Allen-Bradley

CENTERLINE 2100 Motor Control Center with IntelliCENTER Technology Using an EtherNet/IP Network

Bulletin 2100

Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
Updated information about the 24V DC power supply.	10
Updated the Integrated 24V DC power layout example	33…34

About This Publication

This document is for engineers or technicians directly involved in the installation, connection, commissioning, energizing, and maintenance of the CENTERLINE® 2100 Motor Control Center (MCC) with EtherNet/IP™ network. See MCC Commissioning Checklist prior to applying power to the MCC.

This document provides the following information about CENTERLINE 2100 MCCs with EtherNet/IP network:

- System architecture
- Factory installed components
- EtherNet/IP network connections
- 24V DC power connections commissioning
- Expansion of the existing lineup
- Integration of the EtherNet/IP network into your plant-wide network

If you do not have a basic understanding of the CENTERLINE 2100 MCC with EtherNet/IP network system architecture, see the IntelliCENTER EtherNet/IP Motor Control Centers Reference Manual, publication MCC-RM001.

This table defines abbreviations that are used in this manual.

Table 1 - Terminology

Abbreviation	Full Term	Definition
MCC	Motor Control Center	An assembly of one or more enclosed sections that contains motor control units and have a common power bus.
IMC	Intelligent Motor Control	Motor Control devices that can connect to a communication network.
ODVA	Open DeviceNet Vendors Association	Organization that standardizes communication networks that use CIP among other technologies.
CPwE	Converged Plantwide Ethernet	Rockwell Automation and Cisco initiative to standardize Ethernet network implementation across the manufacturing and enterprise networks.
REP	Resilient Ethernet Protocol	Redundant network topology/feature in the Stratixã 5700 switch.
DHCP	Dynamic Host Configuration Protocol	Networking protocol that is used to distribute network parameters such as IP addresses to connected devices.

IntelliCENTER Motor Control Center with EtherNet/IP Network Overview

The IntelliCENTER® EtherNet/IP MCC couples the reliability of the CENTERLINE 2100 MCC with robust EtherNet/IP network, Intelligent Motor Control (IMC) devices, and intuitive IntelliCENTER software to deliver an effective and integrated motor control solution.

The IntelliCENTER EtherNet/IP MCC is an assembly of one or more enclosed vertical sections that are powered by a common power bus. Each section can contain multiple intelligent motor control units. The MCC assembly has two types of unit construction:

- Plug-in unit construction:

  Units that can be inserted and removed from an MCC section. Plug-in units typically have a lower current capacity than frame-mounted units.
- Frame-mount unit construction:

  Units that are built with frame-mounted construction are permanently mounted to an MCC section and cannot be inserted or removed. Frame-mounted units typically have a higher current capacity than plug-in units.

The MCC section can have two types of built-in wireways where the wiring connections are made inside the MCC enclosure. The built-in wireways typically contain the following components, which could vary based on customer requests. See the MCC one-line drawing included with your MCC for actual MCC setup:

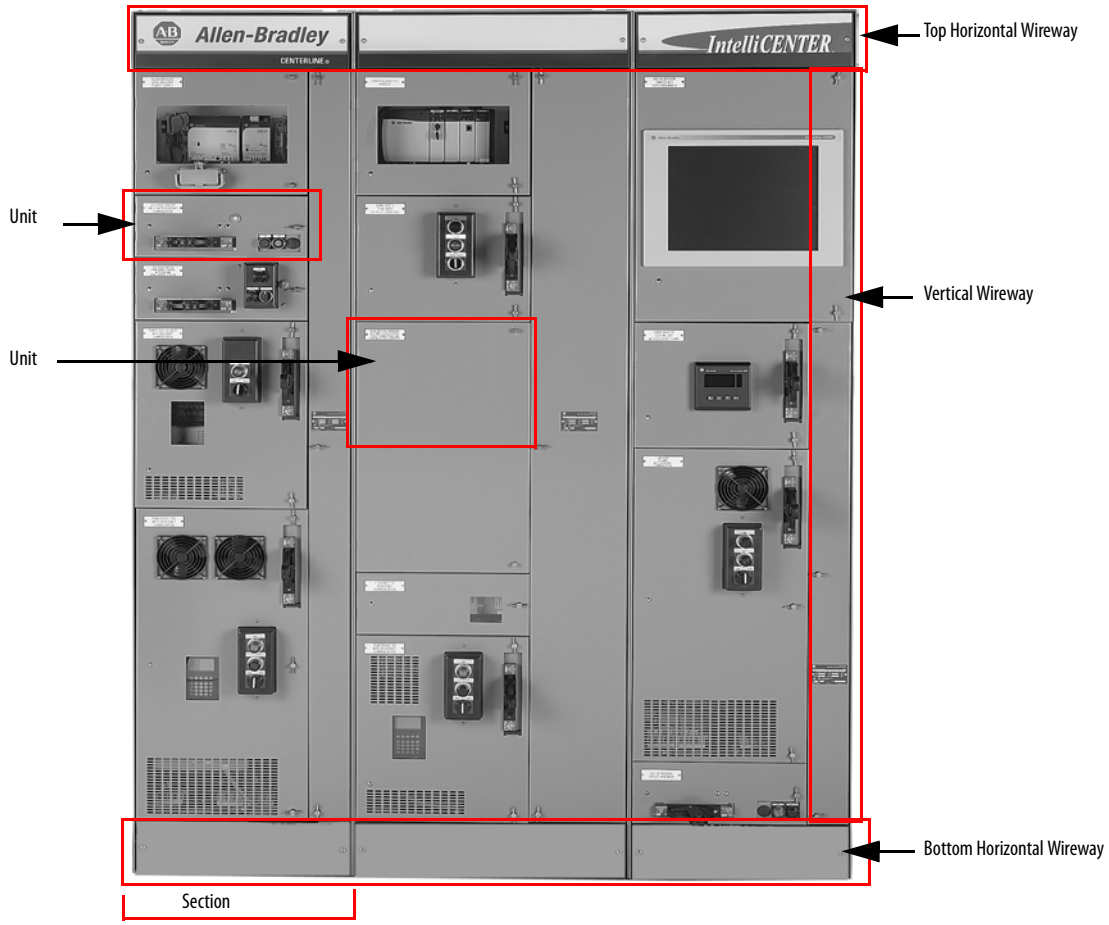
- Top and bottom horizontal wireways can contain the following:
  - Motor cable routings
  - Stratix 5700 industrial Ethernet switch
  - Industrial Ethernet cable routings
  - 24V DC power supply wiring
- Vertical wireways are typically seen in sections with plug-in unit construction and can contain the following:
  - Wireway adapters for the EtherNet/IP network and 24V DC power that provide easy connections for IMC devices
  - Industrial Ethernet cable routings
- Motor cable routings
  - 24V DC power supply wiring

The MCC section can have two different industrial Ethernet switch mounting locations:

- Top or bottom horizontal wireway-mounted Stratix 5700 switches
  - One Stratix 5700 switch per switch group
  - A switch group is composed of all sections, and Ethernet devices within those sections that are connected to a given Stratix 5700 switch
  - The standard switch group cannot exceed 9 sections or 8 intelligent device connections in that switch group for horizontal wireway-mounted switches
- Top or bottom unit-mounted Stratix 5700 switches
  - One or two Stratix 5700 switches per switch group
  - A switch group is composed of all sections, and Ethernet devices within those sections that are connected to a given Stratix 5700 switch unit
  - The standard switch group cannot exceed 9 sections or 24 intelligent device connections in that switch group for unit-mounted switches

IMPORTANT You must choose one industrial Ethernet switch mounting methodology per MCC lineup. For example, if you choose to have your industrial Ethernet switch mounted in the horizontal wireway, all of the sections within that MCC lineup must have the industrial Ethernet switch mounted in the same horizontal wireway.

Figure 1 - Example of a CENTERLINE 2100 Motor Control Center with IntelliCENTER Technology



The EtherNet/IP network is an industrial version of an Ethernet network. IntelliCENTER EtherNet/IP MCCs use the EtherNet/IP network to connect IMC devices in your application. The EtherNet/IP network provides excellent reliability and a robust network solution for your entire factory from the control room to the MCC. The integrated EtherNet/IP network within your IntelliCENTER MCC is preconfigured, tested, and validated at the factory before shipment. The EtherNet/IP network integrates with current IT networks and lets you collect data to determine plant production, energy efficiency, and other key performance indicators and metrics.

The EtherNet/IP network can accommodate a vast number of nodes and unlike other fieldbus networks has no specific node maximum. The limit varies based on the number of connections the EtherNet/IP scanner can make within the controller application, and the network topology that is implemented. The number of connections that are used by each node varies. To estimate the number of connections an Ethernet network uses, see the Advanced EtherNet/IP capacity tool embedded in the Integrated Architecture® Builder (IAB) software
http://raiseinstall.rockwellautomation.com/pst-lite.html.

See the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001, for detailed information on the EtherNet/IP network and the IntelliCENTER MCC system.

IntelliCENTER MCC with EtherNet/IP System Architecture and Connections

The IntelliCENTER EtherNet/IP MCC system architecture is composed of a physical infrastructure that enables the appropriate network layout and topology for MCC applications. The physical infrastructure consists of industrial Ethernet switches, industrial Ethernet cables, integrated 24V DC power, and IMC device connections. This section focuses on these topics and describes how your IntelliCENTER EtherNet/IP MCC is shipped from the factory.

Industrial Ethernet Switch

The IntelliCENTER EtherNet/IP MCC is designed with Stratix 5700 Layer 2 managed switches. The Stratix 5700 switch is an industrial Ethernet switch that provides a range of advanced features. With the managed switch, the IntelliCENTER EtherNet/IP MCC connects to the plant-wide EtherNet/IP network providing excellent reliability and a robust connection. The benefits of the Stratix 5700 managed switch are explained in detail in the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001.

The Stratix 5700 switches are factory-configured with customer defined IP addresses and subnet masks that are provided at order entry. All network connections are tested and validated during the system level test at the factory, before shipping.

MCC sections that use a Stratix 5700 switch to connect to IMC devices can come configured with 6-port, 10-port, 20-port, or 30-port (combination of 10-port and 20-port switches) switch options. The Stratix switch can be wireway-mounted or unit-mounted. Unit-mounted switches can be 0.5 or 1.0 space factor depending on the chosen port capacity. The type of Stratix switch that is installed in the IntelliCENTER MCC depends on the quantity and type of intelligent units that are installed and customer preference. See Table 2 for the Stratix switch types and locations available for the IntelliCENTER EtherNet/IP MCC.

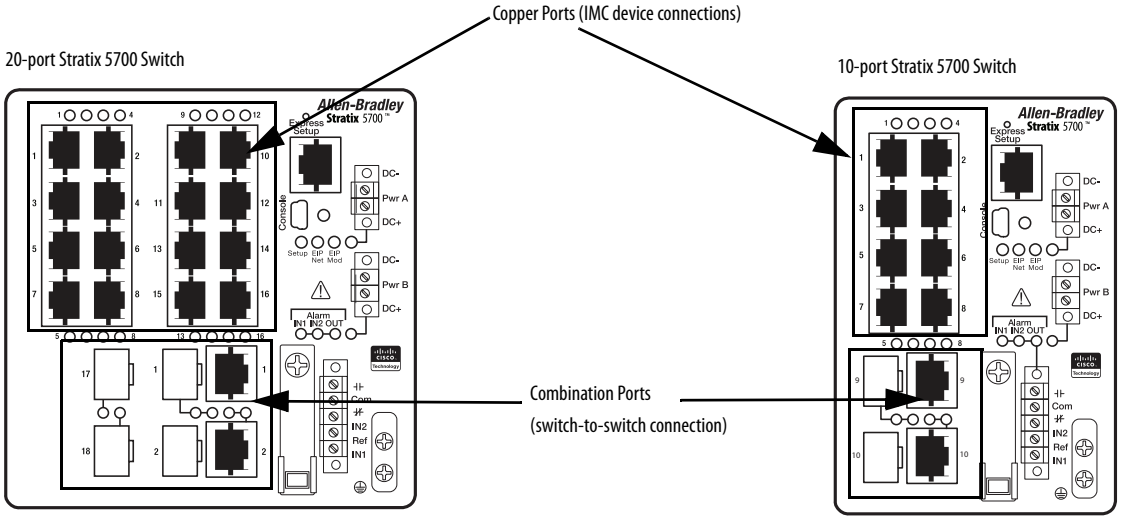
Table 2 - Available Switch Port Capacities for Stratix 5700 Switches Within the IntelliCENTER EtherNet/IP MCC

Switch Location	Stratix 5700 Port Capacities	Space Factor	Total Ethernet Port Capacity	Ethernet Device Connection Capacity	Switch-to-switch Connection Capacity
Unit mounted	6-port switch	0.5 Space Factor	6	4	2
		1.0 Space Factor			
	10-port switch	0.5 Space Factor	10	8	2
		1.0 Space Factor			
	20-port switch	1.0 Space Factor	20(1)	16	2
	Combination 10-port and 20-port switches		30(1)	24	2
Wireway mounted	6-port switch	N/A	6	4	2
	10-port switch		10	8	2

(1) The 20-port switch includes two dedicated SFP ports that are not used in the standard IntelliCENTER MCC design.

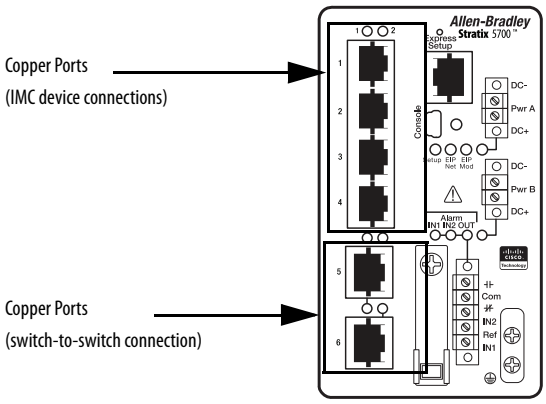
Each Stratix 5700 switch uses copper Ethernet ports for IMC device-to-switch connections and either two copper Ethernet ports or two combination Ethernet ports for switch-to-switch connections (varies by Stratix 5700 model). Combination ports support either fiber-optic or copper Ethernet connections. The standard design uses copper connections for switch-to-switch connections. See the Industrial Ethernet Cable section for more information on when to consider using fiber for switch-to-switch connections.

Figure 2 - Stratix 5700 Switch Examples



IMPORTANT The example10-port Stratix 5700 switch that is shown is catalog number 1783-BMS10CL. The example 20-port Stratix 5700 switch that is shown is catalog number 1783-BMS20CL. See the MCC one-line drawing that is included with your MCC to determine the exact Stratix 5700 model installed in your MCC. For information on other Stratix 5700 switch catalog numbers, see the Stratix Managed Switches User Manual, publication 1783-UM007.

Figure 3 - 6-port Stratix 5700 Switch Example



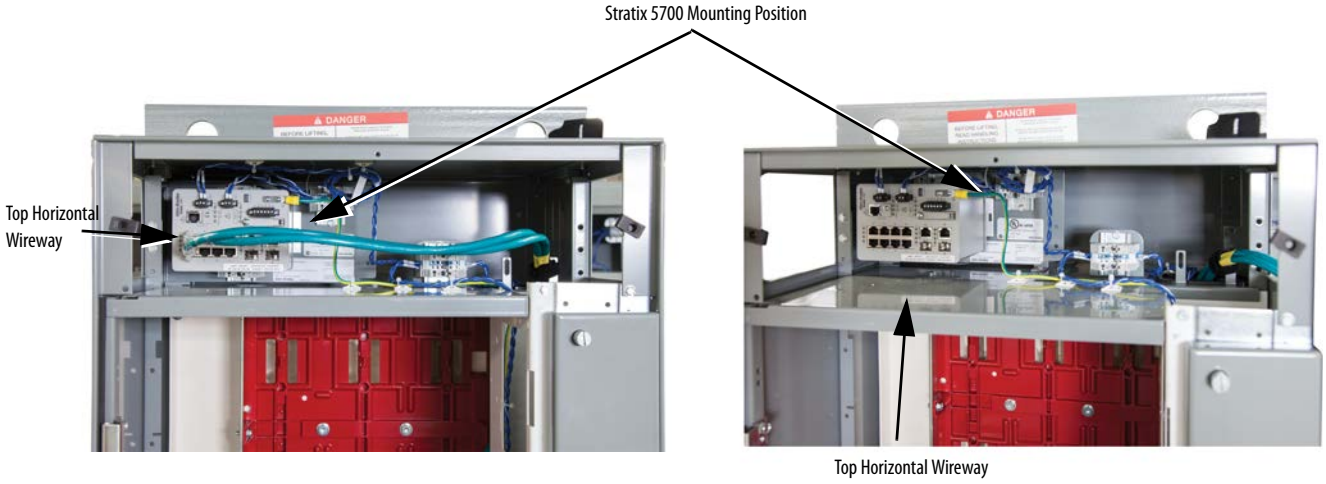
IMPORTANT The example 6-port Stratix 5700 switch that is shown is catalog number 1783-BMS06TL. See the MCC one-line drawing that is included with your MCC to determine the exact Stratix 5700 model installed in your MCC. For information on other Stratix 5700 switch catalog numbers, see the Stratix Managed Switches User Manual, publication 1783-UM007.

For further details on IntelliCENTER EtherNet/IP MCC switch options and switch details, see the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001. See the MCC one-line drawing included with your MCC to determine the exact Stratix 5700 model installed in your MCC.

Horizontal Wireway-mounted Stratix 5700 Switch

A typical top horizontal wireway Stratix 5700 switch mounting example is shown in Figure 4. The switch can also be mounted in the bottom horizontal wireway if desired. Switches that are mounted in the horizontal wireway must be located opposite the horizontal ground bus. Switches must also be mounted in the same side (top or bottom horizontal wireway) across one MCC lineup.

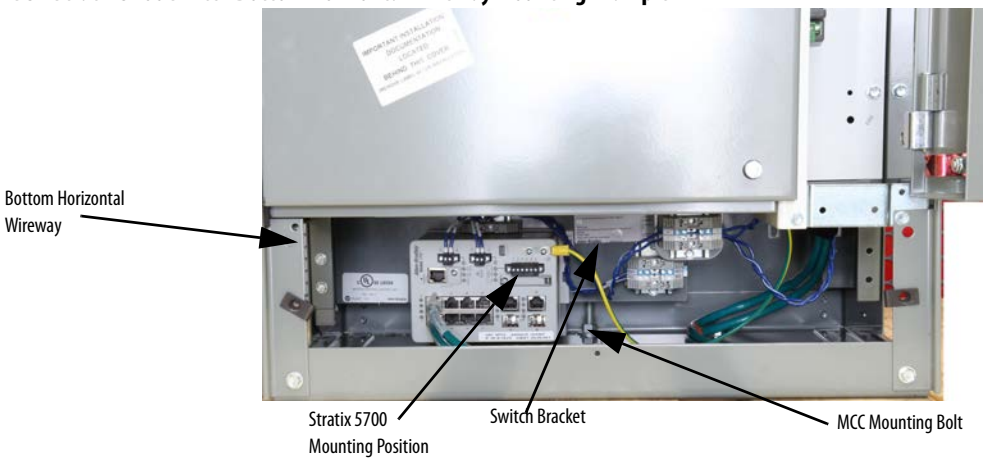
Figure 4 - Stratix 5700 Switch Top Horizontal Wireway Mounting Example with Adapter Ethernet Connections



IMPORTANT When a switch is placed in the top horizontal wireway and optional section heaters are included in the top horizontal wireway as well, the switch can impact the heating system performance by increasing the ambient temperature near the thermostat.

When bottom-mounted wireway switches are installed, access to the bolts used to attach the MCC sections to the skid can be limited as shown in Figure 5. Removal of the switch bracket from the bottom wireway can be necessary for adequate access to the bolts. The switch bracket can be removed by unscrewing the two bolts on the left side and a third bolt above the switch attached to the bottom baffle.

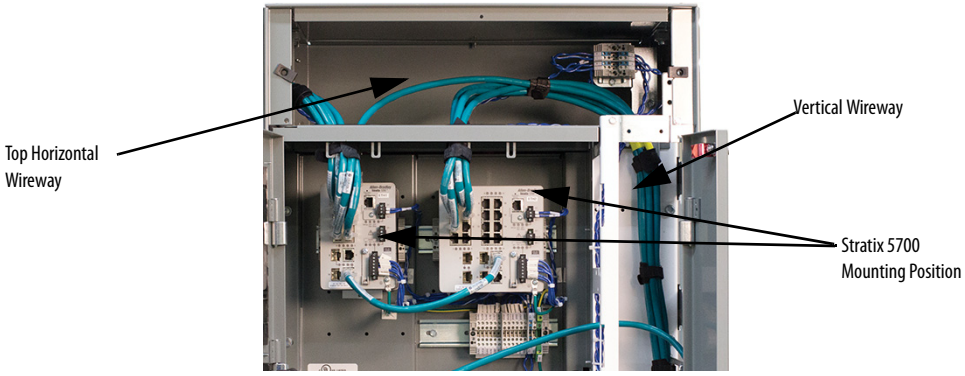
Figure 5 - Stratix 5700 Switch Bottom Horizontal Wireway Mounting Example



Unit-mounted Stratix 5700 Switch

Unit-mounted switches must be in the unit location below the top horizontal wireway or above the bottom horizontal wireway to maintain easy Ethernet cable routing to nearby IMC devices. A typical top unit Stratix 5700 switch mounting example is shown in Figure 6.

Figure 6 - Stratix 5700 Switch Unit Mounting Example (30-port) with Homerun Ethernet Connections



TIP The combination 30-port switch unit is shown. Not all switch units require two switches. Spare (unconnected) switch ports can be chosen to support future device connections. See Table 2 for more information.

Industrial Ethernet Cable

Due to the high potential for electrical interference in an MCC, the proper industrial Ethernet communication cable is critical to provide excellent reliability and a robust EtherNet/IP network. We recommend against the use of standard copper Ethernet cable. To provide the noise immunity necessary in a motor control center, we recommend that you use only exclusive 600V, UL Listed, shielded, power limited tray cable (PLTC) rated, Category 5e industrial Ethernet cable. The industrial Ethernet cable can be routed near high-voltage power cables without impacting the performance or reliability of the network. This cable design is a critical attribute of Ethernet network cabling within an MCC given the close proximity of high-voltage devices and their associated power cables.

With this 600V UL Listed industrial Ethernet cable, the EtherNet/IP network and intelligent devices in the IntelliCENTER MCCs have been tested to the most rigorous standards for electrical noise immunity. These test results let Rockwell Automation deliver a robust, noise-immune EtherNet/IP architecture within the MCC:

- Surge - Simulates lightening strike
  - ± 2 KV, 40 A surge that is repeatedly applied to the network cable
  - IEC 61000-4-5
- Fast Transient Burst - Simulates industrial noise
  - ± 1 KV high voltage burst applied to the network cable
  - IEC 61000-4-4
- Conducted Immunity - Simulates radio frequency interference
  - 150 kHz...80 MHz interference that is applied to the network cable
  - IEC 61000-4-6
- Electrostatic Discharge Immunity - Simulates static discharge
  - ± 8 KV ESD event at 12 locations on the MCC and network cable
  - IEC 61000-4-2

Figure 7 - Industrial Ethernet Cable

Table 3 shows the three speeds that the Category 5e industrial Ethernet cable supports. The higher speed data rates transfer more data in a shorter period, which can be vital for applications that require short response times.

Table 3 - Category 5e Copper Cabling

Speed Rating	Data Speed
10BASE-T	10 Mb/s
100BASE-TX	100 Mb/s
1000BASE-T	1 Gb/s

The standard Ethernet cable for switch-to-unit connections is the 600V UL Listed copper Ethernet cable. However, fiber-optic Ethernet cable is sometimes required for switch-to-switch Ethernet connections in certain Ethernet topologies. For further details on IntelliCENTER EtherNet/IP MCC topologies and cable details, see the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001.

The 600V UL Listed industrial Ethernet cable is also commonly used to connect the IntelliCENTER EtherNet/IP MCC to the plant-wide Ethernet network. For further details on IntelliCENTER EtherNet/IP MCC plant network connections, see the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001.

24V DC Power Supply

24V DC power is integrated throughout the IntelliCENTER EtherNet/IP MCC to provide power for the Stratix 5700 switch and various IMC devices. The integrated 24V DC power within the IntelliCENTER EtherNet/IP MCC can be supplied by 24V DC power supply units. The 24V DC power supply units are available in these common configurations:

- Circuit breaker and control transformer
- Fusible disconnect and control transformer
- No disconnecting means, requires a separate 110...120V source
- Redundant configurations are also available with one of the following options:
  - A Two-branch redundant unit can be included that accepts two separate power supply connections on the input side and outputs one source to 24V DC circuit. When one power supply fails, the other takes over automatically reducing device and network downtime. The separate two-branch unit allows the failed power supply to be replaced without impacting the network. The two-branch unit can be fed by the following options:

    Two Rockwell-supplied 24V DC power supply units

    Two external 24VDC power inputs provided by the customer

    One Rockwell-supplied 24V DC power supply unit and one external power input provided by the customer
  - A second standard power-supply unit can be added to an MCC section that already contains a standard power supply. In this instance, the power supply in the lower unit location is wired to the 24V DC power within the MCC. In the event of a failure, the 24V DC wire can be manually shortened to connect to the other unit in the section
  - A second 8 A power supply can be added in the same unit. The second power supply is wired with blocking diodes to work in concert with the initial power supply. If a failure occurs, power supplies can only be replaced during MCC network downtimes since both power supplies exist behind the same unit disconnect.

The number of 24V DC power supplies required throughout the IntelliCENTER EtherNet/IP MCC is dependent on the number of Stratix 5700 switch and IMC devices in the MCC lineup that require 24V DC power. The integrated MCC 24V DC power consists of multiple branches, each designed to support a maximum of 4 A of current draw. Each branch is protected by a 1-pole mini circuit breaker. Each branch is connected to either a Rockwell Automation Ethernet power supply unit that can support two branches or the two-branch redundant power unit if used. To make sure this specification is not exceeded, the 24V DC power supply current draw for the MCC configuration is calculated at the time of order entry. The calculations are based on the devices that require 24V DC in each MCC section. The result of the calculations determines how many sections can be supported on one branch of the power supply. The 24V DC power can be spliced between multiple sections. Figure 8 shows an example on how 24V DC power is configured.

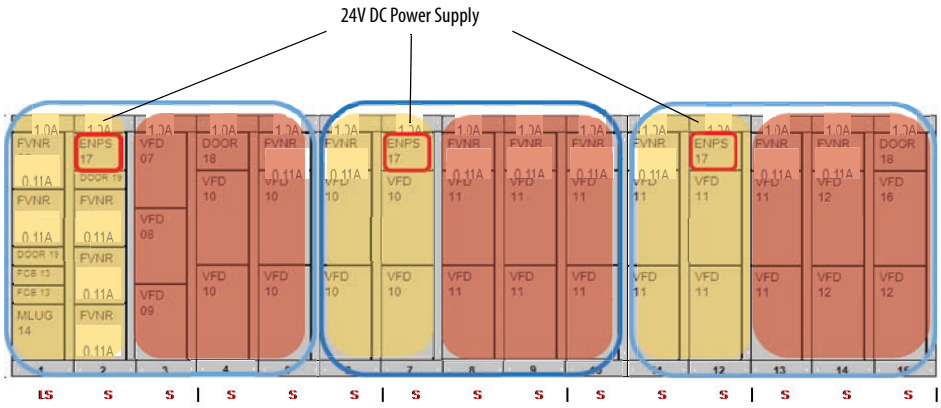
Figure 8 - 24V DC Power Distribution Example

Yellow - Left Branch

Red - Right Branch

Blue Box - Sections that are powered by power supply

Red Box - 24V DC Power Supply unit



When you change your MCC lineup, including when you add or move MCC units or sections, take care to make sure the 24V DC current draw limitations are not exceeded. See Adding EtherNet/IP IntelliCENTER Sections to an Existing Lineup and Adding or Rearranging EtherNet/IP IntelliCENTER Plug-in Units Within an Existing Lineup for more information.

TIP Review the table in your MCC one-line drawing to determine current draw for each power supply branch.

EtherNet/IP Network and 24V DC Connections

This section is for engineers or technicians who are directly involved with the commissioning of the EtherNet/IP network and 24V DC connections in the IntelliCENTER MCC. Additional information and figures can be found in the EtherNet/IP Network Topology section, but the standard IntelliCENTER EtherNet/IP MCC design uses a linear/star EtherNet/IP topology. In this design, the Stratix 5700 switch-to-switch EtherNet/IP connections use a linear topology, and the IMC device EtherNet/IP connections to the Stratix 5700 switches use a star topology. A switch-level ring topology is also available and is identical to the linear/star topology, but the Stratix 5700 switch-to-switch connections use a switch-level ring topology in place of the linear topology. These topologies are implemented throughout the MCC lineup by using an EtherNet/IP network and 24V DC power. The EtherNet/IP network and 24V DC power requires connections in each MCC section. You also need connections within and across MCC shipping splits, which consist of one, two, or three MCC sections. This section focuses on the EtherNet/IP network and 24V DC connections across and within the shipping splits.

EtherNet/IP Network and 24V DC Connections Within a Shipping Split

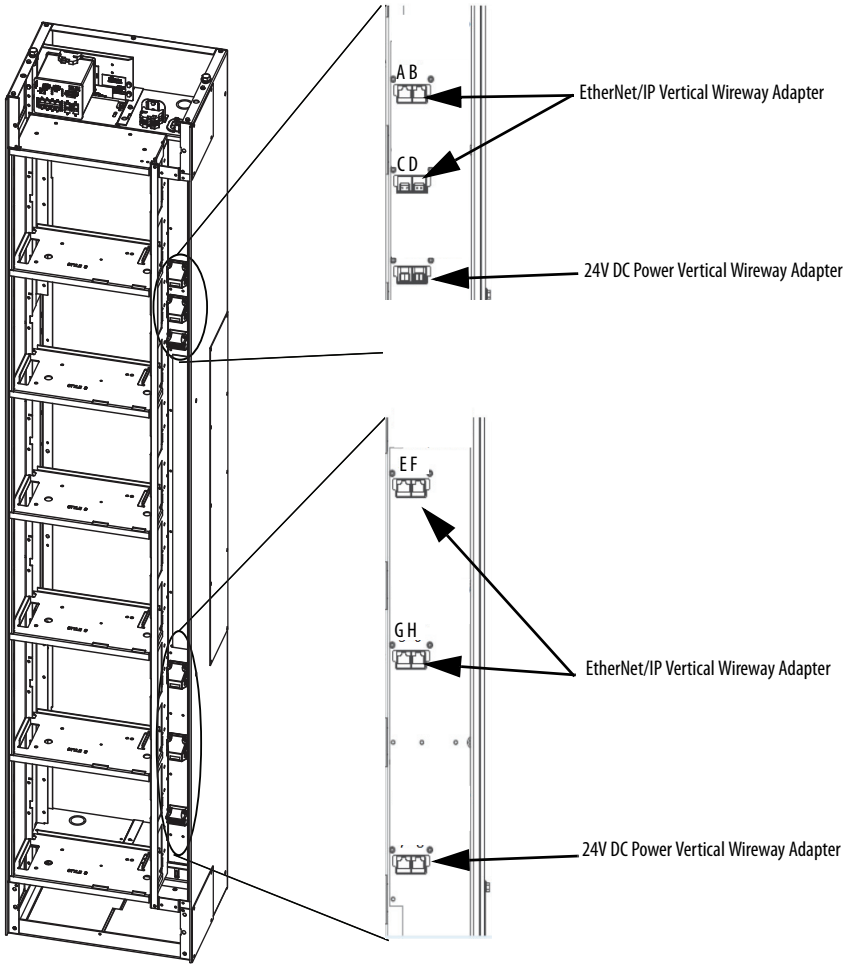
This section provides detailed instructions for commissioning the EtherNet/IP network and 24V DC power connections within the shipping splits.

Within an MCC shipping split, the Stratix 5700 switch-to-switch connections are pre-wired at the factory. Additionally, within an MCC shipping split, the connections from the IMC devices to the EtherNet/IP switch and 24V DC power supply are prewired at the factory. The connection method of Ethernet cables varies based on customer preference.

Sections with Plug-in Units in an MCC with Vertical Wireway Adapters

The IntelliCENTER EtherNet/IP MCC design can include vertical wireway adapters to connect IMC devices in plug-in units to the Stratix 5700 switch and integrated 24V DC power supply. IntelliCENTER MCC sections that contain plug-in units include up to four EtherNet/IP adapters in the vertical wireway, which lets you connect up to eight IMC devices (each EtherNet/IP adapter contains two RJ45 Ethernet ports). Ethernet adapters are scaled in each section according to the number of IMC devices requiring connection, so it is possible that not all sections have four Ethernet adapters. Additionally, two 24V DC power adapters in the vertical wireway provide four 24V DC connections that let you power up to eight IMC devices (two IMC devices can be wired to each of the four 24V DC power connections). The EtherNet/IP and 24V DC power adapters are shown in Figure 9.

Figure 9 - Example of Plug-in Section Vertical Wireway Adapter Locations



The EtherNet/IP plug-in units are pre-wired with an industrial Ethernet cable from the IMC device to one of the eight EtherNet/IP adapters. Each EtherNet/IP adapter is connected directly to the Stratix 5700 switch in a star topology, which lets you plug in and remove each plug-in unit without affecting adjacent IMC devices. These connections are made at the factory before shipping. The vertical wireway adapters are oriented in alphabetical order that starts in the top left, as shown in Figure 9. This labeling remains the same even if a section does not include all four Ethernet adapters. As shown in Figure 10, adapters are designed to mount on the customer-facing side of the vertical wireway. By removing the adapters, you have access to the connections made behind the vertical wireway for easy maintenance. The adapters can also be replaced if needed.

All industrial Ethernet cables have detailed cable labels to maintain proper IMC device to switch port mapping. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more information.

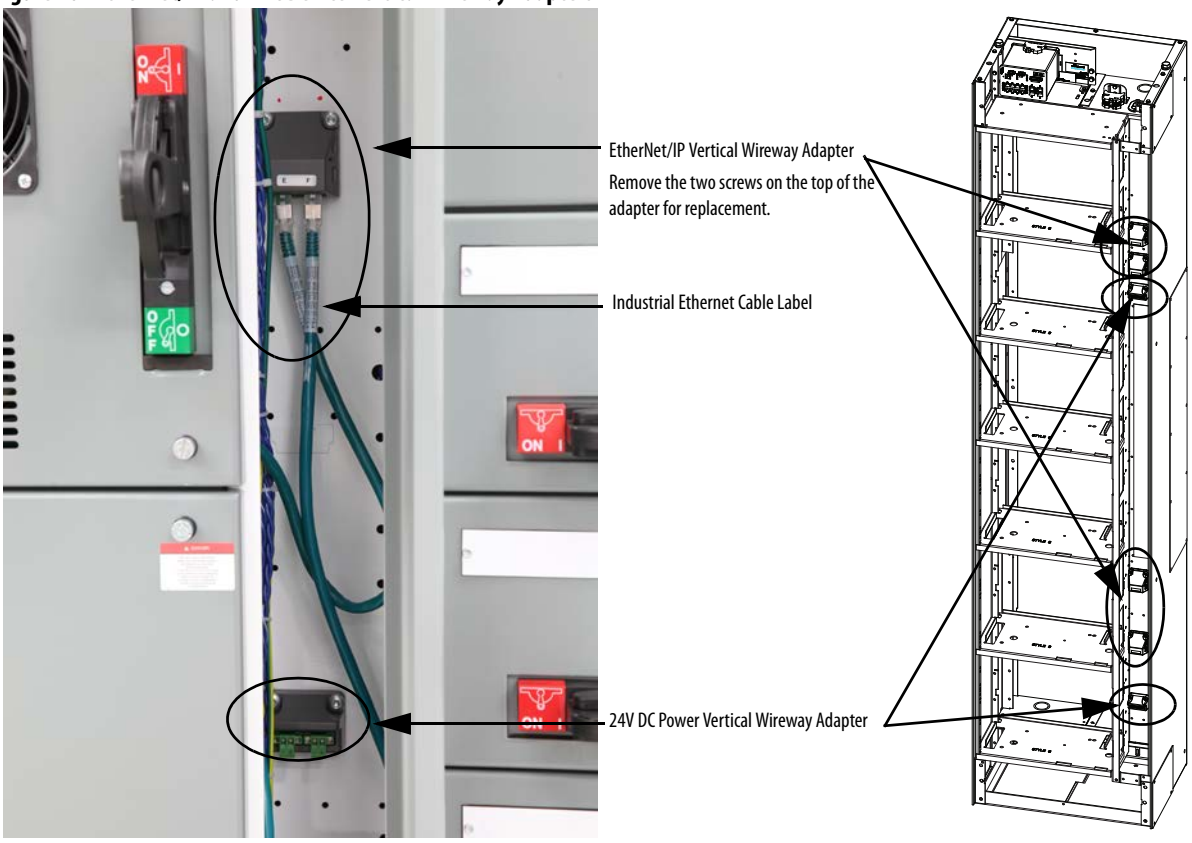
The standard IntelliCENTER EtherNet/IP MCC design with adapter Ethernet connections uses terminal blocks that are in the horizontal wireway. The terminal blocks are used to distribute the 24V DC power to the 24V DC power adapters mounted in the vertical wireways of each section. The plug-in units with IMC devices that require 24V DC power are pre-wired at the factory with a connection from the device to one of the four 24V DC power connectors. The terminal blocks are also used to extend 24V DC power to adjacent MCC sections and shipping splits. For more information on section-to-section 24V DC connections, see Splicing the 24V DC Power Supply.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

Figure 10 shows an example of an IMC device connection to the EtherNet/IP and 24V DC power vertical wireway adapters. The front-mounted adapter design provides the following:

- A slanted housing that helps protect Ethernet and 24V DC connections
- Ability to access connections behind the vertical wireway for maintenance activities
- Optional replacement of adapters
- Screw terminals for 24V DC connection plugs to help maintain the connection

Figure 10 - EtherNet/IP and IMC Device Vertical Wireway Adapters



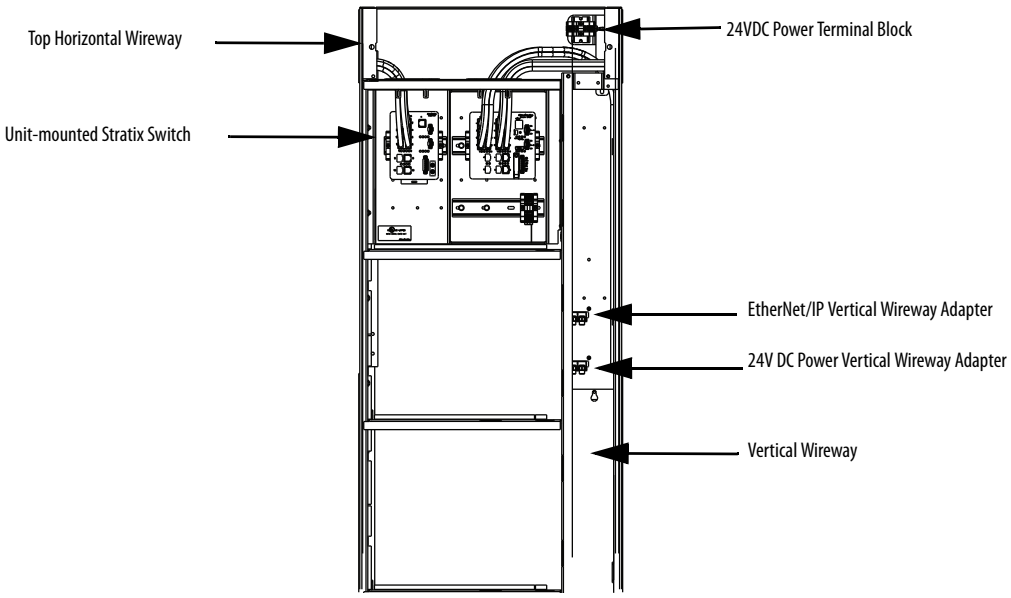
When you remove a plug-in unit or IMC device, the best practice is to disconnect the industrial Ethernet cable and 24V DC cable from the IMC device. The other end of the industrial Ethernet cable and 24V DC cable remain plugged into the vertical wireway adapter. You can then easily reconnect the plug-in unit or IMC device to the same EtherNet/IP adapter and 24V DC adapter. The standard IMC device configuration includes a static IP address, which allows the device Ethernet cable to be reconnected to any vertical wireway adapter because the device to switch port mapping is not critical. However, if a device is connected to the wrong EtherNet/IP vertical wireway adapter while using a Stratix 5700 switch feature such as DHCP port persistence, the device can no longer communicate properly on the EtherNet/IP network until the issue is resolved. Device to switch port mapping is critical when using advanced switch features. Cable labels are included on both ends of every Ethernet cable, which provides information on where the cable is connected to on both ends. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more information. See the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001 for more information on DHCP port persistence.

When you add or move plug-in units in an MCC section, special care must be taken to make sure the 24V DC current draw limitations are not exceeded. See Adding EtherNet/IP IntelliCENTER Sections to an Existing Lineup and Adding or Rearranging EtherNet/IP IntelliCENTER Plug-in Units Within an Existing Lineup for more information.

Sections with Plug-in Units in an MCC with Homerun Connections

The IntelliCENTER EtherNet/IP MCC design can include direct Ethernet connections (homerun connections) to connect IMC devices in plug-in units to the Stratix 5700 switch. This design uses vertical wireway power adapters to connect IMC devices in plug-in units to the integrated 24V DC power supply. Two 24V DC power adapters in the vertical wireway provide four 24V DC connections that let you power up to eight IMC devices (two IMC devices can be wired to each of the four 24V DC power connections). The EtherNet/IP connections and 24V DC power adapters are shown in Figure 11.

Figure 11 - Example of Plug-in Section Unit-mounted Stratix Switch and 24V DC Power Adapter Locations



The EtherNet/IP plug-in units are pre-wired with an industrial Ethernet cable from the IMC device directly to the unit-mounted Stratix switch. You can plug in and remove each plug-in unit without affecting adjacent IMC devices. These connections are made at the factory before shipping when within a shipping split. The connection scheme connects each IMC device to a Stratix switch with industrial Ethernet cables that are labeled on both ends with the location of the Stratix switch and plug-in unit that the Ethernet cable connects. For more information on the connection across splits, see Splicing EtherNet/IP Network.

The IntelliCENTER EtherNet/IP MCC design with homerun Ethernet connections uses terminal blocks that are in the horizontal wireway. The terminal blocks are used to distribute the 24V DC power to the 24V DC power adapters mounted in the vertical wireway of the section. The plug-in units with IMC devices that require 24V DC power are pre-wired at the factory with a connection from the device to one of the four 24V DC power connectors. The terminal blocks are also used to extend 24V DC power to adjacent MCC sections and shipping splits. For more information on section-to-section 24V DC connections, see Splicing the 24V DC Power Supply.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

When you remove a plug-in unit or IMC device, the best practice is to disconnect the industrial Ethernet cable and 24V DC cable from the IMC device. The other end of the industrial Ethernet cable and 24V DC cable remain plugged into the connected Stratix switch and the vertical wireway power adapter respectively. You can then easily reconnect the plug-in unit or IMC device to the same industrial Ethernet cable and 24V DC adapter. The standard IMC device configuration includes a static IP address, which allows the device Ethernet cable to be reconnected to any vertical wireway adapter because the device to switch port mapping is not critical. However, if a device is connected to the wrong EtherNet/IP vertical wireway adapter while using a Stratix 5700 switch feature such as DHCP port persistence, the device can no longer communicate properly on the EtherNet/IP network until the issue is resolved. Device to switch port mapping is critical when using advanced switch features. Cable labels are included on both ends of every Ethernet cable, which provides information on where the cable is connected to on both ends. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more information. See the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001 for more information on DHCP port persistence.

Detailed cable labels were added to all industrial Ethernet cables to maintain proper IMC device to switch port mapping. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more information.

Sections with Frame-mount Units

The standard IntelliCENTER EtherNet/IP MCC design uses direct EtherNet/IP network and 24V DC power connections (homerun connection) in place of vertical wireway adapters in sections with full-section frame-mounted units. The Stratix 5700 switch is connected directly to the IMC device EtherNet/IP port. Similar to sections with plug-in units, terminal blocks are located in the horizontal wireway. The terminal blocks are used to distribute the 24V DC power to the IMC devices in that section. The 24V DC power is connected directly to the IMC devices that require 24V DC power. The terminal blocks are also used to extend 24V DC power to adjacent MCC sections and shipping splits. For more information on section-to-section 24V DC connections, see Splicing the 24V DC Power Supply. The EtherNet/IP network and 24V DC power connections with frame-mount units are made at the factory before shipping.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

EtherNet/IP Network and 24V DC Connections Across Shipping Splits

This section provides detailed instructions for the commissioning of the EtherNet/IP network and 24V DC power connections across the shipping splits.

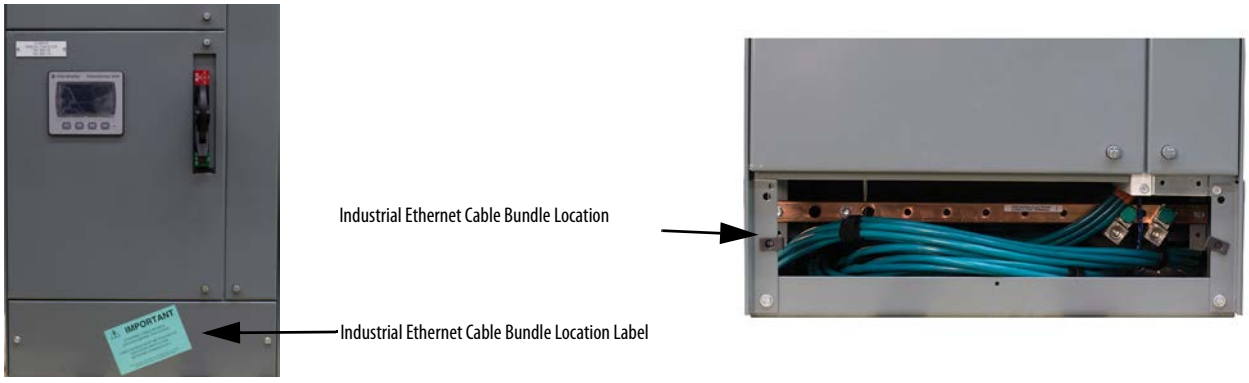
As explained in the EtherNet/IP Network and 24V DC Connections section, the EtherNet/IP network and 24V DC power connections within a shipping split are pre-wired at the factory. This section focuses on EtherNet/IP network and 24V DC power splicing across shipping splits.

Switch groups can span multiple shipping splits. All 24V DC power connections that connect to IMC devices in each shipping split are connected at the devices in the shipping split and then left in the horizontal wireway for future connection to the adjacent split. All industrial Ethernet network connections that connect to IMC devices in each shipping split are connected at the devices in the shipping split and then coiled in the horizontal wireway. This coil, or industrial Ethernet cable bundle, must be connected to the appropriate switch in the field during commissioning of the MCC lineup. When industrial Ethernet cables are routed to the industrial Ethernet switch, they sometimes require a transition to the opposite horizontal wireway to avoid obstructions in the MCC lineup that impact the horizontal wireway. See Ethernet Cable Transitions for MCC Lineups with Homerun Connections for more information on Ethernet cable transitions.

A teal-colored label on the outside of the MCC indicates the location of each coil of Ethernet cables that must be connected. Each cable in the bundle contains a detailed cable label to maintain proper IMC device to switch port mapping. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more information.

TIP Cable bundles for each section are assembled and marked with colored tape (yellow for top or orange for bottom). The tape helps the factory measure the switch-to-section distance and mounting location to verify the appropriate length of industrial Ethernet cable is allocated for field connections to the switch unit.

Figure 12 - Industrial Ethernet Cable Bundle to Connect Across Shipping Split



Ethernet Network Table For IntelliCENTER EtherNet/IP MCCs

In the one-line drawing for your IntelliCENTER EtherNet/IP MCC, an explanation of the Stratix switch connections is included. This drawing is used in the commissioning of your MCC and includes the following information:

1. Ethernet Switch Detail - This section of the drawing contains information about the Stratix switches in your MCC.
   - Location
   - Catalog Number
   - IP Address and Subnet Mask
   - Port Assignments
2. Ethernet Cable Detail - This section of the drawing contains information about the industrial Ethernet cables that connect the switch to each IMC device. The information includes the cable label string, the length of the cable used, and associated manufacturing information.
3. IMC Device Detail - This section of the drawing contains information about the IMC devices that are connected to the Stratix switches. This information includes the device location, type of device, IP Address, Subnet Mask, and current draw. Switch-to-switch connections (switch ports that are connected to other switch ports) are also shown.

Figure 13 - Ethernet Network Table Example

1 - Ethernet Switch Detail

Switch Data	Port (3)
Uplink ID: 01 Switch Section: 1 Switch Location: Top Wireway T01 Catalog Number: 1783-BMS10CL IP Address: 192.168.1.5 Subnet Mask: 255.255.255.0 Current Draw (A) 1.00	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
Uplink ID: 01 Switch Section: 3 Switch Location: Top Wireway T03 Catalog Number: 1783-BMS10CL IP Address: 192.168.1.14 Subnet Mask: 255.255.255.0 Current Draw (A) 1.00	1
	2
	3
	4
	5
	6
	7
	8
	9
	10

2 - Ethernet Cable Detail

Switch-to-Adapter Ethernet Cable (1)					Manufacturing Code (2)	Device Ethernet Cable	
Adapter Section Loc.	Adapter Port Loc.	Label	Length (m)		Label	Length (m)
1	A	SGT01-L01-EAA-01A-01-1.6-S	1.6	23T	SGT01-L01-EPA-01A-01-1.0-A	1.0
1	B	SGT01-L02-EAB-01D-01-1.6-S	1.6	23T	SGT01-L02-EPB-01D-01-1.0-S	1.0
1	C	SGT01-L03-EAC-01F-01-1.6-S	1.6	23T	SGT01-L03-EPC-01F-01-0.8-A	0.8
1	D	SGT01-L04-EAD-01G-01-1.6-S	1.6	23T	SGT01-L04-EPD-01G-01-1.6-A	1.6
1	E	SGT01-L05-EAE-01G-02-2.5-S	2.5	23T	SGT01-L05-EPE-01G-02-1.6-S	1.6
1	F	SGT01-L06-EAF-01#-##-2.5-S	2.5	23T		
				---	SGT01-L10-SGT03-L09-1.6-S	1.6
2	A	SGT03-L01-EAA-02C-01-0.8-S	0.8	13T	SGT03-L01-EPA-02C-01-1.6-A	1.6
2	B	SGT03-L02-EAB-02K-01-0.8-S	0.8	13T	SGT03-L02-EPB-02K-01-2.0-S	2.0
3	A	SGT03-L03-EAA-03A-01-1.6-S	1.6	23T	SGT03-L03-EPA-03A-01-0.8-A	0.8
3	B	SGT03-L04-EAB-03B-01-1.6-S	1.6	23T	SGT03-L04-EPB-03B-01-0.8-A	0.8
3	C	SGT03-L05-EAC-03C-01-1.6-S	1.6	23T	SGT03-L05-EPC-03C-01-0.8-A	0.8
3	D	SGT03-L06-EAD-03D-01-1.6-S	1.6	23T	SGT03-L06-EPD-03D-01-1.0-S	1.0
3	E	SGT03-L07-EAE-03G-01-2.5-S	2.5	23T	SGT03-L07-EPE-03G-01-1.0-S	1.0
3	F	SGT03-L08-EAF-03J-01-2.5-S	2.5	23T	SGT03-L08-EPF-03J-01-0.8-S	0.8
				---	SGT01-L10-SGT03-L09-1.6-S	1.6

3 - IMC Device Detail

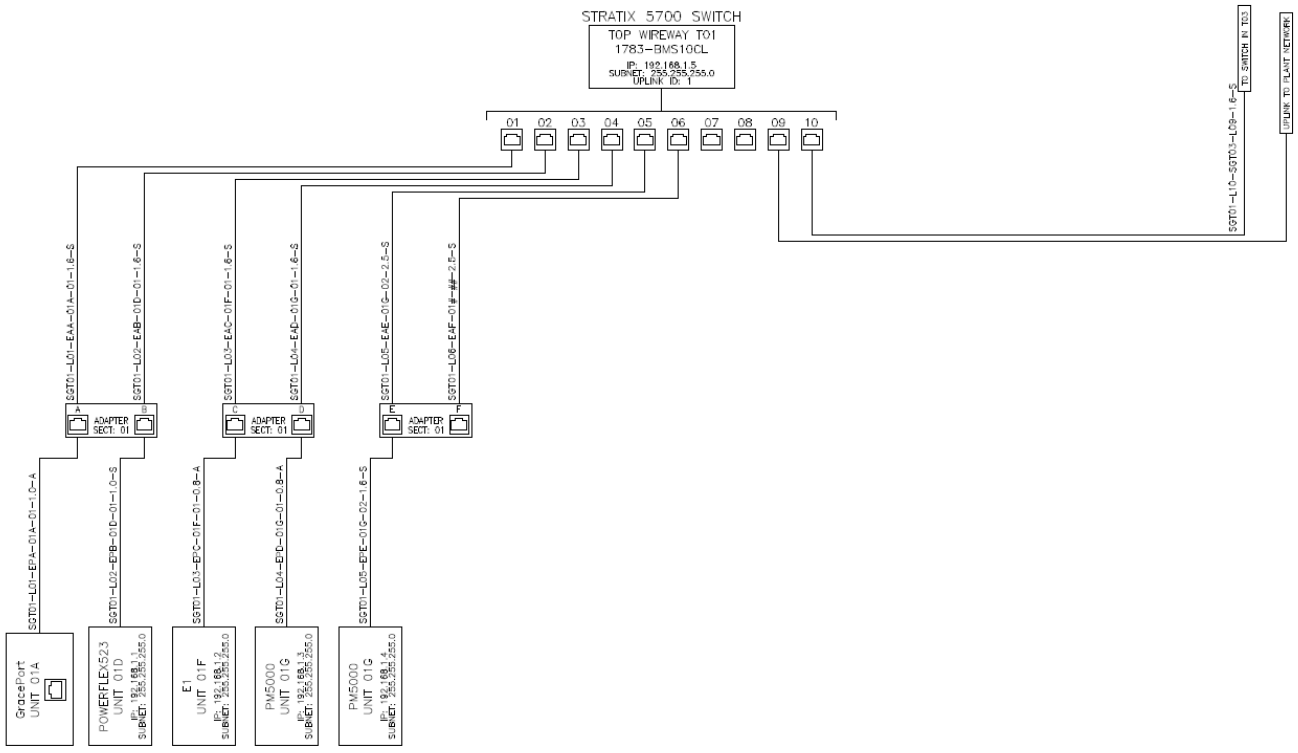
Device				
Unit Loc.	Type	IP Address	Subnet Mask	Current Draw (A)
01A	GracePort	---	---	---
01D	PowerFlex523	192.168.1.1	255.255.255.0	0.00
01F	E1	192.168.1.2	255.255.255.0	0.11
01G	PM5000	192.168.1.3	255.255.255.0	0.00
01G	PM5000	192.168.1.4	255.255.255.0	0.00
T03	SW to SW	See Switch Info	See Switch Info	---
02C	SMC-Flex	192.168.1.6	255.255.255.0	0.00
02K	E300	192.168.1.7	255.255.255.0	0.34
03A	E1	192.168.1.8	255.255.255.0	0.11
03B	E1	192.168.1.9	255.255.255.0	0.11
03C	E1	192.168.1.10	255.255.255.0	0.11
03D	E3	192.168.1.11	255.255.255.0	0.27
03G	PowerFlex40	192.168.1.12	255.255.255.0	0.00
03J	E300	192.168.1.13	255.255.255.0	0.00
T01	SW to SW	See Switch Info	See Switch Info	---

TIP For MCCs with homerun Ethernet connections, the 'Switch-to-Adapter Ethernet Cable' column is left blank.

Ethernet Network Diagram for IntelliCENTER EtherNet/IP MCCs

In addition to the network table, a network diagram is also included in the one-line drawing for your IntelliCENTER EtherNet/IP MCC. The network diagram explains the Stratix switch connections in graphical format and can be used in the commissioning of your MCC.

Figure 14 - Ethernet Network Diagram Example

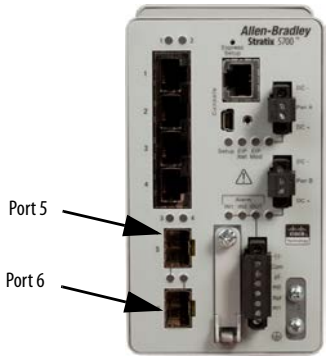


Switch-to-switch Ethernet Connection

The standard IntelliCENTER EtherNet/IP MCC design includes a Stratix 5700 switch that has two ports that are reserved for the switch-to-switch connections. The Stratix 5700 switches within a shipping split have switch-to-switch connections that are pre-wired at the factory by using the 600V rated industrial Ethernet copper cable (see the Industrial Ethernet Cable section for further details). Fiber-optic cables could also be used if required by your application.

As shown in Figure 15, port 5 and port 6 on 6-port Stratix 5700 switches are reserved for connections between the switches and plant connections. Port 5 is designated for the left switch-to-switch connection or for connections to the plant-wide EtherNet/IP network (see the MCC Uplink Connections section for further details). Port 6 is designated for the right switch-to-switch connection or the plant-wide EtherNet/IP network connection.

Figure 15 - Example of a 6-port Stratix 5700 Switch

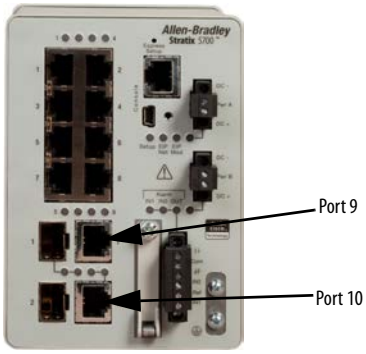


IMPORTANT The 6-port Stratix 5700 switch that is shown is catalog number 1783-BMS06TL. See the MCC one-line drawing that is included with your MCC to determine the exact Stratix 5700 model installed in your MCC. For information on more Stratix 5700 switch catalog numbers, see the Stratix Managed Switches User Manual, publication 1783-UM007.

IMPORTANT Stratix 5700 switches with gigabit Ethernet ports label the switch-to-switch or uplink ports as port 1 and port 2. See the Stratix Managed Switches User Manual, publication 1783-UM007.

As shown in Figure 16, port 9 and port 10 on 10-port Stratix 5700 switches are reserved for connections between switches or for connections to the plant-wide EtherNet/IP network (see the MCC Uplink Connections section for further details). Port 9 is designated for the left switch-to-switch connection or the uplink connection. Port 10 is designated for the right switch-to-switch connection or the plant-wide EtherNet/IP network connection.

Figure 16 - Example of a 10-port Stratix 5700 Switch

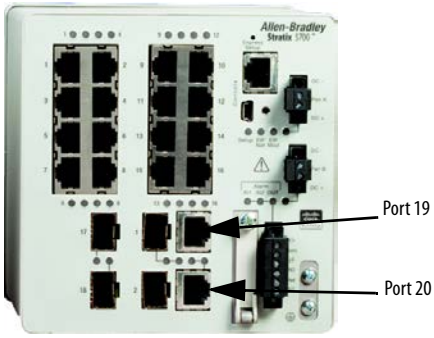


IMPORTANT The 10-port Stratix 5700 switch that is shown is catalog number 1783-BMS10CL. See the MCC one-line drawing that is included with your MCC to determine the exact Stratix 5700 model installed in your MCC. For information on more Stratix 5700 switch catalog numbers, see the Stratix Managed Switches User Manual, publication 1783-UM007.

IMPORTANT Stratix 5700 switches with gigabit Ethernet ports label the switch-to-switch or uplink ports as port 1 and port 2. See the Stratix Managed Switches User Manual, publication 1783-UM007.

As shown in Figure 17, port 19 and port 20 on 20-port Stratix 5700 switches are reserved for connections between switches or for connections to the plant-wide EtherNet/IP network (see the MCC Uplink Connections section for further details). Port 19 is designated for the left switch-to-switch connection or the uplink connection. Port 20 is designated for the right switch-to-switch connection or the plant-wide EtherNet/IP network connection.

Figure 17 - Example of a 20-port Stratix 5700 Switch



IMPORTANT The 20-port Stratix 5700 switch that is shown is catalog number 1783-BMS20CL. See the MCC one-line drawing that is included with your MCC to determine the exact Stratix 5700 model installed in your MCC. For information on more Stratix 5700 switch catalog numbers, see the Stratix Managed Switches User Manual, publication 1783-UM007.

IMPORTANT Stratix 5700 switches with gigabit Ethernet ports label the switch-to-switch or uplink ports as port 1 and port 2. See the Stratix Managed Switches User Manual, publication 1783-UM007.

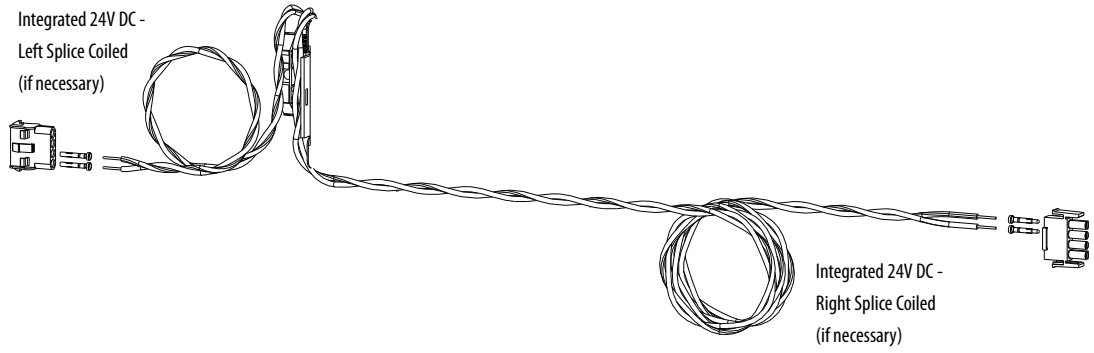
To maintain network performance, the standard IntelliCENTER EtherNet/IP MCC design enforces a limit on the number of switch-to-switch connections before an additional uplink connection to the plant network is required. See the MCC Uplink Connections section for further details on MCC uplink requirements and connections before making switch-to-switch connections across the shipping splits.

IMPORTANT It is critical to maintain the organization of the MCC sections (left-to-right orientation must follow section numbering scheme). Reorganizing sections can affect the MCC network uplink, the MCC cable bundles that need to connect to each switch, and 24V DC power distribution conditions.

Splicing the 24V DC Power Supply

The 24V DC power can be spliced across shipping splits if the power supply is able to support EtherNet/IP IMC devices in multiple sections. The shipping split sections that are designed to be spliced together include a coiled 24V DC twisted-pair wiring harness in the top horizontal wireway. The left branch of the power supply supports the left sections; the right branch of the power supply supports the right sections.

Figure 18 - 24V DC Power Wiring Harness



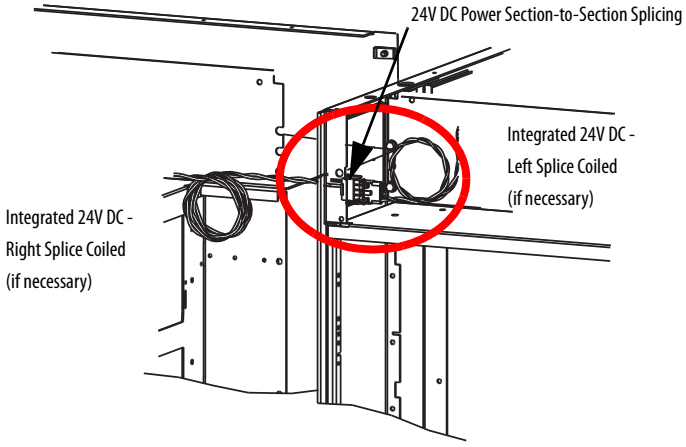
The left side of the section includes, if necessary, the female end of the 24V DC power wire harness. The right side includes, if necessary, the male end of the 24V DC power wire harness. Each end is mated with the wiring harness from the adjacent section to complete the 24V DC power wire splicing. There could be two wire harness connectors, one for power terminal bracket and one for the 24V DC power adapters in the vertical wireway.

TIP There can be one or two 24V DC power wire harnesses in the horizontal wireway for splicing depending on the switch mounting methodology.

IMPORTANT If there is no coiled 24V DC power wire included in the top or bottom horizontal wireway, the adjacent sections are designed to have isolated 24V DC power networks to stay within amperage specification.

IMPORTANT It is critical to maintain the organization of the MCC sections (left-to-right orientation must follow section numbering scheme). Reorganizing sections can affect the MCC network uplink, the MCC cable bundles that need to connect to each switch, and 24V DC power distribution conditions.

Figure 19 - 24V DC Power Connection Across Sections



TIP The location of the harness splice (top or bottom horizontal wireway) can vary depending on the switch mounting methodology.

Depending on the switch mounting and cable routing methods that are chosen, the physical location of the 24V DC power terminal blocks that are used for section-to-section distribution can vary. Table 4 and Figure 20 show the three different locations and when they occur.

Table 4 - 24V DC Distribution Terminal Block Locations

Ethernet Switch Location	Ethernet Connection Method	24V DC TB Bracket Location
Top unit-mount	Homerun	Top C Channel
	Adapter	Top Baffle
Bottom unit-mount	Homerun	Top C Channel
	Adapter	Top C Channel
Top horizontal wireway-mount	Homerun	Top C Channel
	Adapter	Top Baffle
Bottom horizontal wireway-mount	Homerun	Bottom Baffle
	Adapter	Bottom Baffle

Figure 20 - 24V DC Bracket Location

Top C Channel

Top Baffle

Bottom Baffle

Splicing the Horizontal Bus Bar

The horizontal bus bar can be spliced together from section to section. See CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections, publication 2100-IN010, for detailed instructions on splicing the horizontal bus bar.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

Cable Labels for MCC Lineups with Industrial Ethernet Switches

To confirm proper IMC device to switch port mapping and switch-to-switch port mapping, the industrial Ethernet cables are labeled with detailed IMC device and switch port connection information. See Figure 21 for an example of the label, and Figure 22 for the cable label legend. The cable label is on both ends of every Ethernet cable. The cable label legend is on the following locations:

- Inside of the door of each unit-mounted switch
- On the inside of the horizontal wireway cover for each horizontal wireway-mounted switch
- On the MCC one-line drawing

Figure 21 - Industrial Ethernet Cable Label

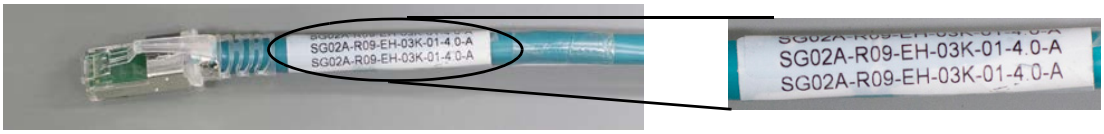
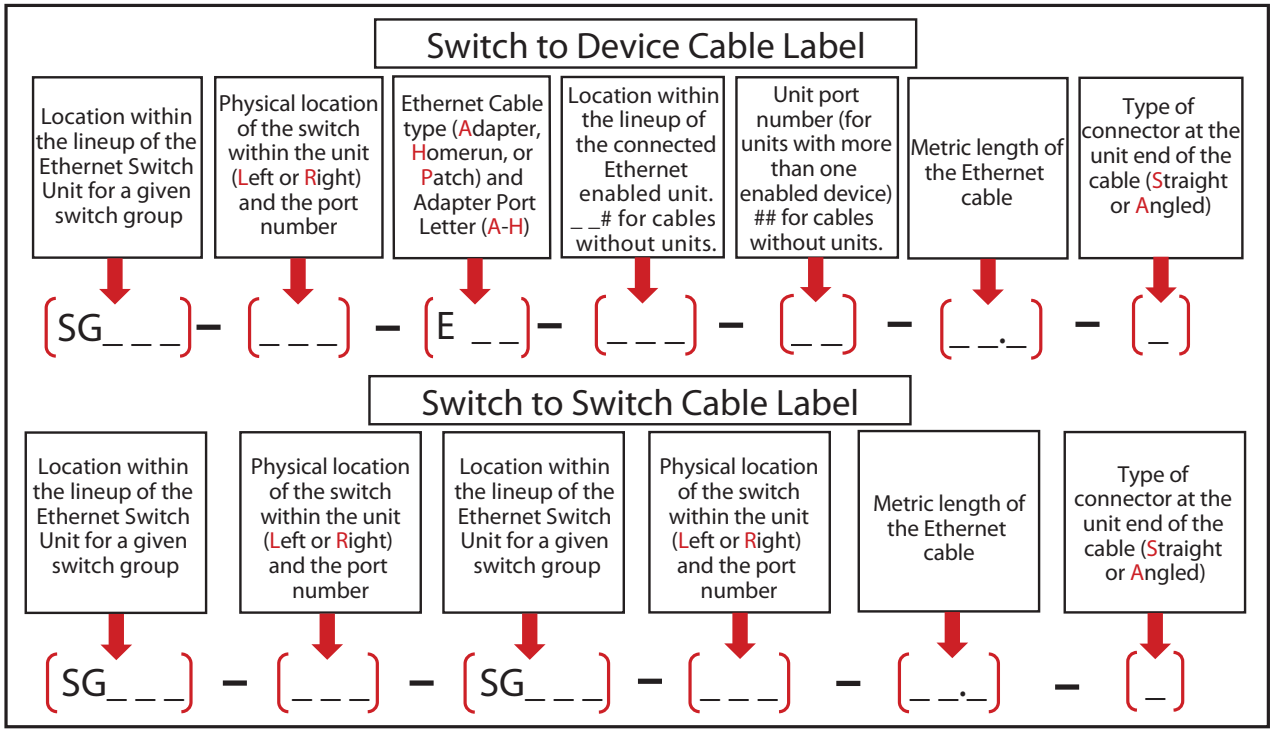


Figure 22 - Industrial Ethernet Cable Label Explanation



Ethernet Cable Transitions for MCC Lineups with Homerun Connections

When industrial Ethernet cables are routed to the switch units, they can run into a main fusible disconnect, main circuit breaker, or other frame-mount unit that blocks the horizontal wireway. In these cases, the industrial Ethernet cable must transition from one horizontal wireway to the other (for example, top horizontal to bottom horizontal wireway). All industrial Ethernet cables that are blocked are routed through the opposite horizontal wireway. They continue in that horizontal wireway until they reach the section with the switch unit (they are not transitioned back to the initial horizontal wireway). The industrial Ethernet cables route to the switch unit through the vertical wireway of the section with the switch unit. If the switch is horizontal wireway-mounted, Ethernet transition cables are not always routed in the section that contains the switch.

IMPORTANT Transitions for switch-to-device connections are only allowed when the homerun Ethernet connection methodology is used.

Your MCC lineup ships with all Ethernet cables, including transition cables, pre-connected within the shipping split that contains the switch. For shipping splits that don't contain the switch, the Ethernet cable bundles are located in the proper horizontal wireway so that they can be easily routed to the switch unit. See EtherNet/IP Network and 24V DC Connections Across Shipping Splits for more info on cable bundles. Bundles are located in the horizontal wireway that corresponds to the switch location they are to be routed to if there are no obstructions between the cable bundle and the switch. Bundles are located in the opposite horizontal wireway if there are obstructions between the cable bundle and the switch location it is to be routed to. The Ethernet cable wireway transitions follow these rules:

- Sections with unit-mounted Stratix switches must contain a full vertical-wireway with no cutoffs. This layout supports routing of Ethernet cable transitions in that section.
- Sections with horizontal wireway-mounted Stratix switches do not require a full vertical-wireway. Ethernet cable transitions can occur in an adjacent section if necessary.
- Only one transition is allowed for industrial Ethernet cables that connect Stratix switches to IMC devices. Transitions occur in the section that contains the switch unit.
- A maximum of three transitions is allowed for industrial Ethernet cables that connect two Stratix switch units. The third transition, if necessary, can occur in any vertical wireway between the two switch sections.

IMPORTANT Industrial Ethernet Cable Transition Guidelines:

- Route the industrial Ethernet cables in each cable bundle toward the direction of the section with the switch for that switch group. See Cable Labels for MCC Lineups with Industrial Ethernet Switches for more info on determining switch group information.
- Route the industrial Ethernet cables through the horizontal wireway where the bundle is located.

If the industrial Ethernet cable routing is in the horizontal wireway opposite of the switch unit for that switch group, transition the Ethernet cables through the vertical wireway of the section with the switch into the horizontal wireway above or below the switch and then into the switch itself.

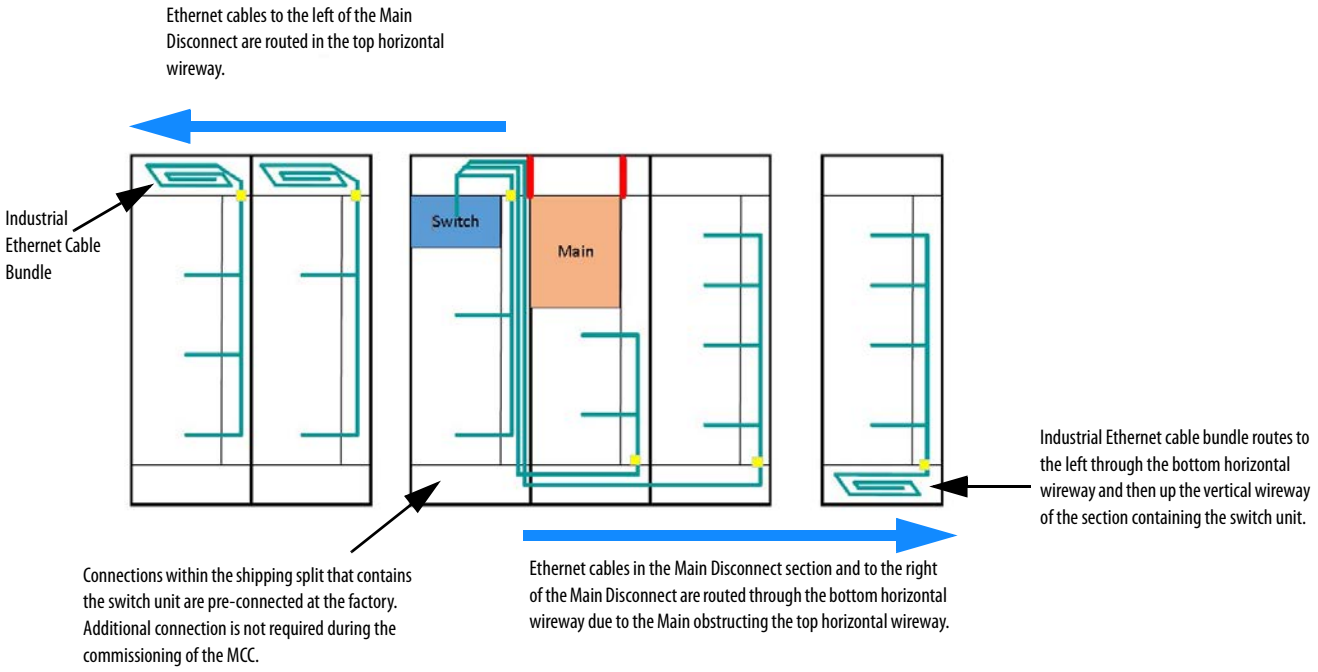
Do not route the cables directly from the vertical wireway into switches that are unit-mounted, always transition into the horizontal wireway first and then into the switch unit to achieve proper cable routing as shown in Figure 23.

TIP Units that create wireway blockages can be placed at the ends of MCCs to help reduce the number of Ethernet cable transitions.

Figure 23 - Examples of Industrial Ethernet Cable Transitions with Connections Across Shipping Splits

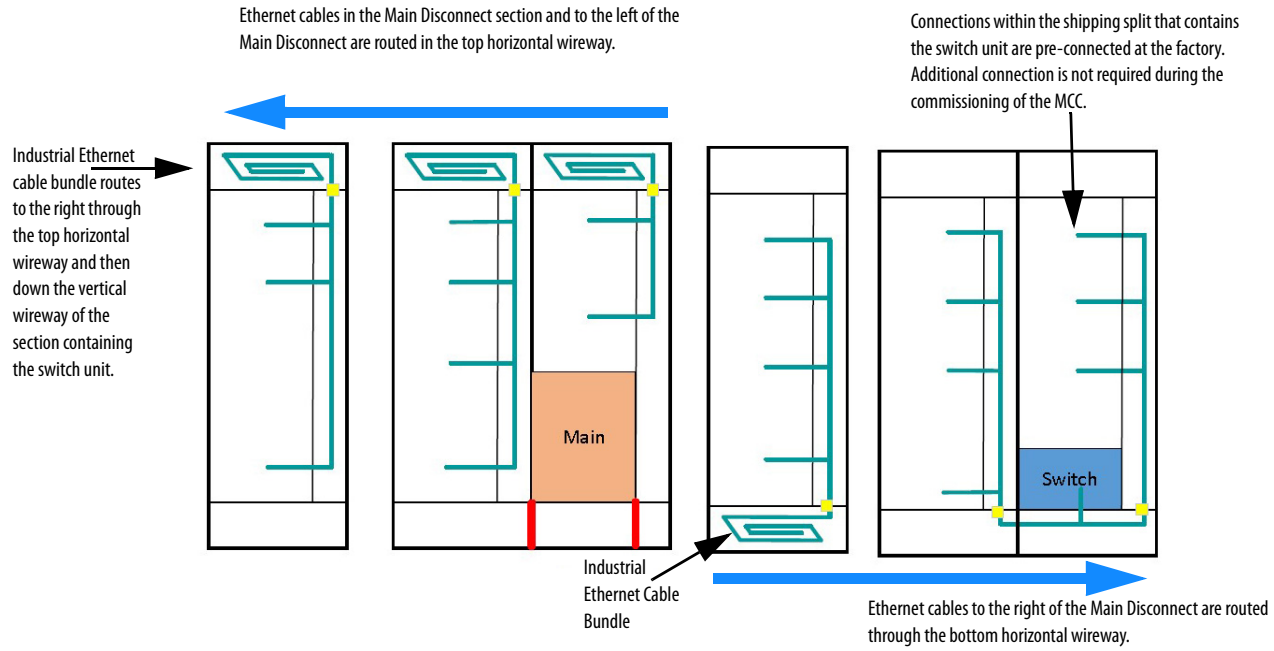
Top unit-mounted Stratix switch to the left of a top Main Disconnect:

1. Route Ethernet cables from all sections to the left of the Main Disconnect in the top horizontal wireway to the switch unit.
2. Route Ethernet cables from the Main Disconnect and all sections to the right of the Main Disconnect in the bottom horizontal wireway. Transition to the switch unit through the vertical wireway in the section with the switch unit.



Bottom unit-mounted Stratix switch to the right of a bottom Main Disconnect:

1. Route Ethernet cables from all sections to the right of the Main Disconnect in the bottom horizontal wireway to the switch unit.
2. Route Ethernet cables to the Main Disconnect section and all sections to the left of the Main Disconnect in the top horizontal wireway. Transition to the switch unit through the vertical wireway in the section with the switch unit.



Plant-wide Connections

The EtherNet/IP network provides an easy to use, robust, and flexible network solution. This section is focused on the integration of the IntelliCENTER EtherNet/IP MCC into an existing plant-wide and/or enterprise network. IntelliCENTER EtherNet/IP MCC uses a star topology at the IMC device level and either a linear or ring topology at the industrial Ethernet switch level. For detailed information about various network topologies that are supported by the IntelliCENTER EtherNet/IP MCC, see EtherNet/IP Network Topology.

MCC Uplink Connections

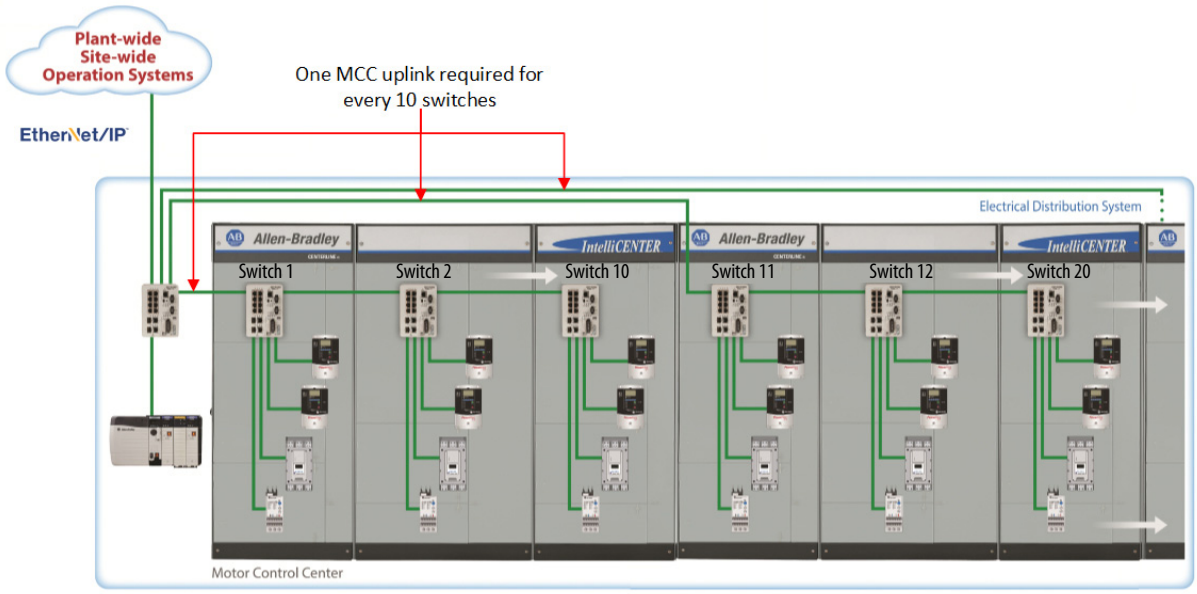
The IntelliCENTER EtherNet/IP MCC connects to the rest of your plant-wide EtherNet/IP network through the industrial Ethernet cable. This connection is referred to as an MCC Uplink connection and can be used for intelligent device monitoring and/or control depending on the needs of the MCC application.

Based on the best practice EtherNet/IP guidelines in the Converged Plantwide Ethernet (CPwE) and Implementation Guide, publication ENET-TD001, there are limits on the amount of data latency that is acceptable on an EtherNet/IP network. These limits make sure that the network data is received when needed during critical plant processes. To make sure that the IntelliCENTER EtherNet/IP MCC lineup stays within these limits, there are MCC uplink requirements that are based on the number of industrial Ethernet switches in the lineup. There is a ten switch limit before another MCC uplink connection is required to the plant-wide EtherNet/IP network. The ten switch uplink requirement is imposed irrespective of the network topology that is implemented at the switch level.

Figure 24 shows an example of how the IntelliCENTER EtherNet/IP MCC lineup can be connected to the plant-wide EtherNet/IP network by using an Access Layer switch with an industrial Ethernet cable. The example also displays that there is an uplink connection to the Access Layer switch for every 10 switches in the lineup. See IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001 for further details on MCC uplink connections.

IMPORTANT After making the EtherNet/IP network and 24V DC Power Connections, see the MCC Commissioning Checklist before you apply power.

Figure 24 - MCC Uplink Connections Example



The maximum length of copper twisted-pair wiring is 100 m (328 ft) between devices. If distances longer than 100 m (328 ft) between devices are required, fiber-optic Ethernet cables can be used. Fiber-optic Ethernet cable maximum distances vary by design of the cable, but can be kilometers in length. See the Fiber Optic Infrastructure Application Guide, publication ENET-TD003 for more information about how to use a fiber-optic Ethernet cable in an EtherNet/IP architecture. Consult the design specifications of the fiber-optic Ethernet cable being used for actual length limitations. Additionally, fiber-optic Ethernet cables provide a more noise-immune cabling solution than standard copper Ethernet cabling. Fiber-optice Ethernet cables also provide faster uplink speeds that are sometimes required to meet performance requirements or to support redundant topologies. For more information on fiber-optic Ethernet cable requirements for redundant topologies within the IntelliCENTER EtherNet/IP MCC, see Switch-level Ring Topology.

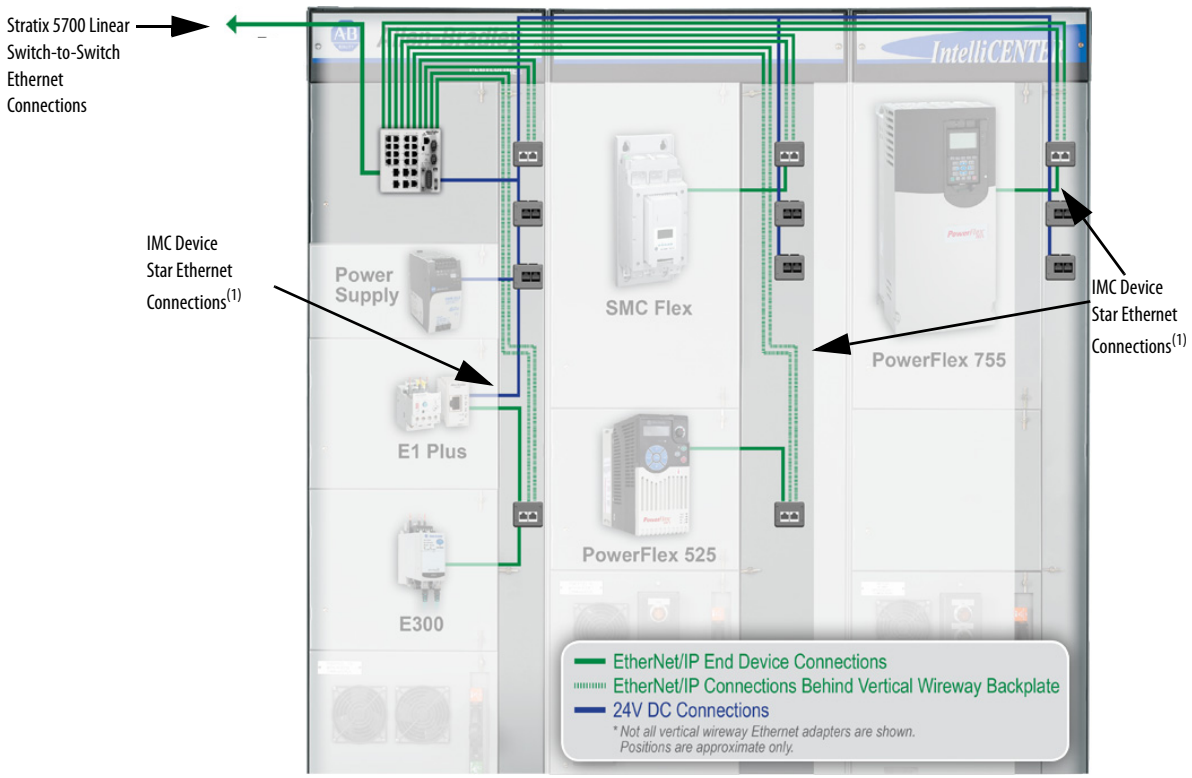
EtherNet/IP Network Topology

An EtherNet/IP network is flexible and supports multiple topologies. The network topology within an IntelliCENTER EtherNet/IP MCC must provide a robust, and flexible network solution.

Linear/Star Topology

The standard IntelliCENTER EtherNet/IP MCC design uses a star topology for the IMC device connections and a linear topology for the Stratix 5700 switch-to-switch connections. An example of the IntelliCENTER EtherNet/IP MCC linear/star topology is shown in Figure 25.

Figure 25 - Linear/Star Topology Within an IntelliCENTER EtherNet/IP MCC



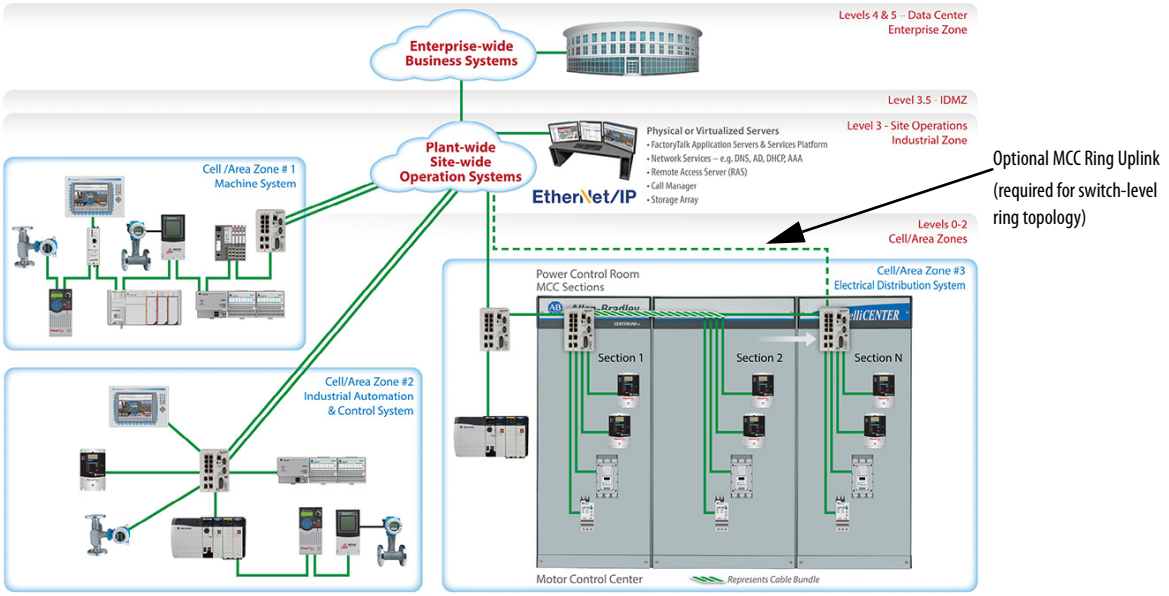
(1) Not all IMC device vertical wireway adapters are shown in the graphic, nor are they shown in correct order.

See the IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001 for more information on how to implement a linear/star topology in an IntelliCENTER EtherNet/IP MCC.

Switch-level Ring Topology

The IntelliCENTER EtherNet/IP MCC is designed to provide an easy to use, resilient, and serviceable motor control center solution. Building on the typical linear/star topology of an IntelliCENTER EtherNet/IP MCC. The industrial Ethernet switches throughout the MCC lineup can also be connected in a switch-level ring topology. There are protocols in the Stratix managed switches that provide a level of resiliency at the switch level, while the IMC devices in each section still maintain a star topology. In an IntelliCENTER EtherNet/IP MCC, the Stratix 5700 industrial Ethernet switch uses these protocols to provide the switch-level ring redundant-path topology. The implementation of the switch-level ring topology within an IntelliCENTER EtherNet/IP MCC is similar to the linear/ star topology example in Figure 25. In a switch-level ring topology, an industrial Ethernet cable that connects the last MCC section in the switch-level ring back to the plant network is added, which creates a ring topology at the switch-level. If one industrial Ethernet cable or industrial Ethernet switch fails, communication is converged in the other direction around the ring to make sure that all other switches are still connected to the network. The switch-level ring topology is highlighted in Figure 26.

Figure 26 - Switch-level Ring Topology Within an IntelliCENTER EtherNet/IP MCC



See IntelliCENTER EtherNet/IP Reference Manual, publication MCC-RM001 for more information on how to implement switch-level ring topology in an IntelliCENTER EtherNet/IP MCC.

New IntelliCENTER EtherNet/IP MCC Lineup Commissioning

This section is for engineers or technicians directly involved with installing new MCC lineups, commissioning EtherNet/IP network and 24V DC connections, and energizing the CENTERLINE 2100 Motor Control Center with EtherNet/IP network.

MCC Lineup Installation

If you are installing a new IntelliCENTER MCC lineup, see the CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012 for details on how to install a new MCC lineup.

Splicing the Horizontal Bus Bar

See CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections, publication 2100-IN010, for detailed instructions on splicing the horizontal bus bar.

EtherNet/IP and 24V DC Connections

See the section EtherNet/IP Network and 24V DC Connections for details on commissioning EtherNet/IP network and 24V DC power connections across the entire MCC lineup.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

IntelliCENTER EtherNet/IP MCC Expansion

This section is for engineers or technicians directly involved with installing new units/sections or rearranging units and commissioning EtherNet/IP network and 24V DC power connections within the existing MCC lineup.

The IntelliCENTER EtherNet/IP MCC is a flexible and expandable motor control solution. This section provides information on the methods to expand your IntelliCENTER EtherNet/IP MCC through the life of the system.

Adding EtherNet/IP IntelliCENTER Sections to an Existing Lineup

If you are adding new sections to an existing IntelliCENTER EtherNet/IP MCC lineup, planning must be done to make sure IMC devices in the new section work as intended.

24V DC Power Supply Planning

When new sections are added to an existing lineup, it requires a new 24V DC power supply for devices within that section. The 24V DC power connections for IMC devices within the new section are made at the factory before shipping. Do not connect the 24V DC power supply from the new section to the last section in the existing lineup.

IMPORTANT It is critical to maintain the organization of the MCC sections (left-to-right orientation must follow section numbering scheme). Reorganizing sections can affect the MCC network uplink and 24V DC power distribution conditions.

TIP If you are using IntelliCENTER software, make sure to order the IntelliCENTER Data CD so the new section can be added to the IntelliCENTER software database. The IntelliCENTER Data CD merges the new section database with the existing lineup database. See the IntelliCENTER EtherNet/IP Software section for further details.

Splicing EtherNet/IP Network Connections Within a Shipping Split

The EtherNet/IP connections for IMC devices within the new section are done at the factory before shipping. For further details, see the EtherNet/IP Network and 24V DC Connections section.

Splicing EtherNet/IP Network

The addition of a new section requires that you make EtherNet/IP switch-to-switch and uplink connections. See the MCC Uplink Connections section for the uplink guidelines before you make plant connections. If there is no violation of network uplink guidelines, see the EtherNet/IP Network and 24V DC Connections Across Shipping Splits section for splicing the EtherNet/IP network between the existing lineup and the new section.

Splicing the Horizontal Bus Bar

The horizontal bus bar can be spliced together from the existing lineup to the new section, if the horizontal bus current limitations are not exceeded. See CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections, publication 2100-IN010, for detailed instructions on splicing the horizontal bus bar.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

Adding or Rearranging EtherNet/IP IntelliCENTER Plug-in Units Within an Existing Lineup

If you are adding new units to an existing IntelliCENTER EtherNet/IP MCC section or if you rearrange existing units within a section, planning must be done to make sure the IMC devices work as intended.

Plug-in Sections With Vertical Wireway Connections

As described in the EtherNet/IP Network and 24V DC Connections section, the IntelliCENTER EtherNet/IP MCC sections with vertical wireway Ethernet adapters are designed to accommodate up to eight EtherNet/IP connected devices. Therefore, if there are any blank-space factors and spare vertical-wireway Ethernet adapters in a section, then EtherNet/IP IntelliCENTER units can be rearranged or purchased and easily installed.

Plug-in Sections With Homerun Connections

The IntelliCENTER EtherNet/IP MCC sections with homerun Ethernet cable routing can have spare switch ports. Therefore, if there are any spare Stratix 5700 ports in a switch-unit, then EtherNet/IP IntelliCENTER units can be purchased and easily installed.

IMPORTANT Make sure that the desired number of spare switch ports or spare Ethernet adapter ports are accounted for at order entry for the appropriate switch unit. Otherwise, additional units are not able to connect to the industrial Ethernet switch.

IMPORTANT When homerun connections are used, cable length calculations are based on the unit location and unit type at the time of order entry. Rearranging units within a section can result in Ethernet cables being too short or excessively long.

24V DC Power Supply Planning

Follow this checklist to verify if the addition of the new units meets the existing 24V DC power supply limits:

- Check MCC one-line drawing to determine current draw for each power supply branch
- Calculate the remaining current available out of the maximum 4 A available (8 A total, 4 A per branch)
- Determine if the existing branch can support additional units/moving units/moving sections

Each power supply unit for the 24V DC infrastructure powers two 4 A branches that are protected by two 1-pole mini circuit breakers. The branches are designed based on the devices that are being housed in each section that the power supply supports at the time of order entry. The final layout of the 24V DC infrastructure can be seen in the one-line drawing that is created for each order. Table 5 shows an example of the breakdown of the 24V DC power supply current distribution in a lineup. The table includes the location of each power supply within the lineup, if they exist, and which branch of each power supply powers which sections. The table also indicates if the two-branch redundant unit is being used, and what type of power supplies are feeding it. In this example, the first power supply is mounted in location 2*A*.

TIP In CENTERLINE 2100 MCCs, two characters define device locations:
– Section number (moving from left to right starting with 1)
– Unit location letter (moving from top to bottom starting with *A*)

The left 24V DC branch of the power supply in location 2*A* provides power for the devices in sections 1 and 2 with a total current draw of 2.54 A. With the device layout in sections 1 and 2, the first left branch of the 24V DC infrastructure can support 1.46 A more before it reaches the 4 A maximum.

Table 5 - Integrated 24V DC Power Layout Example

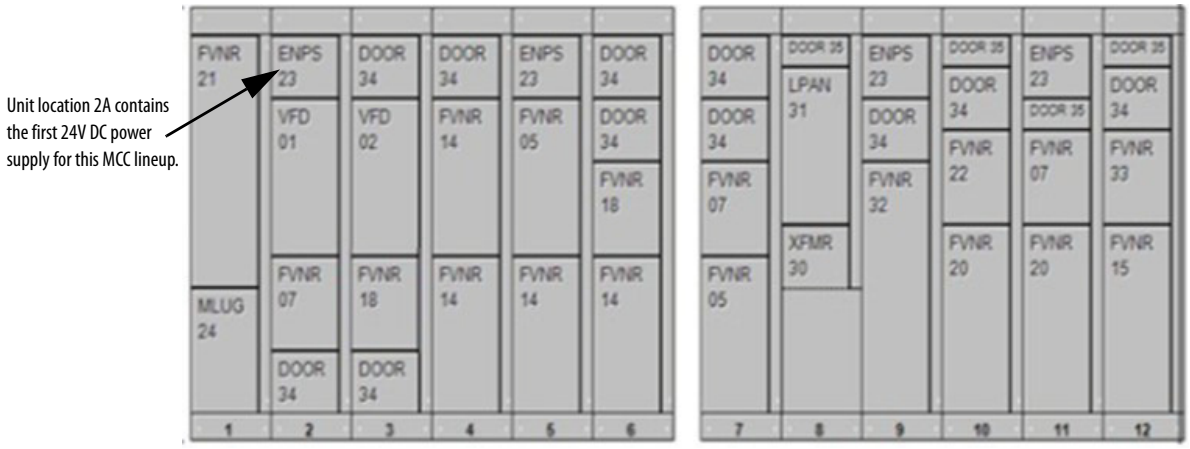
Ethernet Power Supply Location	Ethernet Power Supply Cat. No.	2-Branch Redundant Unit Loc (1)	2-Branch Redundant Cat. No. (1)	Max Amp (A)	Left Branch Sections	Left Branch Total Current (A)	Right Branch Sections	Right Branch Total Current (A)
02*A*	2100-EPS8KB-30TGM			8.00	1…2	2.54	3…4	2.81
05*A*	2100-EPS8KB-30TGM			8.00	5	1.54	6	1.54
09*A*	2100-EPS8KB-30TGM			8.00	7…9	3.81	10	1.54
11*A*	2100-EPS8KB-30TGM			8.00	11	1.54	12	1.54

(1) The column is left blank when the 2-branch redundant unit is not used.

Figure 27 shows the physical layout of the lineup that corresponds with Table 5. From the example, the first power supply can be seen in location 2*A*, labeled 'ENPS'. As noted, this branch can support an additional 1.46 A on the left branch. Section 2 has an empty unit that is labeled 'DOOR' at the bottom of the section. If a unit that requires 24V DC power is mounted into this location, it cannot exceed 1.46 A. An additional power supply is required if the current exceeds 1.46 A for this example. Use this example as a reference to determine current draw flexibility for each branch of the 24V DC infrastructure in your lineup.

The IMC devices within a section are pre-wired at the factory, for detailed information on connections within and across the shipping splits. See the EtherNet/IP Network and 24V DC Connections section for connections and wiring information.

Figure 27 - Example MCC Lineup Corresponding with Table 5



IMPORTANT If you rearrange the plug-in units in an existing lineup, see the 24V DC Power Supply Planning to make sure that you follow the 24V DC power rules.

TIP If you are using IntelliCENTER software, make sure to order the IntelliCENTER Data CD so the unit can be added to the IntelliCENTER software database. The IntelliCENTER Data CD lets you add the new unit to your IntelliCENTER software lineup by merging the existing lineup database. See the IntelliCENTER EtherNet/IP Software section for detailed information on how to add units to an existing IntelliCENTER software lineup.

Installing a Plug-in Unit

See the CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012 for details on how to install a plug-in unit.

IMPORTANT If you rearrange the plug-in units in an existing lineup, see the 24V DC Power Supply Planning to make sure that you follow the 24V DC power rules.

IMPORTANT Units that are not ArcShield™ units are not rated for 100 ms arc duration and must not be installed in ArcShield sections that are rated for 100 ms arc duration. The arc resistant rating does not apply if the unit is not properly rated.

TIP If you are using IntelliCENTER software, make sure to order the IntelliCENTER Data CD so the unit can be added to the IntelliCENTER software database. The IntelliCENTER Data CD lets you add the new unit to your IntelliCENTER software lineup by merging the existing lineup database with the new unit database. See the IntelliCENTER EtherNet/IP Software for detailed information on how to add units to an existing IntelliCENTER software lineup.

EtherNet/IP and 24V DC Connections

Each EtherNet/IP device is factory wired within the unit and has an industrial Ethernet cable. The industrial Ethernet cable connects the IMC device to an available vertical-wireway Ethernet adapter or directly to a switch depending on the Ethernet connection methodology specified at the time of purchase. The switch can be mounted in a top or bottom horizontal wireway or in a unit depending on the specification at the time of purchase.

See EtherNet/IP Network and 24V DC Connections for further details. Certain EtherNet/IP units require 24V DC power, see the 24V DC Power Supply Planning to make sure that you follow the 24V DC power rules.

IMPORTANT After making the EtherNet/IP network and 24V DC power connections, see the MCC Commissioning Checklist prior to applying power.

IntelliCENTER EtherNet/IP Software

The IntelliCENTER software is an intuitive software package that is customized to your particular IntelliCENTER MCC configuration. The software provides a system-level dashboard, which is a graphical representation of your MCC. Individual views of each IMC device provide monitoring and configuration functionality. This graphical interface can be accessed on the plant floor, in the plant control room, or from a secure remote connection. The ability to monitor remotely, diagnose, and modify intelligent device parameters keeps personnel from hazardous areas. The software has been designed to keep your MCC lineup operating well into the future.

For information on how to install IntelliCENTER software or use the various software tools available, see the IntelliCENTER Software User Manual, publication MCC-UM002.

MCC Commissioning Checklist

When installing a new CENTERLINE 2100 MCC lineup with EtherNet/IP network, see the following MCC Commissioning Checklist before applying power.

Table 6 - New IntelliCENTER EtherNet/IP MCC Lineup Commissioning

Step	Commission	Tasks	Status
1	MCC Lineup Installation	See CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012 for details on how to install a new MCC lineup.	
2	Horizontal Bus Bar Splicing	See CENTERLINE 2100 MCC Joining and Splicing Vertical Sections, publication 2100-IN010 for details on how to splice horizontal bus bar.	
3	EtherNet/IP network and 24V DC power connections	See EtherNet/IP Network and 24V DC Connections Within a Shipping Split for detailed information about connections within each section. The EtherNet/IP network and 24V DC connections within each section are made at the factory, before shipping.	
		IP addresses and subnet masks for the IMC devices and industrial Ethernet switches within each section are preconfigured at the factory before shipping.	
		See EtherNet/IP Network and 24V DC Connections Across Shipping Splits and make required switch-to-switch, switch-to-plant-wide network, and 24V DC power (if required) connections.	
		IMPORTANT: For MCC lineups with switches that support switch groups that span shipping splits, see EtherNet/IP Network and 24V DC Connections Across Shipping Splits to verify the proper IMC device-to-switch port mapping is used. Ethernet cable labels, the Ethernet cable label legend, the one-line Ethernet network table, and Ethernet cable transition guidelines can be used for the IMC device-to-switch port mapping.	
		IMPORTANT: Understand MCC uplink connection limitations before making connections. See MCC Uplink Connections for further details.	
		IMPORTANT: The static IP address and subnet masks for the IMC devices in each section are already configured and tested at the factory before shipping.	
4	Connections Integrity	Check the integrity of the horizontal bus splice connections, new EtherNet/IP network, and power connections. Finally, inspect all of the other connections for loose wires, opens, and shorts as well.	
5	MCC Lineup/Physical Inspection	Inspect the enclosure and units for damage and verify that electrical clearances have been maintained based on the voltage and impulse rating of the equipment. All covers and doors must be in place before applying power to the MCC.	
		If there are any blank space factors within the MCC lineup, they must be replaced with the appropriate items such as units, doors, and unit support pans. For further details, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
6	Pre-energizing Check	Finally, before applying the power perform the pre-energizing check procedure and then apply power to the MCC. For details on the pre-energizing check, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
7	Troubleshooting	If there is an issue with EtherNet/IP and 24V DC power operations recheck the integrity of the EtherNet/IP and 24V DC power connections. Before rechecking the connections integrity, de-energize, lockout, and tag-out all sources of power to the MCC.	
		IMPORTANT: The static IP address and subnet masks for the IMC devices are already configured and tested at the plant before shipping. Hence, the functionality issue can reside in the integrity of the network wiring.	
		ATTENTION: De-energize the EtherNet/IP MCC and follow appropriate lockout and tag-out policies before commencing the troubleshooting processes. Failure to de-energize all power sources can result in severe injury or death.	

When installing a new vertical section within the existing CENTERLINE 2100 MCC lineup with EtherNet/IP network, see the following MCC Commissioning Checklist before applying power.

Table 7 - Adding EtherNet/IP IntelliCENTER Sections to an Existing Lineup

Step	Commission	Tasks	Status
1	Vertical Section - Installation	See CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012 for details on how to install a new section.	
		ATTENTION: De-energize all power sources to the motor control center before adding new vertical section to the existing EtherNet/IP MCC lineup. Failure to de-energize all power sources can result in severe injury or death.	
		IMPORTANT: Maintaining the organization of the MCC sections is critical (left-to-right orientation must follow section numbering scheme). Reorganizing vertical sections can affect the MCC network uplink and 24V DC power distribution conditions.	
2	Horizontal Bus Bar Splicing	See CENTERLINE 2100 MCC Joining and Splicing Vertical Sections, publication 2100-IN010 for details on how to splice the horizontal bus bar.	
		ATTENTION: De-energize all power sources to the motor control center before adding new vertical sections to the existing EtherNet/IP MCC lineup. Failure to de-energize all power sources can result in severe injury or death.	
3	EtherNet/IP network and 24V DC power connections	See Adding EtherNet/IP IntelliCENTER Sections to an Existing Lineup for 24V DC power supply planning.	
		See EtherNet/IP Network and 24V DC Connections Within a Shipping Split for detailed information about connections within each section. The EtherNet/IP network and 24V DC connections within each section are made at the factory, before shipping.	
		IP addresses and subnet masks for the IMC devices and industrial Ethernet switches within each section are preconfigured at the factory before shipping.	
		See EtherNet/IP Network and 24V DC Connections Across Shipping Splits and make required switch-to-switch, switch-to-plant-wide network, and 24V DC power (if required) connections.	
		IMPORTANT: Understand MCC uplink connections limitations before making connections. See MCC Uplink Connections for further details.	
		ATTENTION: De-energize all power sources to the motor control center before adding new vertical sections to the existing EtherNet/IP MCC lineup. Failure to de-energize all power sources can result in severe injury or death.	
4	Connections Integrity	Check the integrity of the horizontal bus splice connections, new EtherNet/IP network, and power connections. Finally, inspect all of the other connections for loose wires, opens, and shorts as well.	
5	MCC Lineup/Physical Inspection	Inspect the enclosure and units for damage and verify that electrical clearances have been maintained based on the voltage and impulse rating of the equipment. All covers and doors must be in place before applying power to the MCC.	
		If there are any blank space factors within the new vertical section, they must be replaced with the appropriate items such as units, doors, and unit support pans. For further details, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
6	Pre-energizing Check	Finally, before applying the power perform the pre-energizing check procedure and then apply power to the MCC. For details on the pre-energizing check, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
7	Troubleshooting	If there is an issue with EtherNet/IP and 24V DC power operations, recheck the integrity of the EtherNet/IP and 24V DC power connections. Before rechecking the connections integrity, de-energize, lockout, and tag-out all sources of power to the MCC.	
		IMPORTANT: The static IP address and subnet masks for the IMC devices are already configured and tested at the plant before shipping. Hence, the functionality issue can reside in the integrity of the network wiring.	
		ATTENTION: De-energize the EtherNet/IP MCC and follow appropriate lockout and tag out policies before commencing the troubleshooting processes. Failure to de-energize all power sources can result in severe injury or death.	

When installing a new unit or rearranging a unit within the existing CENTERLINE 2100 MCC lineup with EtherNet/IP network, see the following MCC Commissioning Checklist before applying power.

Table 8 - Adding or Rearranging EtherNet/IP IntelliCENTER Units Within an Existing Lineup

Step	Commission	Tasks	Status
1	MCC Units - Installation and Rearrangement	See CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012 for details on how to remove and install a unit.	
		ATTENTION: De-energize all power sources to the motor control center before installing or rearranging the units within the existing EtherNet/IP MCC lineup. Failure to de-energize all power sources can result in severe injury or death.	
		If the MCC units are installed or removed with power applied to the main power bus, follow established electrical safety work practices. See the NFPA 70E Standard for Electrical Safety in the Workplace publication.	
2	Horizontal Bus Bar Splicing	N/A	N/A
3	EtherNet/IP Network and 24V DC Power Connections	See Adding or Rearranging EtherNet/IP IntelliCENTER Plug-in Units Within an Existing Lineup, verify that addition of new unit or rearrangement of a unit is not violating the 24V DC power supply limitations.	
		See EtherNet/IP Network and 24V DC Connections Within a Shipping Split for further information on switch-to-device and 24V DC power (if required) connections within the section. Make the required switch-to-device and 24V DC power (if required) connections.	
		IP addresses and subnet masks for the IMC device within the plug-in units are preconfigured at the factory before shipping.	
		IMPORTANT: For MCC lineups that use direct Ethernet cable connections, cable length calculations are based on the unit location and unit type at the time of order entry. Rearranging units within a section can result in Ethernet cables being too short or excessively long.	
		IMPORTANT: The static IP address and subnet masks for the IMC devices in each section are already configured and tested at the plant before shipping.	
4	Connections Integrity	Check the integrity of the new EtherNet/IP network and power connections. Finally, inspect all of the other connections for loose wires, opens, and shorts as well.	
5	MCC Lineup/Physical Inspection	Inspect the enclosure and units for damage and verify that electrical clearances have been maintained based on the voltage and impulse rating of the equipment. All covers and doors must be in place before applying power to the MCC.	
		If there are any blank space factors within the MCC lineup, they must be replaced with the appropriate items such as units, doors, and unit support pans. For further details, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
6	Pre-energizing Check	Finally, before applying the power perform the pre-energizing check procedure and then apply power to the MCC. For details on the pre-energizing check, see CENTERLINE 2100 MCC Installation Manual, publication 2100-IN012.	
7	Troubleshooting	If there is an issue with EtherNet/IP and 24V DC power operations, recheck the integrity of the EtherNet/IP and 24V DC power connections. Before rechecking the connections integrity, de-energize, lockout, and tag-out all sources of power to the MCC.	
		IMPORTANT: The static IP address and subnet masks for the IMC devices are already configured and tested at the plant before shipping. Hence, the functionality issue can reside in the integrity of the network wiring.	
		ATTENTION: De-energize the EtherNet/IP MCC and follow appropriate lock out tag out policies before commencing the troubleshooting processes. Failure to de-energize all power sources can result in severe injury or death.	

Additional Resources

These documents contain additional information about related products from Rockwell Automation.

Resource	Description
Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001	Describes how to design a Converged Plant-wide Ethernet Network.
Fiber Optic Infrastructure Application Guide, publication ENET-TD003	Describes fiber-optic infrastructure.
Resilient Ethernet Protocol in a Converged Plantwide Ethernet System (CPwE), publication ENET-TD005	Describes how to deploy REP in a Converged Plant-wide Ethernet Network.
Stratix 5700 Industrial Ethernet Switch Product Profile, publication ENET-PP005	Provides Stratix 5700 switch information.
EtherNet/IP Media Planning and Installation Manual ODVA Pub. 148 and EtherNet/IP Network Infrastructure Guidelines ODVA Pub 35(1)	Describes EtherNet/IP media planning.
IntelliCENTER software user manual, publication MCC-UM002	Provides information on how to install and use IntelliCENTER software.
IntelliCENTER EtherNet/IP Motor Control Centers Reference Manual, publication MCC-RM001	Describes the EtherNet/IP IntelliCENTER motor control center with a focus on the system architecture and integration into your plant.
CENTERLINE 2100 Low Voltage Motor Control Centers Instruction Manual, publication 2100-IN012	Provides general instructions for MCC units.
Stratix Managed Switches User Manual, publication 1783-UM007	Provides Stratix 5700 switch information.
Integrated Architecture Builder (IAB) Advanced EtherNet/IP capacity tool	Provides EtherNet/IP network performance and Logix controller utilization estimates based on a particular system layout.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

(1) For ODVA publications, see the ODVA EtherNet/IP library at http://odva.org/Home/ODVATECHNOLOGIES/EtherNetIP/EtherNetIPLibrary/tabid/76/lng/en-US/Default.aspx

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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