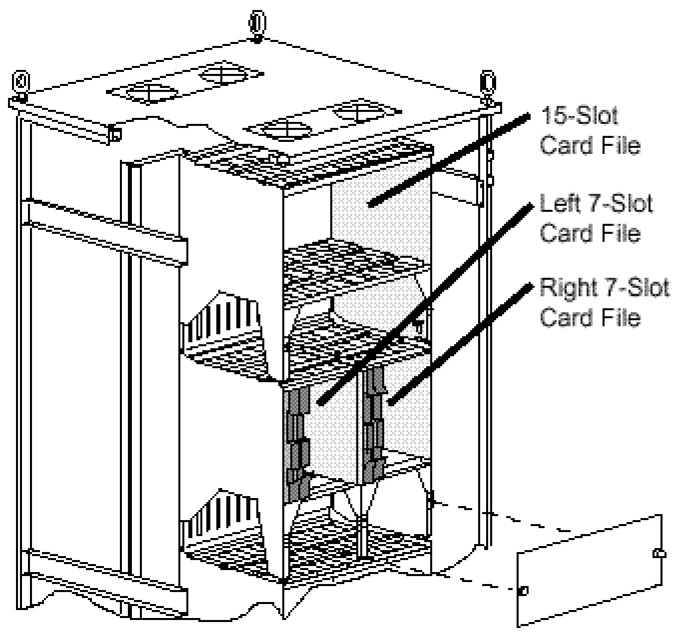


Note: Dimensions are in millimeters/inches.

7-Slot and 15-Slot card files installation

There are three types of card file assemblies, Left 7-Slot, Right 7-Slot, and 15-Slot. The Left and Right 7-Slot card files are the same size and are intended to be mounted adjacent to each other on the cabinet's 19-inch RETMA mounting infrastructure by using appropriate hardware. The 15-Slot card file mounts alone on the 19-inch RETMA mounting infrastructure. The following figure illustrates the installation of Left and Right 7-Slot and 15-Slot card files in a side-by-side configuration.

Typical 7-Slot and 15-Slot Card File Installation



FTA Mounting Channel Configurations

Vertical FTA Mounting Channel layout

ATTENTION

- It was previously a requirement that Galvanically Isolated, Intrinsically Safe (GI/IS) FTAs had to be mounted on horizontally oriented FTA Mounting Channels in an IOP cabinet. This is no longer a requirement due to component and design improvements.
- Galvanically Isolated FTAs can now be mounted on vertically oriented FTA Mounting Channels; however, there is still a requirement that Galvanically Isolated FTAs and standard (non-Galvantically Isolated) FTAs, and the wiring to them, be properly separated in the cabinet.

The vertical FTA Mounting Channel length, approximately 93 centimeters (36 inches) is approximately half the height of the cabinet. The FTA Mounting Channels can be mounted adjacent to each other in this vertical area. The FTA mounting configurations will allow:

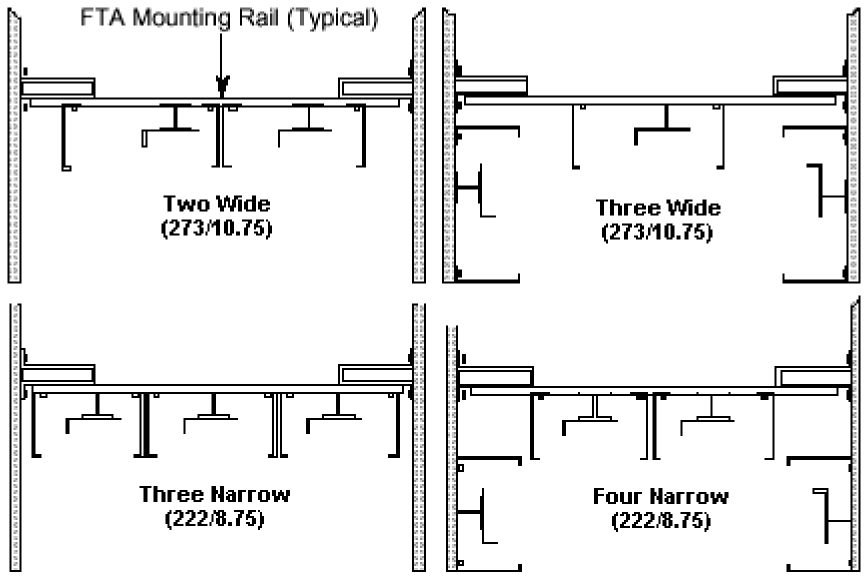
- up to four narrow channels or
- up to three wide channels.

The FTA Mounting Channels can be mounted adjacent to each other in the area below the Power System in a single-access cabinet as shown in the previous cabinet layout figures.

In the dual-access cabinet, one FTA Mounting Channel is normally installed above another, adjacently in pairs, as shown in the previous cabinet layout figures.

Normal Vertical FTA Mounting Channel orientation

When Standard type FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its “normal” position where field wiring enters the left channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the right channel of the FTA Mounting Channel. The following figure shows the normal orientations for four typical vertical FTA Mounting Channel layouts in a cabinet.



Note: Space between adjacently mounted channels is typically 6 mm (0.25 in).
Dimensions are in millimeters/inches

Inverted Vertical FTA Mounting Channel orientation

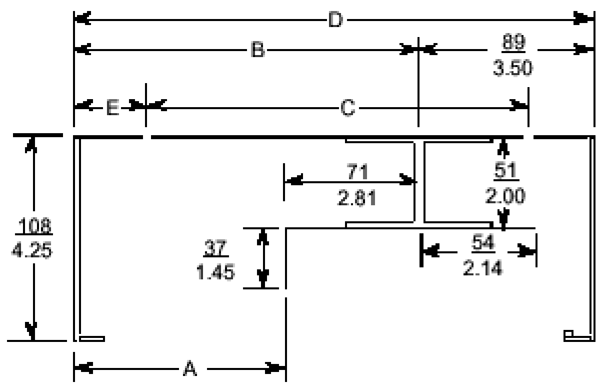
When Galvanically Isolated FTAs are mounted on the vertical FTA Mounting Channel, the FTA Mounting Channel is installed in its "inverted" position where field wiring enters the right channel and connects to the FTAs. The cables connecting the FTAs to their associated IOP(s) or Power Distribution Assemblies are routed in the left channel of the FTA Mounting Channel.

CAUTION

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

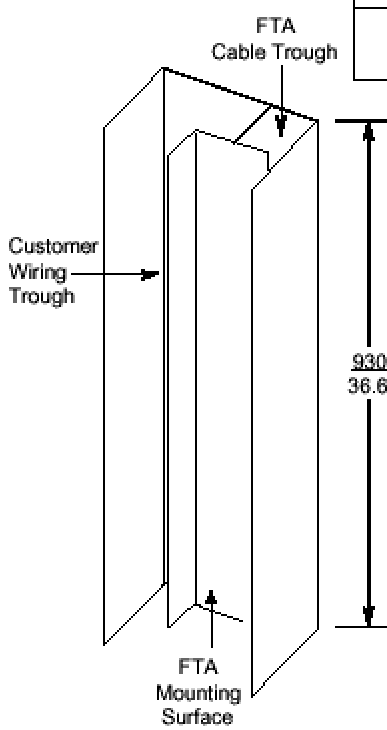
FTA Mounting Channel dimensions

Vertical FTA Mounting Channels are available in narrow and wide widths as shown in the following figure.



Cross Section View

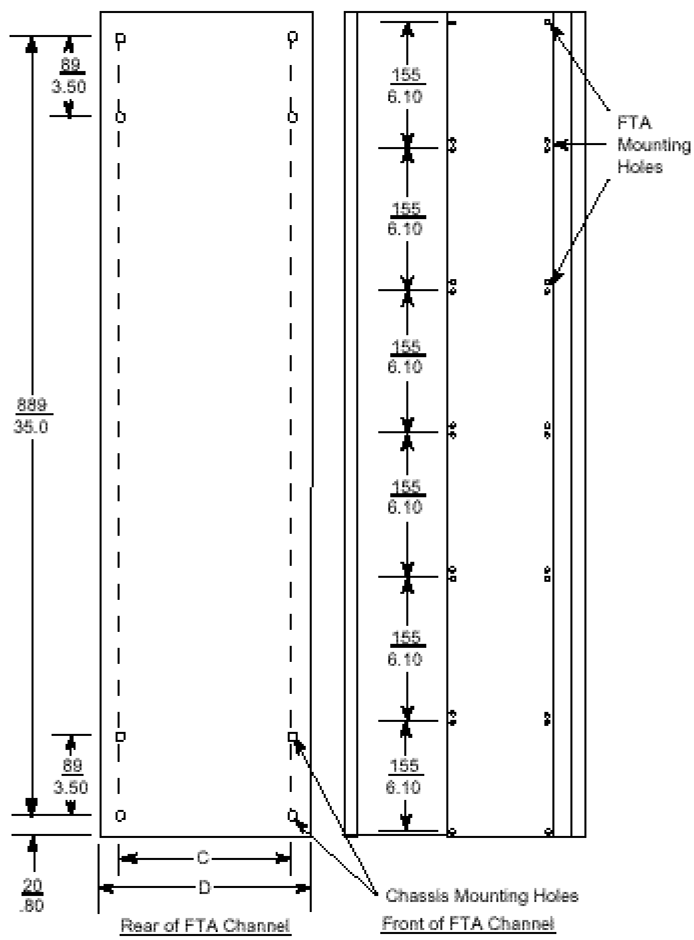
Channel Size	A	B	C	D	E
Wide	114 4.50	184 7.25	222 8.75	273 10.75	57 2.25
Narrow	64 2.50	133 5.25	172 6.75	222 8.75	32 1.25



Note: Dimensions are in millimeters/inches.

FTA installation hole locations

The following figure shows the locations of the FTA mounting holes on the FTA Mounting Channel and the holes used to install the FTA Mounting Channel.



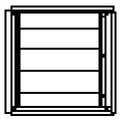
Note: See the previous figure for C and D dimensions.
Dimensions are in millimeters/inches.

IOP Cabinet Floor Planning

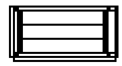
Floor template

The following figure is a cabinet floor template that will help you in planning your facility layout when installing IOP cabinets. The following notes pertain to the template in the following figure.

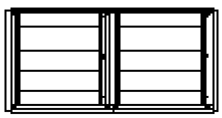
- Cabinet scale is 0.25 inch (6 millimeters) = 1 foot (0.3 meter).
- A dual access cabinet is approximately 30 inches (0.7 meter) by 30 inches (0.7 meter). The side and door panels add 1.5 inches (38 millimeters) to each cabinet dimension. When cabinets are complexed, 1.5 inches (38 millimeters) is added to the total complex dimensions.
- A single access cabinet is approximately 30 inches (0.7 meter) wide and 19 inches (0.5 meter) deep. The side panels and the single door panel add 0.75 inch (19 millimeters) to the cabinet depth and1.5 inches (38 millimeters) to the cabinet width. When cabinets are complexed, 0.75 inch (19 millimeters) is addedto the complex depth and 1.5 inches (38 millimeters) is added to the total complex width.



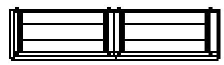
Single Dual Access Cabinet



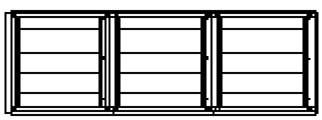
Single Single Access Cabinet



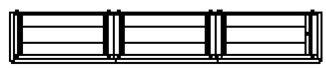
Dual Dual Access Cabinet Complex



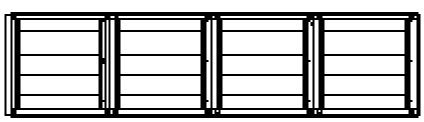
Dual Single Access Cabinet Complex



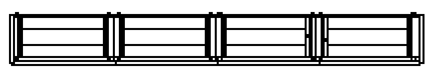
Triple Dual Access Cabinet Complex



Triple Single Access Cabinet Complex



Quad Dual Access Cabinet Complex



Quad Single Access Cabinet Complex

Appendix E

Power Draw for IOP

Power System considerations

Each Power System can provide up to 20 A of 24 Vdc power. By calculating the total current requirement, you can determine how many Power Systems are required. If more than one Power System is required, it may be desirable to connect the “A” IOP and “B” IOP of a redundant pair to separate Power Systems.

A subsystem with redundant I/O may need additional Power Systems. The power calculation is made using the information provided in this Appendix. Subsystems with either remote I/O, or remote cabinets containing one or more IOP card files must be self-contained with at least one Power System.

Power calculation procedure

The calculations are based on the power requirements of the components listed in the following 24 Vdc Power Usage table. The current requirements are based on the typical maximum, assuming all channels are in use. Use the following procedure to calculate the number of each type of IOP and associated FTA that an individual Power System must support.

Step	Action	Result
1	Determine the number of channels needed for each type of IOP and associated FTA.	Divide the total number by the number of channels that are available for the given type of IOP.
		For example, if a total of 256 High Level Analog Input (HLAI) IOP channels are needed, divide 256 channels by 16 channels per IOP to find that 16 HLAI IOPs and 16 FTAs are required.
2	Multiply the number of IOPs by the current requirement for the type of IOP.	Add the current requirement to the Total Module Current for the Power System.
		For example, 16 model MU-PAIH02 HLAI IOPs require 183 mA each, multiply 16 times 183 mA to find that 2928 mA or 2.928 A is the current requirement.

Step	Action	Result
3	Multiply the number of FTAs by the current requirement for the type of FTA.	Add the current requirement to the Total Module Current for the Power System. For example, 16 model MU-TAIH12/52 HLAI FTAs require 320 mA each, multiply 16 times 320 mA to find that 5120 mA or 5.120 A is the current requirement.
4	If redundant IOPs are required in the same Power System, double the IOP type count.	When the redundant IOPs reside in separate Power Systems, half the IOP power requirement is added to each Power System's Total Module Current power requirement (IOP A and IOP B). For example, 16 redundant HLAI channels, A and B, divide 16 channels by 16 channels per IOP times 2 to find that 2 IOPs are required.
5	To determine the Total Module Current, add together the total current for both the IOPs and their associated FTAs.	Sum of current requirements for IOPs and FTAs equals Total Module Current. For example, adding the results from the example current calculations in Steps 2 and 3 of this procedure yields 2928 mA plus 5120 mA equals 8048 mA or 8.048 A Total Module Current.

Component power usage

The following table lists the 24 Vdc power usage for IOP components.

ATTENTION

Be sure to include applicable power consumption data for the Process Controller chassis and its components. See the Chassis -Series A I/O Specification and Technical Data PS03-240 for details. An on-line version of this *Specification* is included in Knowledge Builder for convenient reference.

Component 24 Vdc Power Usage

Component	Model Number	Channels	Current (Ma)
IOP Card File	MU-IOFX02	N/A	0
Left 7-Slot Card File-Slots 1-7, non-CE Compliant	MU-HPFH01	N/A	0
Left 7-Slot IOP Card File-Slots 1-7, CE Compliant	MU-HPFI03	N/A	0
15-Slot Card File-Slots 1-15, non-CE Compliant	MU-HPFX02	N/A	0
15-Slot IOP Card File-Slots 1-15, CE Compliant	MU-HPFI23	N/A	0
Right 7-Slot Card File-Slots 9-15, non-CE Compliant	MU-HPFH11	N/A	0
Right 7-Slot IOP Card File-Slots 9-15, CE Compliant	MU-HPFI13	N/A	0
AO IOP Card	MU-PAOX02	8	100
AO IOP Card	MU-PAOX03	8	100
AO IOP Card	MU-PAOY22	16	112
DI IOP Card	MU-PDIX02	32	90
DI IOP Card	MU-PDIY22	32	89
DISOE IOP Card	MU-PDIS11	32	210

Component	Model Number	Channels	Current (Ma)
DISOE IOP Card	MU-PDIS12	32	210
DO IOP Card	MU-PDOX02	16	64
DO IOP Card	MU-PDOY22	32	98
HLAI IOP Card	MU-PAIH02	16	183
HLAI IOP Card	MU-PAIH03	16	155
LLAI IOP Card	MU-PAIL02	8	58
LLMux IOP Card	MU-PLAM02	16	70
PI IOP Card	MU-PPIX02	8	208
PI IOP Card	MU-PPIX02	8	208
RHMUX IOP Card (requires an IS or NI Power Adapter)	MU-PRHM01	32	100
STI IOP Card	MU-PSTX02	16	100
STIM IOP Card	MU-PSTX03	16	100
120 Vac/125 Vdc Relay DO FTA	MU-TDOR12/52	16	470
120 Vdc DI FTA	MU-TDIA12/52	32	192
120 Vdc DI FTA	MU-TDIA72	32	200
120/240 Vac Solid-State DO FTA	MU-TDOA13/53	16	160
24 Vdc DI FTA	MU-TDID12/52	32	408
24 Vdc DI FTA	MU-TDID72	32	410
24 Vdc DI FTA	MU-TDIY22/62	32	196
24 Vdc Isolated DO FTA	MU-TDOY22/62	32	004

Component	Model Number	Channels	Current (Ma)
24 Vdc Nonisolated DO FTA	MU-TDON12/52	16	0
24 Vdc Power Distribution Assembly	MU-TDPR02	12	200
240 Vac/125 Vac Relay DO FTA	MU-TDOR22/62	16	470
240 Vac/125 Vac Relay DO FTA	MU-TDOY23/63	16	228
240 Vdc DI FTA	MU-TDIA22/62	32	192
24-240 Vac Solid-State DO FTA	MU-TDOA12/52	16	160
31-200 Vdc Solid-State DO FTA	MU-TDOD22/62	16	160
3-30 Vdc Solid-State DO FTA	MU-TDOD12/52	16	160
3-30 Vdc Solid-State DO FTA	MU-TDOD13/53	16	160
3-30 Vdc Solid-State DO FTA	MU-TDOD14/54	16	160
5-200 Vdc Solid-State DO FTA	MU-TDOD23/63	16	160
AO FTA	MU-TAOX02	8	160
AO FTA	MU-TAOX12/52	8	171
AO FTA	MU-TAOY22/52	16	324
AO FTA	MU-TAOY23/53	16	324
AO HART FTA	MU-THAO11	16	324
HLAI FTA	MU-TAIH03	16	320

Component	Model Number	Channels	Current (Ma)
HLAI FTA	MU-TAIH13/53	16	320
HLAI FTA	MU-TAIH23	16	320
HLAI/STI FTA	MU-TAIH02	16	320
HLAI/STI FTA	MU-TAIH12/52	16	320
HLAI/STI FTA	MU-TAIH22/62	16	320
LLAI FTA	MU-TAIL02	8	350
LLAI FTA	MU-TAIL03	8	350
LLMux—RTD FTA	MU-TAMR02	16	185
LLMux—RTD FTA	MU-TAMR03	16	185
LLMux—TC/Local CJR FTA	MU-TAMT02	16	185
LLMux—TC/Local CJR FTA	MU-TAMT03	16	185
LLMux—TC/Remote CJR FTA	MU-TAMT12	16	185
LLMux—TC/Remote CJR FTA	MU-TAMT13	16	185
PI FTA	MU-TPIX12/52	8	136
RHMUX GI/IS Power Adapter (ISPA)	MU-GRPA01	32 (1)	300
RHMUX GI/NI Power Adapter (NIPA)	MU-TRPA01	32 (1)	575
RHMUX—TC/Local CJR FTA (ISPA or NIPA provides power to FTA)	MC-GRMT01	16	0
STI FTA	MU-TSTX03	16	320
STI FTA	MU-TSTX13/53	16	320
Galvanically Isolated 24 Vdc DI FTA	MU-GDID12/82	32	800

Component	Model Number	Channels	Current (Ma)
Galvanically Isolated 24 Vdc DI FTA	MU-GDID13/83	32	800
Galvanically Isolated 24 Vdc DO FTA	MU-GDOD12/82	16	1800
Galvanically Isolated 24 Vdc DO FTA	MU-GDOL12/82	16	1800
Galvanically Isolated AO FTA	MU-GAOX02/72	8	440
Galvanically Isolated AO FTA	MU-GAOX12/82	8	440
Galvanically Isolated AO HART FTA	MU-GHAO11	16	1252
Galvanically Isolated HLAI FTA	MU-GAIH12/82	16	1200
Galvanically Isolated HLAI FTA	MU-GAIH22/92	16	1200
Galvanically Isolated HLAI/STI FTA	MU-GAIH13/83	16	1200
Galvanically Isolated HLAI/STI FTA	MU-GAIH14/84	16	1200
Galvanic Isolation Power Distribution Assembly	MU-GPRD02	N/A	160
Combiner Panel	MU-GLFD02	N/A	0
Marshalling Panel	MU-GMAR02	N/A	0
Long Distance I/O Link Extender Cards/Couplers	MU-ILDX02	N/A	300
Long Distance I/O Link Extender Cards/Couplers	MU-ILDX03	N/A	300
Standard I/O Link Extender Cards/Couplers	MU-IOLM02	N/A	196
Standard I/O Link Extender Cards/Couplers	MU-IOLX02	N/A	190

Component	Model Number	Channels	Current (Ma)
Analog Output Standby Manual with case	MU-SMAC02	4	250
Analog Output Standby Manual—Digital	51401926-100	8	2200
Digital Output Standby Manual with case	MU-SMDC02	16	70
Digital Output Standby Manual without case	MU-SMDX02	16	100
(1) An RHMUX Power Adapter provides the interface between one RHMUX IOP and one or two RHMUX FTAs. Each RHMUX FTA has 16 input channels providing a total of 32 inputs for the RHMUX subsystem.			

Single Power System Calculation Example

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

Components	Total IOP/Module Current	Total FTA Current
High Level Analog Input (HLAI) IOPs, nonredundant (256 channels divided by 16 channels/IOP equals 16 IOPs times 183 mA equals 2928 mA or 2.928 A) (16 FTAs times 320 mA equals 5120 mA or 5.120 A)	2.928 A	5.120 A
High Level Analog Input (HLAI) IOPs, redundant A & B (16 channels times 2 equals 32 channels divided by 16 channels/IOP equals 2 IOPs times 183 mA equals 366 mA or 0.366 A) (1 FTA times 320 mA equals 320 mA or 0.320 A)	0.366 A	0.320 A
Analog Output (AO) IOPs, nonredundant (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (8 FTAs times 171 mA equals 1368 mA or 1.368 A)	1.500 A	1.368 A
Analog Output (AO) IOPs, redundant A & B (16 channels times 2 equals 32 channels divided by 8 channels/IOP equals 4 IOPs times 100 mA equals 400 mA or 0.400 A) (2 FTAs times 171 mA equals 342 mA or 0.342 A)	0.400 A	0.342 A
Subtotals	5.194 A	7.150 A
Total Power System Current equals 5.194 plus 7.150 equals 12.344 A		

Dual Power System Calculation Examples

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

Components	Total IOP/Module Current	Total FTA Current
Power System 1		
High Level Analog Input (HLAI) IOPs, nonredundant (80 channels divided by 16 channels/IOP equals 5 IOPs times 183 mA equals 915 mA or 0.915 A) (5 FTAs times 320 mA equals 1600 mA or 1.600 A)	0.915 A	1.600 A
High Level Analog Input (HLAI) IOPs, redundant A (240 channels divided by 16 channels/IOP equals 15 IOPs times 183 mA equals 2740 mA or 2.740 A) (15 FTA times 320 mA equals 4800 mA or 4.800 A)	2.740 A	4.800 A
Analog Output (AO) IOPs, nonredundant (40 channels divided by 8 channels/IOP equals 5 IOPs times 100 mA equals 500 mA or 0.500 A) (5 FTAs times 171 mA equals 855 mA or 0.855 A)	0.500 A	0.855 A
Analog Output (AO) IOPs, redundant A (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (15 FTAs times 171 mA equals 2565 mA or 2.565 A)	1.500 A	2.565 A
Subtotals	5.655 A	9.820 A
Total Power System 1 Current equals 5.655 plus 9.820 equals 15.475 A		
Power System 2		
High Level Analog Input (HLAI IOPs, redundant B (240 channels divided by 16 channels/IOP equals 15 IOPs times 183 mA equals 2740 mA or 2.740 A) (15 FTA times 320 mA equals 4800 mA or 4.800 A)	2.740 A	4.800 A
Analog Output (AO) IOPs, redundant B (120 channels divided by 8 channels/IOP equals 15 IOPs times 100 mA equals 1500 mA or 1.500 A) (15 FTAs times 171 mA equals 2565 mA or 2.565 A)	1.500 A	2.565 A
Subtotals	4.240 A	7.365 A
Total Power System 2 Current equals 4.240 plus 7.365 equals 11.605 A		

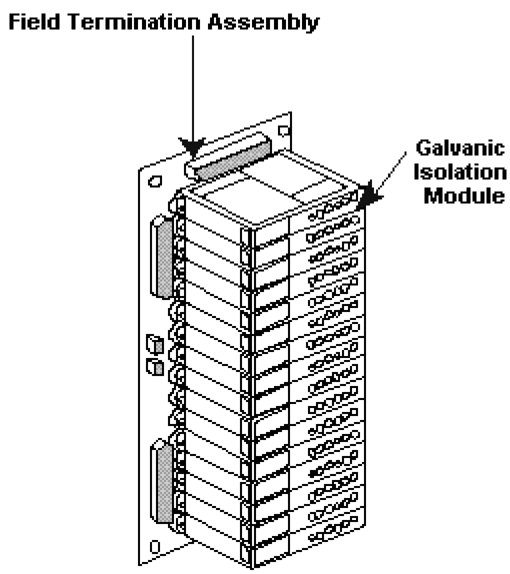
Appendix F

Galvanically Isolated FTA Planning

Galvanically Isolated FTAs are used for connecting input and output signals to field devices in Division 1 (Zone 0 and Zone 1) hazardous areas. These FTAs are available that accept plug-in Galvanic Isolation Modules. The FTAs are compatible with the IOPs that support the companion standard FTAs.

Galvanic Isolation Module

Field signal connections are made at the plug-in Galvanic Isolation Module on the FTA. In general, each module provides a terminal connector for one field device connection. The exception is the Galvanic Isolation Module on the Digital Input FTA. This Galvanic Isolation Module provides terminal connectors for two field devices. The following figure shows a typical Galvanically Islolated FTA with Galvanic Isolation Modules installed.



Usage advantages

The isolating nature of the intrinsically safe connection removes the necessity to install a potential-equalizing conductor where it is called for in any certification. The resultant simplification and reduction in cost of the installation is a considerable advantage, and makes the use of the Galvanic Isolators the preferred method over conventional shunt-diode safety barriers for this type of installation. There are many occasions when the lack of information about the precise site conditions is solved by using the isolators to minimize installation and security problems.

CE Compliance

Some Galvanically Isolated Field Termination Assemblies and their supporting assemblies, such as a Combiner Panel, are CE Compliant, while others are not CE Compliant. The CE Compliant and non-CE Compliant models with their part numbers are listed in the FTA models section. Generally, CE Compliant Galvanically Isolated FTAs are identified by the tab number of the part number that ends in "25" or "75". They do not have a unique model number. The CE Compliant FTAs feature filtered connectors that interface with the CE Compliant model MU-KFTSxx IOP to FTA cable(s).

Standby Manual devices and FTA connections

The following table lists the FTAs that support Standby Manual device connections as well as a description of the Standby Manual device along with model and part number references.

ATTENTION

The Galvanically Isolated Analog Output FTA for HART conneciton (MU-GHAO11) does not support Standby Manual device connection.

If FTA is. . .	You can connect Standby Manual device to. . .	Standby Manual Device Description	Model Number	CE-Compliant Part Number
Analog Output model	A unique third 50-pin connector.	Analog Output Standby Manual Device w/case, cable	MC-SMAC02	51401277-250
24 Vdc Digital Output model	One of the two 50-pin connectors for redundant IOPs.	Digital Output Standby Manual Device w/case, cable	MC-SMDC02	51304526-150
		Digital Output Standby Manual Device with cable	MC-SMDX02	51304527-150

Operation limits

The ambient temperature limits of the Galvanic Isolation Modules are -20 to +60 degrees Celsius (-4 to +140 degrees Fahrenheit) operating range and -40 to +80 degrees Celsius (-40 to +176 degrees Fahrenheit) storage range. The humidity limits are 5 to 95 percent relative humidity.

GI FTA Power

FTA power requirements

The power requirement for the FTAs is a nominal 24 Vdc. Because of the large additional amount of power the Galvanically Isolated FTAs require, power to the FTA is not provided directly from the Power System through the associated IOP, as it is for Standard type FTAs, but instead through a Power Distribution Assembly.

The following table lists the power requirements at 24 Vdc for the given types of Galvanically Isolated FTAs. The requirements assume that all inputs/outputs are active.

FTA Type	Power Requirement (Amperes)
High Level Analog Input/Smart Transmitter Interface	
MU-GAIH12/82	1.28
MU-GAIH13/83	1.28
MU-GAIH14/84	1.20
MU-GAIH22/92	1.20
Analog Output	
MU-GAOX02/12/72/82	0.45
MU-GHAO11	1.252
24 Vdc Digital Input	
MU-GDID12/82	0.72
MU-GDID13/83	0.56
24 Vdc Digital Output	
MU-GDOD12/82	1.10
MU-GDOL12/82	1.10

Power Distribution Assembly

The model MU-GPRD02 Galvanic Isolation Power Distribution Assembly provides individually fused 24 Vdc power for the Galvanically Isolated FTAs.

The dc power is supplied to the Galvanic Isolation Power Distribution Assembly by the same type of 6-pin connector cable, model MU-KDPRxx (the suffix “xx” in the model number represents the length of the cable in meters), used to supply power to the card files from the IOP's Power System when the assembly is located in the same cabinet or cabinet complex.

If the Galvanic Isolation Power Distribution Assembly is located external to the cabinet or cabinet complex and CE Compliance is a requirement, model MU-KSPRxx cables must be used. The 2-conductor cable provides only 24 Vdc power.

A single-source or dual-source (redundant) of power can be supplied because the Power Distribution Assembly has two input power connectors.

Eight 2-pin power connectors

The Power Distribution Assembly has eight 2-pin connectors to which 2-wire power cables can be connected to supply the 24 Vdc power to the power connectors on the Galvanically Isolated FTAs.

Model MU-KGPRxx cables

Two power cable lengths can be ordered by model number. Model MU-KGPR05 is a 5-meter cable and model MU-KGPR10 is a 10-meter cable. Other lengths are available, but the cable must be ordered by part number. Standard lengths are 0.5, 0.75, 1, 1.25, 2, 3, 4, 5 (MU-KGPR05), and 10 (MU-KGPR10) meters (20, 30, 40, 50, 80, 120, 160, 195, and 395 inches). Order by Honeywell part number 51109620-xxx, where “xxx” represents the length of the cable in inches.

Same size as A-size FTA

The Power Distribution Assembly has the same mounting dimensions as an A-size FTA.

Cabling to Power Distribution Assemblies

Model MU-KDPRxx (the suffix "xx" in the model number represents the length of the cable in meters) power cables connect the 6-pin power connectors on the Power System with 6-pin connectors on the Power Distribution Assembly. Cable redundancy is provided by two power cables connected to each Power Distribution Assembly.

The cables can be daisy-chained to up to four Power Distribution Assemblies, provided the current through the series of MU-KDPRxx cables to the most distant Power Distribution Assembly from the Power System does not exceed 12 amperes of 24 Vdc power. The 12-ampere limitation assumes that one of the redundant cables has failed and broke the power loop.

Power Distribution Cable length restrictions

The allowable total length of the model MU-KDPRxx cables is also determined by the current through them. The length in meters cannot exceed 33 divided by the amount of current in amperes in the series of cables. This allows a 0.5 volt drop for the series of cables. Once again, assume that one of the redundant cables has failed when calculating the length.

Cabling to FTAs

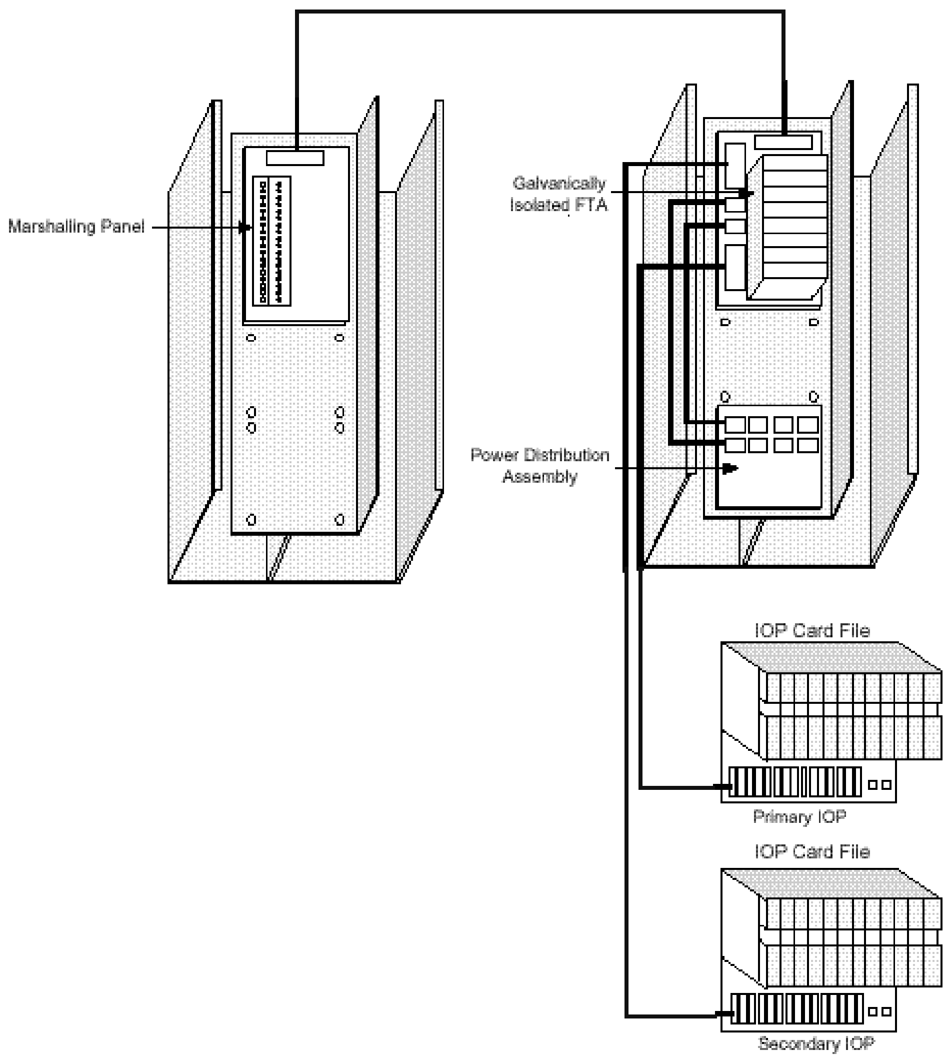
The Power Distribution Assembly has eight 2-pin connectors that supply 24 Vdc power to the FTAs through model MU-KGPRxx (the suffix "xx" in the model number represents the length of the cable in inches) cables. The cable is not shielded and must not exit the cabinet, unless in conduit, for a CE Compliance application. Each FTA must have two cables connected to it to provide a redundant source of power. The cabling must not be daisy-chained to the FTAs.

FTA Cable length restrictions

The allowable total length of the model MU-KGPRxx cables is also determined by the current through them. The length in meters cannot exceed 13 divided by the amount of current in amperes in the series of cables. In any case, the total length cannot exceed 10 meters. This allows a 0.5 volt drop for the series of cables. When calculating the length, assume that one of the redundant cables has failed, and the other cable(s) is carrying all the current.

Typical cabinet configuration

A typical cabinet side might have 12 FTAs and 3 Power Distribution Assemblies, and a 12-inch unused length of FTA Mounting Channel. The following figure is an illustration of the connections between the Galvanically Isolated FTA, its associated IOP, and the Marshalling Panel.



Marshalling Panel mounting

The model MU-GMAR52 Marshalling Panel can be mounted on either a horizontally or vertically oriented FTA Mounting Channel. No Galvanically Isolated FTAs can be mounted on the same FTA Mounting Channel.

Additional Power System

If an additional Power System is required in the cabinet to power the Galvanically Isolated FTAs, it can be installed on the same side of the cabinet as the FTA Mounting Channels. The Power System should be installed at the top of the cabinet if the FTA's field wiring entry is at the bottom of the cabinet so the field wires are not routed near the Power System. If the field wiring entry is at the top of the cabinet, install the Power System at the bottom of the cabinet.

Avoid using a non-IOP power source

Avoid providing 24 Vdc power to the Galvanically Isolated FTAs from a separate power system that is "disassociated" from the IOP Power System. A "disassociated" power system is one that is part of a larger system. Try to use power systems that are local to the loads that they serve.

Use surplus power for the FTAs

If redundant IOPs are both powered from one Power System, use whatever surplus power there is in the system to power the Galvanically Isolated FTAs. Add another Power System, if necessary. If redundant IOPs are each powered by their own Power System, use surplus power from both systems to power the FTAs. If more power is needed for the FTAs, use power from an additional Power System.

Vertical FTA Mounting Channel cabling assignment

All power cables must be routed in the left channel of a vertical FTA Mounting Channel. The field wires to the Galvanically Isolated FTAs must always be routed in the right channel of a vertical FTA Mounting Channel. No other wires, other than field wires to Galvanically Isolated FTAs, can be routed in the right channel of the vertical FTA Mounting Channel.

Field wiring restrictions

Field wires terminating on Galvanically Isolated FTAs must be routed at least 2 inches (50 millimeters) away from any other wires or electrical components, or a nonconductive material or grounded metal barrier must be provided for separation.

Field wiring routing

If the field wires leaving the Galvanically Isolated FTAs are dressed downward toward the bottom of the cabinet, the Power Distribution Assembly(s) must be installed above the FTAs. As a result, the field wires will not pass close to a Power Distribution Assembly. If the field wires are routed upward toward the top of the cabinet, the Power Distribution Assembly(s) must be installed below the FTAs.

High Level Analog Input (HLAI) FTAs

Model MU-GAIH12/MU-GAIH82 FTAs

The model MU-GAIH12 and MU-GAIH82 High Level Analog Input (HLAI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters only.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A nonredundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• The acceptable input signal is from a 4-20 mA 2-wire or 3-wire transmitter. It is not expected that any self-powered transmitters will be the source. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.

Function	Description
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.28 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. • This represents 30.7 watts of power. • The power dissipation is 25.0 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH13/MU-GAIH83 FTAs

The model MU-GAIH13 and MU-GAIH83 High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional and “smart” transmitters whose digital communication signals are superimposed on a standard 4-20 mA signal. The smart transmitter can be calibrated, interrogated, or tested from the system, or from a hand-held communicator connected to the hazardous-side connector terminals on the Galvanic Isolation Module or connected across points on the FTA board.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A nonredundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• Each Galvanic Isolation Module on the HLAI/STI FTA provides a floating dc source for energizing conventional 2-wire or 3-wire 4-20 mA transmitters or smart transmitters, such as the Honeywell model ST3000 Smart Transmitter, whose digital communications signal is superimposed on a 4-20 mA signal. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.
Smart Transmitter communication	Terminals 3 and 4 on the Galvanic Isolation Module are internally connected to the two field terminals and can be used to communicate with a smart transmitter through its hand-held communicator.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.28 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 30.7 watts of power. • The power dissipation is 25.0 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH14/MU-GAIH84 FTAs

The model MU-GAIH14 and MU-GAIH84 High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTAs accommodate up to 16 high level dc signals. The model MU-GAIH14/MU-GAIH84 FTA is similar to the model MU-GAIH13/MU-GAIH83 FTA, except for its safety specifications and the available field terminal voltage is higher. This permits longer field wiring.

The FTA provides floating dc power to energize 2-wire or 3-wire, 4-20 mA transmitters in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional and “smart” transmitters whose digital communication signals are superimposed on a standard 4-20 mA signal. The smart transmitter can be calibrated, interrogated, or tested from the system, or from a hand-held communicator connected to the hazardous-side connector terminals on the Galvanic Isolation Module or connected across points on the FTA board.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A nonredundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• Each Galvanic Isolation Module on the HLAI/STI FTA provides a floating dc source for energizing conventional 2-wire or 3-wire 4-20 mA transmitters or smart transmitters, such as the Honeywell model ST3000 Smart Transmitter, whose digital communications signal is superimposed on a 4-20 mA signal. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. If these signals are connected to monitoring or recording devices, the devices should have at least 1 megohm of input resistance to avoid loading the signals.
Smart Transmitter communication	Terminals 3 and 4 on the Galvanic Isolation Module are internally connected to the two field terminals and can be used to communicate with a smart transmitter through its hand-held communicator.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.2 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 28.8 watts of power. • The power dissipation is 20.8 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MU-GAIH22/MU-GAIH92 FTAs

The model MU-GAIH22 and MU-GAIH92 High Level Analog Input (HLAI) FTAs accommodate up to 16 high level dc signals. The FTA provides floating dc power to energize a 2-wire or 3-wire, 4-20 mA transmitter in a hazardous area and repeats the current accurately in another circuit to drive a range spool in the safe area that generates a 1 to 5 Vdc signal to the associated HLAI IOP.

The model MU-GAIH22 and MU-GAIH92 FTAs is similar to the model MU-GAIH14 and MU-GAIH84 FTAs, except the 4-20 mA output signal from the Galvanic Isolation Module can be routed to an auxiliary receiver through an auxiliary connector before it is sent to the range spool on the FTA to generate the 1-5 Vdc input to the IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Field transmitter compatibility	The FTA is suitable for conventional transmitters only.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. A nonredundant configuration is also acceptable. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.
Field wiring input signals	• The acceptable input signal is from a 4-20 mA 2-wire or 3-wire transmitter. It is not expected that any self-powered transmitters will be the source. • With an open circuit, the voltage to the transmitter wires is a maximum 28 volts. At 20 mA of transmitter current, the voltage is a minimum 15 volts. • Each Galvanic Isolation Module accepts one field device connection.

Function	Description
Auxiliary connector output	The 1 to 5 Vdc PV signals are available at the auxiliary connector. By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the cable length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where they are available at screw terminals. Because it is the same 4-20 mA signal that the range spool is exposed to, the recording or monitoring system connected to the screw terminals of the Marshalling Panel must provide a low impedance of 250 ohms, or less.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 1.2 amperes maximum at 24 Vdc with a 20 mA signal present at all inputs. This represents 28.8 watts of power. • The power dissipation is 20.8 watts with a 20 mA signal at all inputs.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module separates the two sides. • The safety description for the Galvanic Isolation Module input is – 28 volts maximum – 300 ohms – 93 milliamps maximum

12Vdc Digital Input FTAs

Model MU-GDID12/MU-GDID82 FTAs

The model MU-GDID12 and MU-GDID82 24 Vdc Digital Input (DI) FTAs accommodate up to 32 switch or proximity detector inputs from a hazardous area, isolate the signal, and presents them to the FTA's associated 24 Vdc Digital Input FTA in the safe area. The phase of the input signals is selectable, which allows the alarm condition to be chosen for either state of the sensor. This is accomplished with independent switches on the top of the Galvanic Isolation Modules. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Line fault detection	Individual line-fault detection is provided that signals a contact change in the event the field wires are shorted or open. Switches are provided on the Galvanic Isolation Module to optionally defeat the line-fault detection on an individual input basis. The Galvanic Isolation Module signals a change of state to the IOP if the field wires are open or shorted. An open wire is defined as an input current of less than 100 µA, and a shorted wire is defined as an input current of greater than 6.5 mA.

ATTENTION

To prevent false triggering of the line-fault detection feature, proximity sensors must be used. If switch inputs are used, they must be fitted with series and shunt resistors so that an open switch provides 22 k-ohms resistance and a closed switch provides 620 ohms resistance. If this feature is not wanted, it can be disabled by placing two switches on the top of the Galvanic Isolation Module, one for each input, in the "off" position.

Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, redundant Digital Input IOPs are not supported. • One 50-pin auxiliary connector provides signals for remote monitoring and alarming equipment.

Function	Description
Field wiring input signals	The input signal specifications and assumptions are as follows: • Input from a contact or proximity switch. • A sensed current of less than 2 k-ohms resistance is interpreted as a closure. • The hysteresis is nominally 650 ohms. • The voltage applied to the sensor is 7.7 to 9.0 Vdc for 1 k-ohms resistance.
Auxiliary connector output	• Duplicate floating dry contacts that track the action of the signals presented to the IOP are provided by the auxiliary connector. There are two contacts in each module, isolated from the system, but not isolated from each other (three wires per isolator). • By the use of a model MU-KFTAxx cable (the suffix “xx” in the model number represents the length of the cable in meters), the signals can be connected to the model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • Two amber indicators on each Galvanic Isolation Module, one for each input, illuminates when a “closed” signal is sent to the IOP. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 0.72 amperes at 24 Vdc with all inputs in use. This represents 17.3 watts of power. • The power dissipation is 16 watts with all inputs active.

Function	Description
Isolation and safety	• Isolation is 250 Vac between each input, each auxiliary set of contacts, and the IOP. • The safety description for each Galvanic Isolation Module input is: – 10.5 volts maximum – 800 ohms – 14 milliamps maximum

Model MU-GDID13/MU-GDID83 FTAs

The model MU-GDID13 and MU-GDID83 24 Vdc Digital Input (DI) FTAs accommodate up to 32 switch or proximity detector inputs from a hazardous area, isolate the signal, and presents them to the FTA's associated 24 Vdc Digital Input FTA in the safe area. The FTA is similar to the model MU-GDID12/MU-GDID82 FTA, except the phase of the Galvanic Isolation Module's input to output signals are not selectable on the module, and the module's signal outputs are solid-state, instead of contacts. Also, the FTA has no auxiliary output connector. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Signal Connectors	Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, redundant Digital Input IOPs are not supported.
Field wiring input signals	The input signal specifications and assumptions are as follows: • Input from a contact or proximity switch. • A sensed current of less than 2 k-ohms resistance is interpreted as a closure. • The hysteresis is nominally 650 ohms. • The voltage applied to the sensor is 7.7 to 9.0 Vdc for 1 k-ohms resistance.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • Two amber indicators on each Galvanic Isolation Module, one for each input, illuminates when a "closed" signal is sent to the IOP. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• The FTA consumes 0.56 amperes at 24 Vdc with all inputs in use. This represents 13.4 watts of power. • The power dissipation is 14.4 watts with all inputs active.

Function	Description
Isolation and safety	• Isolation is 250 Vac between each input, each auxiliary set of contacts, and the IOP. • The safety description for each Galvanic Isolation Module input is: – 10.5 volts maximum – 800 ohms – 14 milliamps maximum

Analog Output FTAs

Model MU-GAOX02/72 and MU-GAOX12/82 FTAs

The nonredundant model, MU-GAOX02 and MU-GAOX72, and the redundant model, MU-GAOX12 and MU-GAOX82,Analog Output (AO) FTAs isolate up to eight 4-20 mA signals that can drive current-to-pressure (I/P) transducers, position actuators, or any load of 750 ohms or less, from an associated Analog Output IOP. The two models are identical in performance, with the redundant model capable of being controlled from redundant IOPs. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Fault-line detection	In the event of an open or short circuit in the field wiring, the resistance sensed at the input to the Galvanic Isolation Module will be a high value. This permits the readback feature of the associated 4-20 mA Analog Output IOP to detect the open or shorted field circuit and report a soft failure to the user.
Signal connectors	• Two 50-pin connectors on the redundant model of the FTA provide the interfaces to one or two IOPs. • One 50-pin connector accepts signals from an Analog Output Standby Manual Device, permitting removal and replacement of an IOP during normal operation of the FTA.
Field wiring output signals	The FTA provides, nominally, 4-20 mA for control of field devices that are Galvanically Isolated from all other circuits. The load resistance can be no greater than 750 ohms. The signal output's dynamic impedance is greater than 1 megohm.
Calibration terminals	Four screw terminals are provided on the FTA, two pairs for calibrating the primary and secondary IOPs. A touch pad is provided that initiates the calibration procedure in primary or secondary IOP.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.

Function	Description
Current consumption	• Both models of the FTA consume 0.42 amperes at 24 Vdc with a 20 mA signal on all outputs. This represents 10.5 watts of power. • The power dissipation for the FTA is 9.6 watts with all outputs providing 20 mA of current.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 28 volts maximum – 300 ohms – 93 milliamps maximum

Model MC-GHAO11 and MU-GHAO11 FTAs

The redundant model MC-GHAO11 and MU-GHAO11 Analog Output (AO) FTAs isolate up to sixteen 4-20 mA signals that can drive current-to-pressure (I/P) transducers, position actuators, or any load of 870 ohms or less, from an associated Analog Output IOP. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Fault-line detection	In the event of an open or short circuit in the field wiring, the resistance sensed at the input to the Galvanic Isolation Module will be a high value. This permits the readback feature of the associated 4-20 mA Analog Output IOP to detect the open or shorted field circuit and report a soft failure to the user.
Signal connectors	• Two 50-pin connectors on the redundant model of the FTA provide the interfaces to one or two IOPs. • A 20-pin connector that provides the interface to an external HART multiplexer. • The two 2-pin power connectors that provide the interfaces to the GI/IS Power Distribution Panel.
Field wiring output signals	The FTA provides, nominally, 4-20 mA for control of field devices that are Galvanically Isolated from all other circuits. The load resistance can be no greater than 870 ohms. The signal output's dynamic impedance is greater than 1 megohm.
Calibration terminals	Four screw terminals are provided on the FTA, two pairs for calibrating the primary and secondary IOPs. A touch pad is provided that initiates the calibration procedure in primary or secondary IOP.
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• Both models of the FTA consume 928 mA at 24 Vdc with a 20 mA signal on all outputs. • The power dissipation for the FTA is 21.6 watts with all outputs providing 20 mA of current.

Function	Description
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 28 volts maximum – 240 ohms – 116 milliamps maximum – Um= 250 Vrms AC or DC.

12Vdc Digital Output FTAs

Model MU-GDOD12/MU-GDOD82 FTAs

The model MU-GDOD12 and MU-GDOD82 24 Vdc Digital Output (DO) FTA can drive up to 16 suitably certified, intrinsically safe loads in a hazardous area. The loads can be a solenoid or alarm, as well as a nonenergy storing "simple apparatus," such as a Light Emitting Diode (LED). The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, Digital Output IOP redundancy is not supported. • One 50-pin auxiliary connector accepts signals from an emergency shutdown system.
Field wiring output signals	Each output is a voltage source that provides a maximum output voltage of 25.5 Vdc through 232 ohms. The minimum output voltage varies from 22 volts at zero current to 10 volts at 50 milliamps.
Auxiliary connector	• The auxiliary connector provides an input for control signals from an emergency shutdown system that is user-supplied. The shutdown system must provide potential-free floating sets of contacts. When one of the contacts is closed, a corresponding FTA output is disabled (deenergized), regardless of the output state command from the IOP. • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals.. • There is no dedicated Standby Manual Device connector on the FTA. An IOP connector interface is used by the Digital Output Standby Manual device to control the output of the FTA.

Function	Description
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • An amber indicator on the Galvanic Isolation Module illuminates when the module's output is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module.
Current consumption	• At 25 Vdc and with all outputs active into a 350 ohm load (typical for a solenoid value), the FTA consumes 1.10 amperes. • The power dissipation is 18.7 watts with all outputs active.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 25.5 volts maximum – 232 ohms – 110 milliamps maximum

Model MU-GDOL12/MU-GDO82 FTAs

The model MU-GDOL12 and MU-GDOL82 24 Vdc Digital Output (DO) FTA can drive up to 16 suitably certified, intrinsically safe loads in a hazardous area. The loads can be a solenoid or alarm, as well as a nonenergy storing "simple apparatus," such as a Light Emitting Diode (LED).

The FTA is similar to the MU-GDOD12/MU-GDOD82 FTA, except it does not have the capability to accept output override signals from a shut-down device through an auxiliary connector. The following table summarizes typical FTA functions pertinent to these models for planning reference.

Function	Description
Line fault detection	• Each input channel has line fault detection circuitry that causes a contact closure that is present at an auxiliary connector.
Signal connectors	• Two 50-pin connectors provide the interfaces to redundant IOPs. Presently, Digital Output IOP redundancy is not supported. • A 50-pin connector provides contact closure line fault signals from each of the 16 channels.
Field wiring output signals	Each output is a voltage source that provides a maximum output voltage of 25.5 Vdc through 232 ohms. The minimum output voltage varies from 22 volts at zero current to 10 volts at 50 milliamps.

Function	Description
Auxiliary connector	• The auxiliary connector provides Line Fault Detection signals that are represented by a solid-state signal for each of the FTA's 16 channels. Upon detection of a line fault, the Galvanic Isolation Module deenergizes a solid-state switch that has its emitter connected to logic ground. The collector is the output to the auxiliary connector and is not terminated in the module or on the FTA assembly. The solid-state switch has the following characteristics: – Maximum off-state voltage = 35 Vdc – Maximum on-state voltage = 2 Vdc – Maximum off-state leakage current = 10 μA – Maximum on-state current = 50 mA • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to the model MU-GLFD02 CombinerPanel where the signals are combined with 16 other LFD signals from another FTA. The combined 32 signals are available as inputs to redundant Digital Input IOPs, model MU-PDIX02. • By the use of a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters), the signals can be connected to a model MU-GMAR52 Marshalling Panel where the signals are available at screw terminals. • There is no dedicated Standby Manual Device connector on the FTA. An IOP connector interface is used by the Digital Output Standby Manual device to control the output of the FTA.

Function	Description
Indicators	• A green indicator on the FTA illuminates when the primary IOP (A) is active. • An amber indicator on the Galvanic Isolation Module illuminates when the module's output is active. • A green indicator on each Galvanic Isolation Module illuminates when power is applied to the module. • A red indicator on the Galvanic Isolation Module illuminates when a line fault is detected.
Current consumption	• At 25 Vdc and with all outputs active into a 350 ohm load (typical for a solenoid value), the FTA consumes 1.10 amperes. • The power dissipation is 18.7 watts with all outputs active.
Isolation and safety	• The isolation between the safe-side and hazardous-side of the FTA is 250 Vac. The Galvanic Isolation Module divides the two sides. • The safety description for the output of each Galvanic Isolation Module is – 25.5 volts maximum – 170 ohms – 150 milliamps maximum

Combiner Panel

Model MU-GLFD02

The model MU-GLFD02 Combiner Panel is similar in shape and appearance to an "A" size FTA and contains four 50-pin phone-type connectors and a single green LED indicator.

The purpose of the panel is to combine the Line Fault Detection (LFD) outputs (16) of two Digital Output FTAs and present the signals (32) to redundant Digital Input IOPs for integration. The following table summarizes some typical Combiner Panel functions.

Function	Description
Signal connectors	• Two connectors on the panel connect to the auxiliary connector on two Digital Output FTAs that have line fault detection capability. Presently, these are the MU-GDOL12/MU-GDOL82 FTAs. The standard IOP to FTA cable is used to provide the connections. • The combined 32 LFD outputs are available at two output connectors. One output connector connects to IOP A and the other connector connects to its redundant partner, IOP B. The standard IOP to FTA cable is used to provide the connections.
Indicators	• The green LED indicator is illuminated when IOP A is active.

Marshalling Panel

Model MU-GMAR52

The model MU-GMAR52 Marshalling Panel is similar in shape and appearance to a "B" size FTA. It has 38 screw terminal connections. There is only one version of the Marshalling Panel. The Marshalling Panel has one 50-pin connector that receives or sends signals to the safe side of the FTA to which it is connected.

The Marshalling Panel was developed primarily to provide user-accessibility to the signals from the auxiliary connectors on the Galvanically Isolated FTAs, but it can also be used as a general purpose marshalling panel in the IOP subsystem.

ATTENTION

Although the Marshalling Panel is used with the FTAs, the signals present are **not** intrinsically safe or inherently Galvanically Isolated. Therefore, the signals on the Marshalling Panel cannot be exposed to a Division 1, Zone 0 or Zone 1 environment.

Bus bar

Because the Marshalling Panel does not have a built-in shield bus, providing termination for a large number of shield wires requires the use of a horizontal or vertical bus bar. The horizontal or vertical bus bar is connected to the local Master Reference Ground (Safety Ground for CE Compliance).

Mounting

The model MU-GMAR52 Marshalling Panel can be mounted on a vertically oriented FTA Mounting Channel. No Galvanically Isolated or Standard (non-Galvanically Isolated) FTAs can also be mounted on the same FTA Mounting Channel. Cabling to the Marshalling Panel must be routed in the right channel and to the right in a vertical FTA Mounting Channel.

Configurations

The screw terminals connection of the Marshalling Panel can assume six configurations, depending upon the model of FTA to which its 50-pin connector is connected through a model MU-KFTAxx cable (the suffix "xx" in the model number represents the length of the cable in meters). The configurations are described in the following table for the given type of FTA.

Configuration	Description
High Level Analog Input FTAs	
Use	When used with High Level Analog Input (HLAI) FTA or High Level Analog Input/Smart Transmitter Interface (HLAI/STI) FTA, the Marshalling Panel provides either 1 to 5 volt or 4 to 20 mA PV signals.
1 to 5 V signals	The 1 to 5 volt signals are the same signals that the HLAI or STI IOP receives.
4-20 mA signals	The 4 to 20 mA signals must be returned to the FTA to produce the 1 to 5 volt signal across a spool resistor that the IOP requires.
Recording or monitoring devices	The signals are intended to be connected to a recording or monitoring device that the user provides.
1-5 Vdc FTAs	• The following FTAs provide 1 to 5 volt signals: – Model MU-GAIH12/82 HLAI FTA – Model MU-GAIH13/83 HLAI/STI FTA – Model MU-GAIH14/84 HLAI/STI FTA • The subsystem must have an input impedance of 1 megohm, or greater, to avoid loading down the signals and introducing errors into the IOP
4-20 mA FTA	• The following FTA provides 4 to 20 mA signals: – Model MU-GAIH22/92 HLAI FTA • The subsystem must have an input impedance of 250 ohms or less.
Cable routing	The signal wires must be separated from other wires or cables that might induce noise onto the signals. It is suggested that you use a properly grounded, shielded, twisted-pair cable to carry the signals to the recording or monitoring device.
Digital Input FTAs	
Model MU-GDID12/82	Provides potential free sets of contacts that are isolated from the input to the IOP to which the FTA is connected are available.

Configuration	Description
Relay contact interface	Each Digital Input Galvanic Isolation Module mounted on the FTA has two double-pole on/off reed relays. One set of the reed relay contacts is connected to the IOP, the second set of relay contacts is connected to the Marshalling Panel. The contact rating is 10 W, 0.5 A at 35 Vdc.
Application.	The typical applications for the sets of contacts are inputs to sequence of events recorders, monitoring systems, and shutdown systems.
Digital Output FTAs	
Model MU-GDOD12/82	The Digital Output configuration provides control by contacts or transistors to individually deenergize each Galvanic Isolation Module digital output. For example, an “on” output command from the IOP for a channel can be “overwritten” by a control signal from the Marshalling Panel that forces the output signal “off.” The override signal cannot force the output signal “on.”
Application.	• The inputs can be control signals from an emergency shutdown subsystem that is user-supplied. • To disable a particular channel, a designated pair of terminals are shorted together.
Model MU-GDOL12/82	The Digital Output configuration for the model MU-GDOL12/82 FTA is an interface that represents input channel line fault detection from the FTA. Line Fault Detection (LFD) circuitry in each Galvanic Isolation Module controls a solid-state switch output at the FTA’s auxiliary connector. Upon detection of a line fault, the Galvanic Isolation Module deenergizes the solid-state switch that has its emitter connected to logic ground.

Appendix G

Honeywell Services

Honeywell support

Honeywell's **TotalPlant** Services provide you with professional services to meet your needs now, and throughout the life cycle of your automation investment. **TotalPlant** Services are an additional resource to your plant. They deliver technological know-how and industry-specific expertise to help you meet key business goals and compete more effectively. To learn more about Honeywell services, contact your Honeywell Account Manager.

TotalPlant services

TotalPlant Services represent a continuum of consulting, planning, implementation, and support services as described below:

- **Consulting Services** — Honeywell’s Consulting Services work with you to define current needs and future requirements. We draw upon our industry-specific expertise to identify solutions that effectively meet your goals; we create a plan for implementing your automation vision.
- **Training** — Honeywell provides the most effective advanced automation training available.
- **Project Services** — Honeywell’s Project Services provide full, single-source support for automation projects of any size. These services assure you of a high-quality, professional implementation, and allow you to enjoy the benefits of your automation technology much sooner. Project services encompass:
  - requirements definition
  - design
  - implementation
  - installation
  - start-up
- **Integration Services** — Honeywell’s Integration Services address your integration needs at all levels of the plant. At the process level, we help you incorporate smart subsystems (such as lab analyzers or gas chromatographs) into your control system architecture. At the plant level, we apply our extensive resources and experience to provide complete integration solutions.

- **Network Services** — Honeywell's comprehensive Network Services include design, installation, and support for all standard industrial local area networks and their attached devices. Our goal is to provide you with the highest up-time attainable; we do that through proactive consulting and maintenance techniques.
- **Application and Advanced Control Services** — Honeywell's Application Services are designed to meet the specific requirements of your industry. These services provide the advanced control and production management direction, implementation, and support required to optimize your process, while increasing your profits.
- **Environmental Safety and Specialty Services** — As awareness of environmental and safety issues has grown, so has the number of government regulations. Honeywell's Environmental Safety and Specialty Services help you to comply with requirements quickly; doing so completely and in a cost-effective manner.
- **Availability and Optimization Services** — Honeywell's Availability and Optimization Services can increase system and equipment up-time, while improving productivity and reducing support costs. Services include:
  - ***Hardware Support Services*** to keep your system, instrumentation, and equipment in optimal running condition.
  - The ***Asset Management Program*** which offers you an attractive alternative to owning and managing spare parts.
  - The ***System Enhancement and Support Program*** which can improve your productivity and system availability with expert assistance, automatic software updates, automatic documentation management, and an electronic bulletin board.
  - ***The Site-Support Specialist*** which applies the resources of an experienced service professional to the challenge of implementing your automation technology in a quick and proper manner.
  - ***Validation Services*** lowering your cost of complying with regulatory requirements of pharmaceutical manufacturing.

PlantScape training

Honeywell offers the following PlantScape training options:

- **427 PlantScape/SCAN3000 Server and Station Implementation I** - This 5-day course provides training for plant technicians, project engineers and consultants in the operating and configuration procedures for PlantScape Server and the methods used to implement a given database specification. Students are introduced to the concept of "points" being used to convey process data between controllers and the PlantScape Server, how to interpret point data and how to operate plant equipment using points. Having covered operations, the students are then taken through the process of "building" a PlantScape Server with practical exercises being used to supplement classroom sessions. The course concludes with a session on system administration, including backups and restoring a database, and analysis of performance.
- **428 PlantScape Controller Implementation** - This five-day course is designed to enable the student to configure and program the PlantScape Controller. The course has a real world context and all exercises are used to create a functional hybrid control application. In addition, it provides instruction on server ControlNet configuration and the use of Knowledge Builder.
- **418 PLANTSCAPE/SCAN 3000 Implementation II** - This 4-day course provides training for engineers, project engineers, and consultants in the procedures required for the design and optimization of a PlantScape or SCAN 3000 database for a given application. This course is suited for students working with SCAN 3000/PlantScape systems.
- **Custom Training** — Training classes can also be tailored to your specific project and plant needs. Contact your Honeywell Account Manager for additional information regarding the location and content of PlantScape training.

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Reader Comments

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