

CENTERLINE 2100 Low Voltage Motor Control Centers

Bulletin Number 2100



Installation Instructions

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

These labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.



Identifies information that is useful and can help to make a process easier to do or easier to understand.

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Notes:

About This Publication	This manual provides detailed installation instructions for installing, using handle, energizing, and maintaining your CENTERLINE® 2100 Motor Control	the operator Center.
	This manual is intended for engineers or technicians directly involved in th connection, energizing, and maintenance of the CENTERLINE 2100 Motor Co	e installation, introl Center.
	If you do not have a basic understanding of the CENTERLINE 2100 Motor Co contact your local Allen-Bradley distributor or Rockwell Automation sales re information on available training courses.	ntrol Center, epresentative for
Download Firmware, AOP, EDS, and Other Files	Download firmware, associated files (such as AOP, EDS, and DTM), and acce notes from the Product Compatibility and Download Center at <u>rok.auto/pcd</u>	ss product release <u>c</u> .
Summary of Changes	This publication contains the following new or updated information. This lis substantive updates only and is not intended to reflect all changes.	st includes
	Торіс	Page
	Updated Figure 23 Seismic Bolt Down Requirements, and Figure 24 Seismic Weld Down	7/.

Updated <u>Figure 23</u> Seismic Bolt Down Requirements, and <u>Figure 24</u> Seismic Weld Down Requirements	34
Updated Stratix 5700 to The standard Stratix Ethernet switch	115 and 117
Updated User Manual 1783-UM007 to 1783-UM012	115 and 117
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Additional Resources

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

Resource	Description
CENTERLINE Motor Control Centers Power Fuses Product Data, publication 2100-TD003	Provides information and specifications for fuse use in motor control centers.
CENTERLINE Motor Control Centers Mains and Incoming Lines Dimensions Reference, publication <u>2100-TD018</u>	Provides dimensions drawings for lug compartments, main fusible disconnects, main circuit breakers, and conduit entry.
DeviceNet Motor Control Centers (MCC) Technical Data, publication 2100-TD019	Provides information for motor control centers using a DeviceNet® network.
CENTERLINE Motor Control Centers with EtherNet/IP, publication 2100-TD031	Provides information for motor control centers using an EtherNet/IP™ network.
CENTERLINE 2100 Motor Circuit Protection Technical Data, publication 2100-TD032	Provides information for motor circuit protection in units with catalog suffix code 'T' or with Bulletin 140G and 140MG circuit breakers.
CENTERLINE 2100 Low Voltage Motor Control Centers 65 kA Arc Resistant Device Limited and Time Duration Testing Technical Data, publication <u>2100-TD033</u>	Provides information on certification for arc resistant testing.
Power Factor Correction Capacitors for Bulletin 2100 MCC Starter Units Application Techniques, publication <u>2100-AT001</u>	Provides information about the use of power factor correction capacitors.
CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections Instructions, publication <u>2100-IN010</u>	Provides information for joining and splicing vertical sections.
CENTERLINE 2100 Motor Control Centers (MCC) Units with Vertical Operating Handles Installation Instructions, publication <u>2100-IN014</u>	Provides information on installing vertical handle units.
Receiving, Handling, and Storing Motor Control Centers Instructions, publication <u>2100-IN040</u>	Provides information on how to receive, handle, and store motor control centers.
CENTERLINE 2100 Motor Control Center (MCC) Units with Horizontal Operating Handles Installation Instructions, publication <u>2100-IN060</u>	Provides information to install units with horizontal operating handles.

Resource	Description
CENTERLINE 2100 Motor Control Center End Closing Plates Installation Instructions, publication <u>2100-IN069</u>	Provides instructions for installing end closing plates.
CENTERLINE 2100 Motor Control Centers 600A, 800A and 1200A Bolted Pressure Contact Switch, publication <u>2100-IN049</u>	Provides instructions on usage and maintenance of a 600A, 800A and 1200A Bolted Pressure Switch.
CENTERLINE Motor Control Centers Installing a Pull Box on a Bulletin 2100 Vertical Section Installation Instructions, publication <u>2100-IN029</u>	Provides instructions on installing a Pull Box on a motor control center.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control Installation Instructions, publication <u>SGI-1.1</u>	Provides safety guidelines for the application, installation, and maintenance of solid-state control.
Industrial Automation Wiring and Grounding Guidelines, publication <u>1770-4.1</u>	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <u>https://rok.auto/literature</u>.

The documents in <u>Table 1</u> are referenced in this document and can be obtained from their respective organizations.

Table 1 - Association Resources

Resource	Website
 National Electrical Manufacturer's Association (NEMA) NEMA ICS 1 - Industrial Control and Systems: General Requirements NEMA ICS 2.3 - Instructions for Handling, Operation and Maintenance of Motor Control Centers Rated Not More Than 600V 	https://www.nema.org
National Fire Protection Association (NFPA) • NFPA 70 - National Electrical Code • NFPA 70A - Recommended Practice for Electrical Equipment Maintenance • NFPA 70E - Standard for Electrical Safety in the Workplace	https://www.nfpa.org
Institute of Electrical and Electronic Engineers (IEEE) IEEE standard C37.20.7 - IEEE Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults	https://www.ieee.org

Purchased Components and Additional Instruction Sheets

When equipment such as transformers, protection relays, air circuit breakers, variable frequency drives, or soft starters are supplied with the motor control center (MCC), specific publications are shipped with the units. Read and understand these documents before installing and operating the MCC.

General Information

Allen-Bradley[®] CENTERLINE[®] motor control centers (MCCs) consist of one or more vertical sections, which contain electromagnetic or solid-state control devices that are prewired and tested within modular (plug-in) or frame-mounted (hard-wired) units.

These dimensions are the standard for CENTERLINE MCCs:

- Standard widths
 - 20 in. (508 mm)
 - 25 in. (635 mm)
 - 30 in. (762 mm)
 - 35 in. (789 mm)
 - 40 in. (1016 mm)
- Standard front-mounted depths
 - 15 in. (381 mm)
 - 20 in. (508 mm)
 - 25 in. (635 mm)
- Standard back-to-back mounted depths
 - 30 in. (762 mm)
 - 40 in. (1016 mm)
- Standard height
 - 90 in. (2286 mm)
 - 70.5 in. (1791 mm)

All MCC sections are supplied with top and bottom horizontal wireways. Sections that are designed to accommodate plug-in units include a vertical wireway. Each 90 in. (2286 mm) vertical section can accommodate up to 6.0 space factors or 78 in. (1981 mm) for units.

Standard vertical wireways for 20 in. (508 mm) wide sections are 4.38 in. (111.25 mm) wide and 7.5 in. (190.50 mm) deep. Optional vertical wireways in 25 in. (635 mm) wide section are 9.38 in. (238.25 mm) wide and 7.5 in. (190.50 mm) deep.

Units (buckets) are designed in increments of 0.5 space factors. Each 0.5 space factor is approximately 6.5 in. (165.1 mm) high. Units are designed as either removable (plug-in) or frame-mounted (non-plug-in).

Individual units house a wide variety of power and logic devices. Plug-in units are mounted on unit support pans within the section. Stab assemblies on the back of the unit plug onto the vertical bus. A mechanical interlock helps prevent the unit door from being opened when the disconnect is not in the OFF position. An additional mechanical interlock helps prevent the unit from being plugged-in or unplugged when the disconnect is not in the OFF position.

Line power is distributed throughout the MCC via an isolated bus work structure. The main horizontal bus is in the center of each section. Standard, center-fed, 300 A rated vertical bus supplies power to the individual units above and below the horizontal bus for an effective 600

A capacity, providing unrestricted unit arrangement. An optional 600 A vertical bus provides 1200 A effective rating.

The CENTERLINE MCC is also available with an ArcShield™ rating. The ArcShield rating includes arc-resistant features that are intended to help provide enhanced protection to you during internal arcing faults (when compared to MCCs that are designed only to meet UL 845 requirements). Arcing faults can be caused, for example, by accidental touching, closing into faulted lines, or loose connections. Depending on the application, MCCs with the ArcShield rating can provide up to Type 2 accessibility per IEEE standard C37.20.7. The arc-resistant features help protect you when you are at the front, sides, and rear of the enclosure in the unlikely event of an arcing fault.

A label on the MCC with the ArcShield rating provides information in regard to the accessibility level and arc fault ratings.

For more information about accessibility levels, performance, and testing requirements, refer to IEEE standard C37.20.7, IEEE Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults.

MCCs with the ArcShield rating provide a reinforced structure and arc-containment latches on all doors. To help protect you during an arc-fault, arc-containment latches, when closed and latched properly, provide pressure relief and help keep the doors from unlatching or detaching from the structure.

Nameplate Data

Each MCC section has a nameplate on the enclosure or vertical wireway door. The nameplate includes the following information:

- Catalog number/serial number
- Series letter of section
- Busbar voltage and current rating
- Section number
- UL and c-UL-us certification marking
- UL registration number
- Enclosure type

Figure 1 - Section Nameplate



Each plug-in and frame-mounted unit also has an identification label. The unit label is on the interior of the bottom plate of plug-in units or on the interior right-hand side plate of the frame-mounted units. The unit label for each plug-in or frame-mounted unit includes the following information:

- Catalog number/serial number
- Series letter of the unit
- Voltage rating
- Unit location
- UL and c-UL-us certification marking
- Device type and size

Figure 2 - Unit Label



The catalog number or serial number and series letter are required to properly identify the equipment to sales or factory personnel.

MCC Sequence Numbering

CENTERLINE MCCs are designed so functionality is not affected by the section installation order, for example, vertical section-numbering sequence order.

All MCC sections carry a serial plate that identifies vertical section sequence numbering. For example, MCC section 1 of 1, 1 of 5, and so on.

Figure 3 - Section Nameplate



Sections are numbered to match factory-supplied MCC elevation drawings. Numbering each section helps installers and users easily identify MCCs, sections, and units. If there are questions about section numbering during field installation, inspection, or operation, the following information can provide guidance on equipment acceptability, listing, and certification.

CENTERLINE MCC sections can be installed or added as follows:

- In non-sequential order
- Addition of one section (add-on section)
- · Addition of multiple sections (add-on lineup of sections)
- Addition of single section or multiple sections between MCC sections

If sections are added to an existing lineup and not installed in sequential order, the installation is not considered a misapplication or in conflict with Underwriter Laboratories (UL) listing and Canadian Standards Association (CSA) certification.

The paramount criteria for additions of sections to existing MCCs is matching the horizontal bus electrical and ingress protection (enclosure type) ratings for the total MCC line up. For example, the voltage, current rating, short circuit withstand, and NEMA/UL enclosure type (IP rating) for all sections must match.

Non-sequential numbering cannot create a functional or listing/certification issue. However, install MCCs sin sequential order. Installing MCCs in sequential order helps confirm proper installation and confirms that factory-supplied documentation matches the equipment.

You can rearrange MCC sections. However, if a section that uses a right-hand side sheet with integral, internal mounting flanges is on the outside of a lineup, an additional closing kit plate is required. See CENTERLINE 2100 Motor Control Center End Closing Plates Installation Instructions,

publication <u>2100-IN069</u>. MCCs that contain arc-resistant features cannot use a section with integral mounting flanges on the outside of a lineup.

UL/CSA Marking CENTERLINE MCCs are listed by Underwriter's Laboratories, Inc. (UL), Standard for Safety UL 845, and certified by the Canadian Standards Associate (CSA), Standard C22-2, No. 14.

Due to standards harmonization, an MCC can also carry the c-UL-us designation. The c-UL-us designation is comparable to CSA certification.

Vertical sections and units are labeled independently. It is possible to have combinations of labeled and non-labeled sections and units in the same MCC.

Vertical sections and structure options that are UL Listed and CSA/c-UL certified are marked accordingly. All components in a UL or CSA listed section must be UL Listed and c-UL/CSA certified. The UL and/or CSA/c-UL designation is a part of the section nameplate as shown on page <u>Figure 3 on page 11</u>.

Units and unit options that are UL Listed and CSA/c-UL certified are marked accordingly. All options and components in a UL and/or c-UL/CSA listed unit must be UL Listed or recognized and/or c-UL/CSA certified. The UL designation is on the interior of the bottom plate of plug-in units or on the interior right-hand side plate of frame-mounted units.

Figure 4 - UL Label Designation for Units



Short-circuit Rating Label

MCC vertical sections that are UL Listed and/or CSA/c-UL certified carry a short circuit rating label. The short circuit rating label for a vertical section is on the inside of the vertical wireway door of standard sections or on the interior right-hand side plate of a section that contains a unit that occupies the full section and does not contain a vertical wireway.

Figure 5 - Short Circuit Label for Sections

SHORT-CIRCUIT RATING 65,000 AMPERES RMS SYMMETRICAL 600 VOLTS MAXIMUM DO NOT INSTALL ON CIRCUITS WITH AVAILABLE SHORT-CIRCUIT CURRENTS GREATER THAN THE ABOVE RATING OF ANY INSTALLED UNIT. Allen-Bradley

MCC units that are UL Listed and/or CSA/c-UL certified carry a short-circuit rating label on the bottom plate of plug-in units or on interior right-hand side plate of frame-mounted units.

Figure 6 - Short Circuit Label for Units

UNIT SHORT-CIRCUIT RATING 100,000 RMS SYMMETRICAL AMPERES, 480 VOLTS MAXIMUM

ArcShield Rating Labels

MCC units that have the arc-resistant rating carry a rating label on the vertical wireway door. This label serves as the arc-resistant nameplate and provides information on the arc-resistant rating. There are labels on other parts that must be in place before operating an arc-resistant MCC.

Figure 7 - ArcShield Labels



Series Number and Series ID as Manufactured in the United States



ATTENTION: Read tables $\underline{2}$ through $\underline{5}$ before adding new sections or units to an existing CENTERLINE MCC.

Table 2 - Sections

Series Letter	Scope	Description of Change	Date Implemented in the U.S.
A ⁽¹⁾	-	Original design	February 1971
B ⁽¹⁾	All	Changed terminal blocks	November 1976
C ⁽¹⁾	All	Elimination of external mounting channels	June 1979
D ⁽¹⁾	All	Reverse fed 2192 and 2193	April 1981
E ⁽¹⁾	All	Redesign gasketing	October 1982
F ⁽¹⁾	All	Modified top horizontal wireway pan to accept units with handle interlock in topmost space factor	October 1983
G ⁽¹⁾	42K	42k bracing-incorporates new bus support and cover	January 1985
G ⁽¹⁾	65K	65k bracing-incorporates new bus support and cover	July 1985
Н	All	New hinge design	January 1986
J	All	Changed handle, operating mechanism, and circuit breaker to Cutler-Hammer series C, 150 A, 250 A, 400 A frame	October 1986
K	All	Changed to new unit grounding system	May 1990
L	All	Changed to new 6001200 A circuit breaker operating mechanism	February 1996
М	All	Changed to serpentine DeviceNet® cabling system	May 2001
Ν	All	New design for 100,000 A bus bracing and begin use of right-hand sidesheet with integral mounting flanges.	May 2009
Р	All	New design for bus covers	February 2012

 Replacement and renewal parts are no longer supported. For more information, contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.

Table 3 - 2100 Units

Series Letter	Scope	Description of Change	Date Implemented in U.S.
A ⁽¹⁾	-	Original design	February 1971
B ⁽¹⁾	All sizes	Changed terminal blocks	November 1976
C ⁽¹⁾	All sizes	Changed handle mechanism to Cutler-Hammer MCPs	June 1979
D ⁽¹⁾	Size 5	Changed from ITE to Allen-Bradley 400 A disconnect	April 1981
E ⁽¹⁾	All sizes	Changed from Bulletin 709 series K starters to Bulletin 500 line starters	April 1981
F ⁽¹⁾	All sizes	Redesign of gasketing, wraparound, and unit support pan for Bulletin 700 line	October 1982
G ⁽¹⁾	All sizes	Redesign of gasketing, wraparound, and unit support pan for Bulletin 500 line	October 1982
H ⁽¹⁾	All sizes	Changed to new door, circuit breaker mechanism and control station	April 1984
	Size 5	Changed to Bulletin 500 series L	October 1984
J ⁽¹⁾	Size 3	Changed to new PCP 100 A disconnect	December 1988
	Size 6	Changed to Bulletin 500 Series B starters	October 1988
К	Size 15 CB units and size 12 disk units	Changed handle, operating mechanism and circuit breaker to Cutler-Hammer series C, 150 A, 250 A, 400 A frame	October 1986
L	21 A through 54 A	Changed to Bulletin 100 line contactors in 21 A, 30 A, 45 A SMC™ units and original design 24 A, 35 A, 54 A SMC units	November 1989
М	All sizes	Changed to new unit grounding system and 600 A, 800 A, 1200 A bolted pressure switch	May 1990
N	All sizes	Changed to PCP 200 A and 400 A disconnect, derated vacuum Bulletin 2112 and 2113 and new pilot device offerings	January 1993
Р	0.5 SF CB units 2103L, 2113, 2193	External auxiliary on circuit breakers	April 1994
Q	All sizes and ratings	New disconnect external auxiliary contacts and new 600 A1200 A circuit breaker operating mechanism	May 1996

Table 3 - 2100 Units (Continued)

Series Letter	Scope	Description of Change	Date Implemented in U.S.
	SMC™ units	Redesign and upgrade of ratings for 24 A500 A SMC-2 and SMC-PLUS units. Original design of SMC Dialog Plus units	August 1997
R	1200 A 2193	Redesign of 1200 A, 2193F, and 2193M units	November 1997
	800 A 2193	Changed circuit breakers to MDL Frame	November 1998
	225 A 2193F	Changed circuit breakers from J Frame to F Frame	October 1999
	2000 A 2193	Changed to flange mounted operating handle	November 2000
T	All sizes	Changed the Bulletin 800MR and Bulletin 800T-PS pilot devices to Bulletin 800Es	November 2000
	All 1.5 space factor units	Changed unit bottom plate	November 2000
	All except 2100-SD1	Changed to new Bulletin 1497 control circuit transformer	July 2001
U	2100-SD1	Changed smoke detector head and base components	November 2001
	2162Q, 2163Q, 2164Q, 2165Q	Redesign of 240-480V PowerFlex $^\circ$ 70 and release of 600V PowerFlex 70	April 2002
	2162R, 2163R, 2164R, 2165R	Original release of PowerFlex 700	July 2002
	2154H, 2155H	Original release of SMC-3	November 2002
V	2154J, 2155J	Original release of SMC Flex	April 2004
	2112, size 3, 4 and 5	Redesign to reduced space factor with Class J fuse clip	April 2004
	2162T, 2163T	Original release of PowerFlex 40	September 2004
	2107, 2113, size 3	Reduced space factor	April 2005
v	2162Q, 2163Q	Reduced space factor, changed CCT with integral fuses	April 2005
٨	All sizes	800F pilot devices	August 2005
Ŷ	2154J, 2155J, 108 A and 135 A	Redesign to change units from frame mounted to plug-in	March 2006
	2164Q, 2164R, 2165Q, 2165R (Drive with manual bypass)	Redesign for change from SMP™ overload relay to E1 Plus™ Electronic Overload Relay	August 2006
	2107, 2113, size 2 and 3	Redesign due to starter component series letter change	December 2009
7	2103L, 2107, 2113, 2123, 2155H, 2155J, 2163Q, 2163R, 2163T, 2163U, 2163V, 2193F, 2193M	Changed to Bulletin 140G and 140MG circuit breakers.	December 2013
	2162W, 2163W, 2162X, 2163X	Original release of PowerFlex 525 and PowerFlex 523 drives.	September 2014
	2102L, 2106, 2112, 2122, 2154, 2162, 2192M, 2192F	Redesign of units for use with Bulletin 1494U disconnects.	January 2018

Replacement and renewal parts are no longer supported. For more information, contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support. (1)

Table 4 - 2400 Units

Series Letter	Scope	Description of Change	Date Implemented in U.S.
А	-	Original design	June 1990
В	18 A, 24 A, 30 A	Changed to Series B, Bulletin 194R™, 30 A disconnect	March 1992
С	18 A, 24 A, 30 A	Changed to three Bulletin 800E pilot devices on 0.5 space factor units	July 1992
n	All sizes	New disconnect external auxiliary contacts and new 600 A1200 A circuit breaker operating mechanism	February 1996
U	16A-85A	Original design of units with a Bulletin 100-C contactor	September 1999

Sections

Series Lettering - Units and When using sections with units of different series letters, consult the following table.

If Mounted in this Type	Plug-in Units		No Additiona I Parts Required	Requires Style 1 Unit Support Pan	Requires Style 3 Unit Support Pan	Requires Style 3 Unit Support Pan w/ Bushing	Requires Alternate Top Horizontal Wireway Pan	Requires Door Gasketing Kit	Requires Retrofit Kit ⁽³⁾	Requires Ground Bus Kit
of Section ⁽¹⁾⁽²⁾	Space Factor	Series	-	2100H-UAJ1	2100H-UA1 2100H-UJ1	2100H-USPA1 2100H-USPJ1	2100H-NA4A1 2100H-NA4J1 2100H-NA4A2 2100H-NA4J2	2100-GJ10	2100H-R1 2100H-R2	2100H-GS1
		A-E ⁽⁴⁾	~	-	-	-	-	-	-	-
NEMA/UL Type 1 Series	1.0 or	F-L ⁽⁴⁾	-	✓	-	-	✓ ⁽⁵⁾	-	-	-
AD ⁽⁴⁾	larger	M or later ⁽⁶⁾	_	~	_	-	√ (5)	_	_	~
	0.5 ⁽²⁾	N or later	-	-	-	✓	-	-	~	~
NEMA/III Type 1 Series	1.0 or larger	A-E ⁽⁴⁾	-	-	~	-	-	-	-	(8)
EJ ⁽⁴⁾		F-L ⁽⁴⁾	~	-	-	-	-	-	-	-
		M or later ⁽⁶⁾	_	_	-	-	-	_	_	~
	0.5 ⁽²⁾	N or later	~	-	-	-	-	-	-	-
NEMA/UL Type T Series K or later	1.0 or	A-L ⁽⁴⁾	-	-	~	-	-	-	-	(8)
	larger	M or later	✓	_	_	_	_	1	_	_
NEMA/UL Type 1 w/ gasket or Type 12 Series AD		A-E ⁽⁴⁾	~	-	_	-	-	-	-	_
	1.0 or larger	F-L ⁽⁴⁾	_	~	_	_	✓ ⁽⁵⁾	\checkmark	_	_
		M or later	_	✓	_	_	✓ ⁽⁵⁾	\checkmark	_	~

Table 5 - MCC Modifications for Unit and Structure Compatibility

If Mounted in this Type of Section ⁽¹⁾⁽²⁾	Plug-in Units		No Additiona I Parts Required	Requires Style 1 Unit Support Pan	Requires Style 3 Unit Support Pan	Requires Style 3 Unit Support Pan w/ Bushing	Requires Alternate Top Horizontal Wireway Pan	Requires Door Gasketing Kit	Requires Retrofit Kit ⁽³⁾	Requires Ground Bus Kit
	Space Factor	Series	-	2100H-UAJ1	2100H-UA1 2100H-UJ1	2100H-USPA1 2100H-USPJ1	2100H-NA4A1 2100H-NA4J1 2100H-NA4A2 2100H-NA4J2	2100-GJ10	2100H-R1 2100H-R2	2100H-GS1
	0.5 ⁽²⁾	N or later	-	-	-	~	-	-	~	~
NEMA/UL Type 1 w/ gasket or Type 12 Series	1.0 or larger	A-E ⁽⁴⁾	_	_	~	_	-	-	_	(8)
EJ ⁽⁷⁾		F-L ⁽⁴⁾	~	-	-	-	-	-	-	-
		M or later	-	_	_	_	-	_	-	✓
NEMA/UL Type 1 w/ gasket or Type 12 Series K or later	0.5 ⁽²⁾	N or later	~	-	_	-	-	_	-	-
	1.0 or	A-L ⁽⁴⁾	-	-	~	-	-	-	-	(8)
	larger	M or later	✓	_	_	_	_	_	_	_

(1) When installing unit in topmost location in vertical sections, care must be taken to comply with the National Electric Code 6.7 ft (2000 mm) unit handle-to-floor height limitation. A unit operating handle extender (catalog number 2100-NE1) that provides 3 in. (76.2 mm) added height flexibility is available.

 When CENTERLING space factor or Space Saving NEMA Starter plug-in units are ordered unassembled or ordered for existing sections, order a centralized wiring diagram holder kit (catalog number 2100H-WDH).

3) Permits installation of 0.5 space factor or Space Saving NEMA Starter plug-in units in existing series E...J CENTERLINE 2100 vertical sections.

(4) Replacement and renewal parts are no longer supported. Contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.

(5) Required only if series F or later, 1.0 space factor or larger CENTERLINE 2100 unit is installed in topmost location of series A...E vertical sections.

(6) For more information about possible door hinge requirements, contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.

(7) Series E...J sections cannot accommodate 0.5 space factor or Space Saving NEMA Starter plug-in units in bottom-most unit location.

(8) A ground strap can be used to ground units rather than installing a ground bus. See the CENTÉRLINE 2100 Motor Control Centers (MCC) Units with Vertical Operating Handles Installation Instructions, publication <u>2100–10014</u>.

Receiving, Handling, and Storage

See the following sections for information on receiving, handling, and storage of MCC units.

Receiving

As standard, CENTERLINE MCCs are shipped upright in shipping blocks of one to three frontmounted sections or two to six back-to-back sections. Each shipping block of an MCC is provided with a lifting angle. The lifting angle is optional on NEMA/UL Type 3R and Type 4 MCCs. Each vertical section in a shipping block is bolted to the shipping skid and covered with clear plastic wrap. Equipment that extends from the structures is also protected. Protection is for upright shipping and is not water-resistant or waterproof. If necessary, other types of packaging are available.

Remove Shipping Brackets and install bottom closing plates. See publication <u>2100-IN040</u> for receiving, handling, and storage instructions. This publication is shipped with each MCC, attached to the outside of the MCC within the layer of clear plastic wrap. For additional information about the handling, installation, operation, and maintenance of MCCs rated more than 600V, consult NEMA ICS 2.3.

Export Packaging

A maximum of three vertical sections standing upright can be shipped with export packaging together in one block. The MCC is bolted to a skid and wrapped in polywrap that is suitable for occasional water-spray; a wooden frame and chipboard surround the sections. Export packaging is not water-resistant or waterproof, and is not intended for long-term storage. Extended storage can require space heaters and other considerations. Export packing adds extra weight and dimensions to the shipping block.





Handling

Lifting with a forklift, overhead lifting, sling lifting, and pipe or rod rolling are methods that can be used to handle vertical sections. See the following tables for typical weights and dimensions for standard 20 in. (508 mm) wide and 15 in. (381 mm) or 20 in. (508 mm) deep sections. For sizes not listed, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Fable 6 -	- Shipping	Weights	and Dime	nsions -	Standard F	Packaging
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Standard Packing ⁽¹⁾	Weight Ib (kg), approx.	Height in. (cm), approx.	Depth in. (cm), approx.	Width in. (cm), approx.
Front-mounted 1-section block	500 (227)	96 (244)	36 (91)	43 (109)
Front-mounted 2-section block	1000 (454)	96 (244)	36 (91)	43 (109)
Front-mounted 3-section block	1500 (680)	96 (244)	36 (91)	63 (160)
Back-to-back 2-section block	1000 (454)	96 (244)	42 (107)	43 (109)
Back-to-back 4-section block	1800 (816)	96 (244)	42 (107)	43 (109)
Back-to-back 6-section block	2200 (998)	96 (244)	42 (107)	63 (160)

 Standard packing for shipments in the United States and Canada. The MCC shipping block is mounted on a skid and covered in clear plastic wrap. This packaging is not water-resistant or waterproof.

Export Packing (below deck) ⁽¹⁾	Weight Ib (kg), approx.	Height in. (cm), approx.	Depth in. (cm), approx.	Width in. (cm), approx.
Front-mounted 1-section block	600 (295)	99 (252)	37 (94)	44 (112)
Front-mounted 2-section block	1150 (522)	99 (252)	37 (94)	44 (112)
Front-mounted 3-section block	1650 (748)	99 (252)	37 (94)	64 (163)
Back-to-back 2-section block	1200 (544)	99 (252)	43 (109)	44 (112)
Back-to-back 4-section block	2000 (907)	99 (252)	43 (109)	44 (112)
Back-to-back 6-section block	2450 (1111)	99 (252)	43 (109)	64 (163)

Figure 9 - Shipping Weights and Dimensions - Export Packaging

(1) Export packing for below deck is required for all international shipments. The MCC shipping block is mounted on a skid and covered in clear plastic wrap. This packaging is not water-resistant or waterproof. Additional packing materials surround the shipping block. The export packing adds extra weight and increases the dimension of the shipping block.



ATTENTION: MCCs are top and front heavy. To avoid personal injury or structural damage, never attempt to lift or move the MCC by any means other than the methods outlined in Receiving, Handling, and Storing Motor Control Centers, publication <u>2100-IN040</u>.

Storage and Operation

CENTERLINE MCCs conform to NEMA standard ICS 1 for service and storage conditions. MCC ambient operating temperature range is 0...40 °C (32...104 °F) at 95% noncondensing humidity. Ambient storage temperature range is -30...+65 °C (-22...+149 °F). In addition, MCCs have an altitude class of 2 km (1 km for MCCs that contain variable-frequency drives). The altitude class of 2 km designates equipment for installation where the altitude does not exceed 2000 m (6600 ft). For installation above 2000 m (6600 ft), contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.

Notes:

Installation Procedures

Location Planning

When planning the location for your CENTERLINE® MCC, consider the following:

- Conduits
- Busways
- Overall height of installation area
- Alignment with other equipment
- Future needs
- Ambient temperature

The area must be level and the environment must be compatible with the NEMA/UL enclosure rating of the equipment

Documentation packages shipped with assembled MCCs include an MCC elevation drawing and an MCC floor plan layout.

Height Considerations

If the MCC is equipped with optional external mounting channels or is mounted on a pad, the height from the floor to the center of the top handles must be checked for compliance with NFPA 70 National Electrical Code (NEC) Article 404.8 and UL Standard 845. If the distance from the floor to the center of the highest handle is greater than 6.7 ft (2042.16 mm), add a unit operating handle extender (catalog number 2100H-NE1).

Figure 10 - Height Planning Dimensions



ArcShield Clearance Height

The area above the MCC top plate must be unrestricted for the proper operation of the pressure relief venting system.

- A minimum clearance above the top of the MCC of 12 in. (305 mm) must be available for pressure relief and/or venting if an internal arcing fault occurs.
- Conduit, cable, and wiring must be installed in such a way so that it does not interfere with the opening of the top plate vent (no cable or conduit in the top-rear of cabinet; cable trays must be a minimum of 12 in. (305 mm) above the top plate).

IMPORTANT Do not remove the lifting angle from ArcShield[™] sections that are 100 ms duration rated or device limited with bus ratings 1600 A and above.

Figure 11 - ArcShield Planning Dimensions



Securing an MCC

Anchor bolts [1/2 in. (13 mm)] can be embedded in the foundation prior to installation. Two bolts per vertical section fasten the MCC through its internal mounting angle to the foundation [corner sections require three bolts and 40 in. (1016 mm) wide sections require four bolts]. See the following illustrations and tables for general dimensions. Dimensions matching your equipment can be found on the elevation drawings shipped with your MCC.

Figure 12 - Mounting Dimensions for 15 in. and 20 in. Sections





Figure 13 - Mounting Dimensions for 15 in. and 20 in. Sections - continued

The optional external mounting channels add 1.5 in. (38.1 mm) to the height.

Dimensions, approx.	15 in. Deep				20 in. Deep			
	20 in. Wide in. (mm)	25 in. Wide in. (mm)	30 in. Wide in. (mm)	35 in. Wide in. (mm)	20 in. Wide in. (mm)	25 in. Wide in. (mm)	30 in. Wide in. (mm)	35 in. Wide in. (mm)
Α	20.00 (508)	25.00 (635)	30.00 (762)	35.00 (889)	20.00 (508)	25.00 (635)	30.00 (762)	35.00 (889)
В	15.00 (381)	15.00 (381)	15.00 (381)	15.00 (381)	20.00 (508)	20.00 (508)	20.00 (508)	20.00 (508)
C	11.56 (294)	11.56 (294)	11.56 (294)	11.56 (294)	16.56 (421)	16.56 (421)	16.56 (421)	16.56 (421)
D	10.00 (254)	12.50 (318)	15.00 (381)	17.50 (445)	10.00 (254)	12.50 (318)	15.00 (381)	17.50 (445)
E ⁽¹⁾	9.25 (235)	11.75 (299)	14.25 (362)	16.75 (426)	9.25 (235)	11.75 (299)	14.25 (362)	16.75 (426)

(1) Applies to first and last sections that require seismic ratings.



Figure 14 - Mounting Dimensions for 30 in. and 40 in. Deep Back-to-Back Section

Dimensions, approx.	20 in. Deep				40 in. Deep			
	20 in. Wide in. (mm)	25 in. Wide in. (mm)	30 in. Wide in. (mm)	35 in. Wide in. (mm)	20 in. Wide in. (mm)	25 in. Wide in. (mm)	30 in. Wide in. (mm)	35 in. Wide in. (mm)
A	20.00 (508)	25.00 (635)	30.00 (762)	35.00 (889)	20.00 (508)	25.00 (635)	30.00 (762)	35.00 (889)
В	30.00 (762)	30.00 (762)	30.00 (762)	30.00 (762)	40.00 (1016)	40.00 (1016)	40.00 (1016)	40.00 (1016)
C	11.56 (294)	11.56 (294)	11.56 (294)	11.56 (294)	16.56 (421)	16.56 (421)	16.56 (421)	16.56 (421)
D	10.00 (254)	12.50 (318)	15.00 (381)	17.50 (445)	10.00 (254)	12.50 (318)	15.00 (381)	17.50 (445)





The optional external mounting channels add 1.5 in. (38.1 mm) to the height.



Figure 16 - Mounting Dimensions for 10 in. Wide Section with 10 in. (254 mm) Incoming Line Section

Dimension	Section Depth					
approx.	15 in. (381 mm) Deep in. (mm)	20 in. (508 mm) Deep in. (mm)				
A	12.75 (324)	17.75 (451)				
В	14.75 (375)	19.75 (502)				



Figure 17 - Mounting Dimensions for NEMA/UL 3R and 4 Section



	Front	(2) Mou 0.63 in	unting Holes n. (16 mm) Diameter
		Exterior Section Width	
Dimension, approx.	20 in. (508 mm) Wide ⁽¹⁾ in. (mm)	25 in. (635 mm) Wide ⁽¹⁾ in. (mm)	30 in. (762 mm) Wide ⁽¹⁾ in. (mm)
A	25.00 (635)	30.00 (762)	35.00 (889)

Figure 18 - Mounting Dimensions for NEMA/UL 3R and 4 Section

(1) This measurement is the interior section width.

B C 13.75 (349)

11.25 (286)

IMPORTANT If optional non-removable lifting angle is supplied, add 3.63 in. (92.20 mm) to height.

16.25 (413)

13.75 (349)

18.75 (476)

16.25 (413)



Figure 19 - Mounting Dimensions for Corner Section, 15 in. and 20 in. Deep

The optional external mounting channels add 1.5 in. (38.1 mm) to the height.

Dimension	Section Depth						
approx.	15 in. (381 mm) Deep in. (mm)	20 in.(635 mm) Deep in. (mm)					
A	25.13 (638)	30.13 (765)					
В	12.63 (321)	15.13 (384)					
C	16.81 (427)	21.81 (554)					
D	17.62 (448)	22.62 (575)					



Figure 20 - Mounting Dimensions for Front-mounted Section, 15 in. and 20 in. Deep

Mounting Holes for 5/16 in. Hardware

The optional external mounting channels add 1.5 in. (38.1 mm) to the height.

Dimensions, approx.	Section Width ⁽¹⁾								
	20 in. Wide in. (mm)	25 in. Wide in. (mm)	30 in. Wide in. (mm)	35 in. Wide in. (mm)	40 in. Wide in. (mm)				
A	17.25 (438)	22.25 (565)	27.25 (692)	32.25 (819)	37.25 (946)				
В	16.50 (419)	21.50 (546)	26.50 (673)	31.50 (800)	36.50 (927)				
C	5.25 (133)	7.75 (197)	10.25 (260)	12.75 (324)	15.25 (387)				

When a horizontal bus or a disconnecting means (switch or circuit breaker) is specified, reduce the 'A' dimension by 5 in. (127 mm).



Figure 21 - Mounting Dimensions for Front-mounted Section, 15 in. and 20 in. Deep x 40 in. Wide



Figure 22 - Mounting Dimensions for MCC Sections With Reduced Height (71 in. or 1803.4 mm)

71 in. High Section (1803.4 mm)

Dimension, approx.	Section Depth		
	15 in. (381 mm) Deep in. (mm)	20 in.(635 mm) Deep in. (mm)	
A	15.00 (380)	20.00 (508)	
В	14.75 (374)	19.75 (500)	
C	5.12 (130)	10.12 (256)	
D	4 (101)	8 (203)	
E	_	4.40 (112)	

Seismic Requirements

Actual CENTERLINE 2100 MCC units have been seismically qualified by dynamic (triaxial multifrequency testing) seismic tests using ICC-ES AC156 acceptance criterion that covers general equipment and supports the seismic certification of electrical systems such as MCCs. The testing was carried out in accordance with ICC-ES AC156 criteria and supports data for the following qualification requirements:

Compliance Documents	Compliance Level
2010 American Society of Civil Engineers (ASCE) 7-10 2012 and 2015 International Building Code (IBC) 2013 California Building Code (CBC) 2012 ICC-ES AC156	S _{DS} = 1.63 g



AC156 SDS 1.63 g Required Response Spectra (RRS)

IMPORTANT Variable frequency drive units using 'rollout' drive configurations are not seismically tested.

To obtain a UBC or IBC seismic withstandability, each individual CENTERLINE 2100 MCC lineup (for example, both front and back MCCs in 'back-to-back applications), must be mounted on an adequate seismic foundation and installed per the seismic anchoring requirements as shown in the following illustrations.

In seismic application dimensions 'E' applies to the first and last sections of the MCC lineup. See <u>Figure 12 on page 23</u> for dimensions.

IMPORTANT	For seismic bolt-down of sections with external mounting channels, you can remove the external mounting channel hardware where the additional anchoring is required and use those holes. Drill-out or remove weld nuts from the external mounting channels to accommodate the recommended 1/2 in. hardware.
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Figure 23 - Seismic Bolt Down Requirements



⁽¹⁾ The hardware required is 1/2 in.-13 Grade 5 or HSL-3 M12 or better bolts embedded in the foundation.
 ⁽²⁾ For dimension E in Figure 23 see chart in <u>Figure 13</u>.





Joining and Splicing New MCCs

Joining and Splicing Existing MCCs A main horizontal bus splice kit must be installed between shipping blocks of new MCCs to connect the main horizontal bus. In addition, the neutral bus splice kit (if required) and the ground bus splice kit must be installed between shipping blocks. Refer to CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections Instructions, publication <u>2100-IN010</u>.

A main horizontal bus, a neutral bus (if required), and a ground bus splice kit must be installed when adding to existing CENTERLINE MCCs. When adding to existing MCCs, you must identify the series of the MCC that you are adding to. If the existing MCC is series A or B, you must consult MCC technical support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support for joining and splicing procedures. When the existing MCC is series C or later, refer to CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections Instructions, publication <u>2100-IN010</u>.

Also, be sure to connect network cables and other control cables as required.

Joining and Splicing MCCs with ArcShield

In addition to the horizontal, neutral (if required), and ground bus splicing kits, CENTERLINE MCCs with arc-resistant ratings have these additional requirements:

- MCCs with the 100 ms arc duration rating and device limited with bus ratings of 1600 A • and above, have a back-corner baffle at the end of each lineup and insulation on the side closing-plate at the end of the lineup. They also have external vertical support angles at each end of the lineup.
- Device Limited MCCs with bus ratings of 1600 A and above will require all joining • sections have back plate seam straps and the end plate use the wraparound center plate with insulation.



MCCs with the device-limited rating have insulation on the horizontal bus side closingplates at each end of the lineup.

Installing and Joining Pull When pull boxes are supplied with your MCC, refer to Installing a Pull Box on a Bulletin 2100 Vertical Section, publication 2100-IN029, for installing and joining the pull box onto the vertical Boxes section. **Joining and Splicing** NEMA/UL Type 12 MCCs must be properly installed to prevent the ingress of dust and dirt. Follow the caulking instructions in the NEMA/UL Type 12 Sealing Instructions, publication 2100-**NEMA/UL Type 12 MCCs** IN037, supplied with the NEMA/UL 12 MCC. Use caulk to close any mounting holes in the bottom plates and bolt holes between shipping splits. It is necessary that all door latches and wireway doors be fully latched to prevent dust and dirt from entering the enclosure and to meet NEMA/UL Type 12 requirements. **Joining and Splicing** A main horizontal bus, a neutral bus (if required) and a ground bus splice kit must be installed

NEMA/UL Type 3R and Type 4 MCCs

between the internal sections for new and existing NEMA/UL Type 3R and Type 4 MCCs. Refer to CENTERLINE 2100 Motor Control Centers Joining and Splicing Vertical Sections Instructions, publication

2100-IN010, for splicing Type 3R and Type 4 internal sections.



Bus Torque Specifications

Tighten all bus splice connections with a torque wrench and socket at intervals established by your maintenance policy. See <u>Chapter 9</u> for suggested maintenance.

You can find torque values on the information label on the interior of the vertical wireway door or on the interior right-hand side plate of frame mounted units.

Insulated Bus Splice Installation

To insulate a bus splice, see publications 2100-IN096 and 2100-IN010.
Install Conduit and Cable

Install Conduit

When you install conduit, make sure it is installed according to local codes so water and moisture cannot enter or accumulate in the MCC enclosure. Conduit must be installed so they are compatible with the NEMA/UL rating of the MCC. Place the conduit away from the horizontal ground bus to avoid damage. We recommend that the conduit is positioned to minimize cable bending and maintain relative vertical alignment to incoming connections.

Bottom Entry Conduit

If your conduit is entering from the bottom, follow this procedure.

- 1. Prepare the installation site so the foundation is level.
- 2. Before the MCC is installed, place and stub up conduit approximately 2 in. (51 mm) above floor level, making sure that all incoming conduit is clear of the horizontal ground bus.

For approximate section base dimensions and ground bus locations, refer to <u>Chapter 2</u> for elevation and floor plan drawings shipped with MCC.

For approximate bottom entry locations and wiring schemes for main fusible disconnects, main circuit breakers, and incoming line compartments, refer to Mains and Incoming Lines Dimension Reference, publication <u>2100-TD018</u>.

Top Entry Conduit



ATTENTION: For ArcShield[™] units with 100 ms arc duration rating and device limited with bus ratings of 1600 A and above, conduit, cable, and wiring must be installed in such a way so that it does not interfere with the opening of the top plate vent (no cable or conduit in the top-rear of cabinet; cable trays must be a minimum of 12 in. (305 mm) above the top plate).

If your conduit is entering from the top, follow this procedure.

1. After the MCC is in place, leveled, and the sections are joined and spliced, bring conduit into the top of the incoming section.

For approximate top entry locations and wiring schemes for main fusible disconnects, main circuit breakers, and incoming line compartments, see Mains and Incoming Lines Dimension Reference, publication 2000 TP010

- publication <u>2100-TD018</u>.
- 2. Remove the lifting angle and top plate.
- 3. Modify the top plate for necessary conduit entries.

This method helps guard against metal chips falling into the MCC, which can cause serious damage to the components.

- 4. Replace the top plate and lifting angle bolts to guard against dust or dirt from entering the top horizontal wireway.
- Make sure that all incoming conduit is clear of the horizontal ground bus.
 For approximate location of the horizontal ground bus mounted in the top horizontal wireway, see Mains and Incoming Lines Dimension Reference, publication <u>2100-TD018</u>.

For space availability for incoming cables, refer to the elevation drawings shipped with assembled MCCs.

Install Cable

Install the cable when the temperature is above freezing 0 °C (32 °F), unless the cable is suitable for installation at temperatures below freezing. This helps prevent cable insulation from cracking or splitting.

MCCs are rated for use with 75 °C (167 °F) cable. Cable must be sized by using a 75 °C (167 °F) column in NEC Table 310.15 (B) (16) (NFPA 70-2017). The temperature rating of the lugs is not relevant.



ATTENTION: Properly connect all line and load cables to avoid a bolted fault and equipment damage.

Lugs

To install the lugs, follow this procedure.

1. Verify the compatibility of wire size, type, and stranding versus the power lugs furnished.

Use correct lugs in all applications.

- 2. Crimp compression lugs with manufacturer recommended tools.
- 3. Use the MCC electrical schematics to verify field wiring connection points.

Incoming Line Compartment

Top or bottom entry to the incoming line-section bus is straight through to the connection terminals. The vertical bus provides pads for the incoming lugs. Base the lug selection on the size, number, and type of conductor.

- Use of mechanical screw-type lugs is acceptable only when the incoming lines' available short-circuit current is 42,000 A rms symmetrical or less.
- Use of crimp or compression type lugs is acceptable when the incoming lines' available short-circuit current does not exceed 100,000 A rms symmetrical.

Main Disconnect

Top entry is straight through to the line side of the main fusible disconnect or main circuit breaker. For bottom entry, the connection scheme varies depending on the rating of the main device. In some cases, the bottom entry connects to the top or line side of the main fusible disconnect or main circuit breaker. In other cases the connection is reverse-fed, the bottom entry cables connect to the bottom of the main fusible disconnect or main circuit breaker. For further information see Mains and Incoming Lines Dimension Reference, publication <u>2100-TD018</u>.

Mechanical screw-type lugs are supplied as standard with all main fusible disconnects or main circuit breakers. Crimp or compression lugs are optional.

Cable Bracing

The CENTERLINE MCC bus work system has been tested and is qualified to withstand maximum short-circuit forces exceeding the short-circuit withstand ratings for the MCC. Incoming line cables and outgoing feeder cables also must be supported to withstand the same short-circuit forces. Follow NEC and local codes when bracing incoming and outgoing cables. There are

many sizes and types of cables, and different means that the cables can be supported. Acceptable methods are shown on the following pages.

Securing Cables with Glass Tape

In this example, glass fiber-reinforced tape or glass filament tape is used. Make sure that the taping is continuous from the point the cables enter the MCC to the point the cables are terminated. It is important that cables are wrapped several times for additional strength. Draw up the cable slack during wrapping so that individual cables are supported by the tape as one mass.

Figure 26 - Securing Cables with Glass Tape



Securing Cables with Nylon Rope

In this example, cables are lashed in a 'figure 8'-type configuration by using nylon rope. Make sure that the rope lashing is continuous from the point the cables enter the MCC to the point the cables are terminated. Other types of rope lashing can be acceptable. Draw up cable slack during wrapping so that individual cables are supported by the rope as one mass.

Figure 27 - Securing Cables with Nylon Rope



Securing Cables with Hardwood

In this example, a hardwood brace (maple hardwood) made for the specific application is used. Holes are bored approximately the size of the cable diameter. Several bolt holes are also bored the breadth of the hardwood brace. The brace is cut in two pieces and is used as a clamp to secure the cables. Through bolts are inserted into the brace and tightened so that cables are held tightly in place.

Figure 28 - Securing Cables with Hardwood



A second form of hardwood brace (not shown) is a yolk type, in which the cables are passed through. Make sure that the holes are small enough to provide a snug fit for the cables. The connectors or lugs are attached to the cables and cables are bolted to the terminals.

When using the hardwood bracing method and the short circuit current is less than 42,000 A, brace the cables every 12 in. (305 mm). When the short circuit current is 42,000 A or greater, brace the cables every 6 in. (153 mm).

Incoming Line Brace

Allen-Bradley manufactures an incoming line brace similar to the hardwood clamping-type brace. To order an incoming line brace, contact your local Allen-Bradley distributor or Rockwell Automation sales representative and reference Assembly Number 40113–848.

IMPORTANT Install lugs so they are in line with each other and proper spacing is used between phases. Hardware must be torqued per the torque tables that are found on the enclosure door.

Install and Remove Plug-in Units

ATTENTION: When installing or removing MCC units, when possible, deenergize, lockout, and tag-out all sources of power to the MCC. If the MCC units are installed or removed with power that is applied to the main power bus, follow established electrical safety work practices. See the NFPA 70E Standard for Electrical Safety in the Workplace publication. ATTENTION: Review your company safety lockout and tag-out procedure. De-energize all units before installing or removing. ATTENTION: All covers and doors must be in place before applying power to the MCC. If units are removed, they must be replaced with the appropriate items such as units, doors, and unit support pans. ATTENTION: When installing units for CENTERLINE® 2100 Motor Control Centers with the ArcShield[™] rating, you must make sure you are installing a unit that has the same arc resistance rating as the MCC in which it is being installed. The arc resistance rating can be found on the ArcShield[™] label on the vertical wireway door. Units that are not rated for 100 ms duration rated or device limited 1600 A bus and above must not be installed in a section that is rated for 100 ms duration rated or device limited 1600 A bus and above. If the incorrect unit/door is installed, the arc-resistant rating does not apply. For device limited 1600 A and above, all blank doors require isolation plates to be installed. Failure to do so voids arc resistant rating.



Install Plug-in Units

For unit installation, refer to CENTERLINE 2100 Motor Control Centers (MCC) Doors and Units with Vertical Operating Handles Installation Instructions, publication <u>2100-IN014</u>, and

CENTERLINE 2100 Motor Control Center (MCC) Doors and Units with Horizontal Operating Handles Installation Instructions, publication <u>2100-IN060</u>.

Remove a SecureConnect Unit from a Section

To remove a SecureConnect[™] unit from a section, follow these steps.

- 1. Make sure that the disconnect handle is in the OFF/O position.
- 2. Slide the shaft port cover open.
- 3. Insert the 1/4 in. hex tool into the shaft port.
- Rotate the wrench counter-clockwise to retract the power stabs. The indicator next to the disconnect handle changes from red to green.



5. Pull out the power stabs lockout lever.

You can attach a lock to the lever to help prevent the lever from being pushed in and the power stabs being extended.



6. Remove the cover from the status port.

7. Use a multi-meter to verify that the stabs are disconnected and the stab shutter is closed by using the status port.



- a. Verify that the stabs are retracted by checking the continuity in pins 1 and 2.
 When the stabs are retracted, they complete the circuit verifying that all three stabs have retracted completely.
- b. Verify that the stab housing shutters are closed by checking continuity in pins 3 and 4 of the status port.

A limit switch provides feedback to indicate that the stab housing shutters are closed.

8. Continue following the steps with <u>Remove a Plug-in Unit with a Vertical Operating</u> <u>Handle from a Section</u>.

Remove a Plug-in Unit with a Vertical Operating Handle from a Section

To remove a unit, follow this procedure.

1. Make sure that the disconnect handle is in the OFF/O position.



 For non-arc resistant units, turn the door latches 1/4 turn; for units that are equipped with arc-resistant door latches, push in the latch and rotate 1/4 turn.



3. Open the door completely.



4. Remove the unit door, if necessary.



It is not necessary to remove the unit door to remove a unit from a section. However, these steps can still be necessary even when the door is not removed.

- a. Remove the door-mounted devices and wiring, if necessary.
- b. Remove the hinge pins by sliding upward with a screwdriver.

For Units With	Follow This Step	
A control station	First slide the hinge pin out of the hinge and through the tab on the control station wiring.	
ArcShield units with 100 ms arc duration rated and device limited with bus ratings of 1600 A and above.	Two hinges are required for each hinge leaf.1. The upper hinge on each door must be removed from the structure to remove the uppermost hinge pin.2. Remove the hinge pin through the lower hinge, then through the hinge leaf and upper hinge.	

Hinge for ArcShield units with IUU ms arc duration rated and device limited with bus ratings of I6UU A and above.



The control station can be hung on the front of the unit by using square holes that are adjacent to the top unit latch.

- c. Swing the door to near closed position.
- d. Lift the door outward to remove.



5. Disengage the captive latches at the front of the unit, one at the top and one at the bottom of the unit.

Units that are 2.0 space factor and larger have two latches at the top. All units with 100 ms arc duration rating or device limited with bus ratings 1600 A and above have two latches at the top.



- 6. Detach the front portion of the pull-apart terminal blocks from the unit base and place the wires and terminal blocks in line with the wiring clearance tunnel.
- 7. Remove other cables or devices that can help prevent the unit from being withdrawn.



It is not necessary to place wires and terminal blocks into the vertical wireway to remove a plug-in unit that includes the wiring clearance tunnel.



8. Pull the unit forward (outward) approximately 3 in. (7.5 cm) out of the MCC by using the handle that is provided at the lower left of the unit and the tab in the upper right of the unit as finger holds.

Reposition your hands, as necessary, to properly support the unit while you are removing the unit from the MCC.



ATTENTION: Plug-in MCC units can be heavy or awkward to handle. Use an assistant or a platform lift device, if necessary, to help you handle the unit.

For the CENTERLINE 2100 MCC units with arc-resistant door latches, you can tilt the top of the unit slightly to the rear to avoid interference with the top arc latch bracket before removing the unit. If you do not have enough clearance, you must loosen the latch bracket screw (approximately two turns) to remove the unit.





For dual-mounted, fusible-feeder disconnects switch units, you must remove the bottom arc latch bracket. You can do this by first removing the unit below the dual disconnect unit. 9. Remove the unit from the MCC.

Vertical sections are supplied with either plug-in stab opening protective caps, manual shutters, or automatic shutters.

10. Carefully install protective caps or close manual shutters after the unit is removed.

Automatic shutters close as units are removed.

ATTENTION: All covers and doors must be in place before applying power to the MCC. If units are removed, they must be replaced with the appropriate items such as units, doors, and unit support pans. When installing units for CENTERLINE 2100 Motor Control Centers with the ArcShield rating, you must make sure you are installing a unit that has the same arc resistance rating as the MCC in which it is being installed. The arc resistance rating can be found on the ArcShield label on the vertical wireway door.

Units that are not rated for 100 ms duration rated or device limited 1600 A bus and above must not be installed in a section that is rated for 100 ms duration rated or device limited 1600 A bus and above. If the incorrect unit/door is installed, the arc-resistant rating does not apply. For device limited 1600 A and above, all blank doors require isolation plates to be installed. Failure to do so voids arc resistant rating.



Remove a Plug-in Unit with a Horizontal Operating Handle from a Section

To remove a unit, follow this procedure.

1. Make sure that the disconnect handle is in the OFF/O position.



2. For non-arc resistant units, turn the door latch 1/4 turn; for units that are equipped with arc-resistant door latches, push in the latch and rotate 1/4 turn.



- 3. Open the door completely.
- 4. Remove the unit door, if necessary.

It is not necessary to remove the unit door to remove a unit from a section. However, these steps can still be necessary even when the door is not removed.

- a. Remove the door-mounted devices and wiring, if necessary.
- b. Remove the hinge pins by sliding upward with a screwdriver.

For Units With	Follow This Step	
A control station	First slide the hinge pin out of the hinge and through the tab on the control station wiring.	
ArcShield units with 100 ms arc duration rating	Two hinges are required for each hinge leaf.1. The upper hinge on each door must be removed from the structure to remove the uppermost hinge pin.2. Remove the hinge pin through the lower hinge, then through the hinge leaf and upper hinge.	

Hinge for ArcShield Units with 100 ms duration rating and device limited with bus ratings of 1600 A and above



- c. Swing the door to near closed position.
- d. Lift the door outward to remove.





- 5. Detach the wiring/terminal block from the unit.
- 6. Place the wiring/terminal block in the vertical wireway to the right of unit.



- 7. Push the latch mechanism to the left with your right hand.
- 8. Pull the unit forward (outward) approximately 3 in. (7.62 cm) out of the MCC.
 - You can reposition your hands, as necessary, to properly support the unit while you are removing the unit from the MCC.



For the CENTERLINE 2100 MCC units with swing-out door latches, you must rotate the latch bracket 90° clockwise to avoid interference with the unit.



ATTENTION: Plug-in MCC units can be heavy or awkward to handle. Use an assistant or a platform lift device if necessary to help you handle the unit.

9. Remove the unit from the MCC.

Vertical sections are supplied with either plug-in stab opening protective caps, manual shutters, or automatic shutters.

10. Carefully install protective caps or close the manual shutters after unit is removed. Automatic shutters close as units are removed.



ATTENTION: All covers and doors must be in place before applying power to the MCC. If units are removed, they must be replaced with the appropriate items such as units, doors, and unit support pans.

11. See the next section for additional information.



ATTENTION: All covers and doors must be in place before applying power to the MCC. If units are removed, they must be replaced with the appropriate items such as units, doors, and unit support pans. When installing units for CENTERLINE 2100 Motor Control Centers with the ArcShield rating, you must make sure you are installing a unit that has the same arc resistance rating as the MCC in which it is being installed. The arc resistance rating can be found on the ArcShield label on the vertical wireway door.

Units that are not rated for 100 ms duration rated or device limited 1600A bus and above must not be installed in a section that is rated for 100ms duration rated or device limited 1600 A bus and above. If the incorrect unit/door is installed, the arc-resistant rating does not apply.

For device limited 1600 A and above, all blank doors require isolation plates to be installed. Failure to do so voids arc resistant rating.



Remove the Support Pan

To remove the support pan, perform the following steps.

1. For ArcShield sections with 100 ms duration rated and device limited with bus ratings of 1600 A and above, remove the vertical wireway baffle and set aside for installation later.



2. Pry the plastic retaining clip from the right-hand unit support by using a screwdriver. This is visible in the vertical wireway.



For CENTERLINE MCC units with arc-resistant latches, the unit support pan is secured to the right-hand unit support by the screw that retains the arc latch bracket. To remove the unit support pan, you must remove the arc latch bracket.



For CENTERLINE MCC units with the 100 ms arc duration rated and device limited with bus ratings or 1600 A and above, there is an additional screw that secures the unit support pan. This screw is at the left-rear corner of the unit support pan.



3. Lift the right side of the support pan approximately 4 in. (102 mm).



- 4. Pull the right side of the support pan forward to release from the left rear slot on the structure.
- 5. Push back on the left side of the support pan until the support pan is free from the structure.



ATTENTION: All covers and doors must be in place before applying power to the MCC. If units are removed, they must be replaced with the appropriate items such as units, doors, and unit support pans.

Install Fixed-mount 24V DC Two-branch Redundant Power Unit

For IntelliCENTER[®] EtherNet/IP^m MCCs with 24V DC redundancy, one option is to include the 24V DC two-branch redundant unit. To install or remove the 24V DC two-branch redundant unit, follow these steps.

 To install the unit support pan, follow the instructions in the CENTERLINE 2100 Motor Control Centers (MCC) Units with Vertical Operating Handles Installation Instructions, publication <u>2100-IN014</u> The redundant power unit requires 0.5 space factor and three bolt locations, as shown.



- 2. Place the unit into the open space and secure the unit on the right side with two 10-32 self-tapping screws and tighten to 32 lb•in (3.6 N•m) by using a 5/16 in. socket wrench.
- 3. Secure the unit on the left side with one 1/4-20 self-tapping screw and tighten to 55 lb•in (6.2 N•m) by using a 3/8 in. socket wrench.



To enable redundant operation, we recommend that you use the existing Ethernet power-supply unit within the MCC as one input to the redundant unit, and then bring in a second input from a source external to the MCC.

Use these guidelines to help size the power supply external to the MCC.

- UL Listed
- Voltage: 24V nominal with -5% /15% (22.8...27.6 V) voltage tolerance over load
- Current: 8 A min to 20 A max rated output
- Load Regulation: 100 mV maximum over 0...8 A
- Load Ripple: 50 mVpp maximum



A separate two-branch redundant unit is required for each 24V, 8 A circuit in the MCC.

The existing power supply is pre-wired at the factory to terminal blocks in the horizontal wireway.

4. Move this 24V DC wire connection from the terminal block within the power supply unit to the output terminal block of the two-branch redundant unit.



Terminals PS+ and PS- are for the left 4 A branch, and RS+ and RS- are for the right 4 A branch.

On the incoming side, for redundant operation, independent power supplies are required.

- 5. Wire the existing Ethernet power supply unit output to the '1' terminals, left and right branches.
- 6. Wire the other unique power supply to the '2' terminals, left and right branches.



7. Repeat this process for each existing power supply unit and two-branch, 8 A circuit within the 24V DC infrastructure.



8. To validate proper wiring of the two-branch redundant unit, power up both 24V DC power supplies.

At this point, all V-in and V-out status lights on each 1606-XL module illuminate. If you shut off one of the power supply units, the V-in lights on the 1606-XL module that connects to that power source turn off, which indicates input power was lost. However, the V-out light on that same 1606-XL module remains on, which indicates the second

power supply is still providing 24V DC power. Therefore, the devices on that circuit remain on.

This process can be repeated by alternating the power supplies that were left on or turned off.

IMPORTANT	If the loss of one power supply causes branch power loss in the MCC 8 A circuit, correct the wiring of the two-branch redundant unit.
	unit.

Notes:

Arc Flash Protection Marking as Required by	the
National Electrical Code	

The flash protection marking requirement was initially established in 2000 by The National Fire Protection Association (NFPA 70E), Standard for Electrical Safety Requirements for Employee Workplaces. NFPA 70E applies to workers who install, maintain, or repair electrical systems.

The flash protection marking per NEC Article 110.16 is a field marking requirement and is to be applied by the MCC end user for each specific application. The marking is similar to other NEC marking requirements, for example, voltage, voltage hazard labels, and circuits. However, flash protection markings must be based on application information and calculations from the installation site. The intent of the marking is to identify the presence of a potential flash hazard and to provide assistance in determining necessary protective clothing and personal protective equipment (PPE) that is worn by qualified electrical persons when servicing electrical equipment. You must establish field marking requirements based on the following:

- The level of the on-site personnel safety training
- The level of required clothing and required PPE
- Consistency for the level of marking of various equipment, for example, switchboards, panel boards, industrial control panels, and MCCs
- The available flash energy on each piece of equipment.

This energy is determined from available fault current, arc flash duration due to the type, and degree of short circuit protection equipment.

Flash Prote	ection	Marking		
Requirement				

Arc Flash Marking Clarification

Notes:

Operator Handle and Unit Interlock

The operator handle is a part of each MCC unit. Adjustment of the handle is not required. The operator handle is interlocked with each unit door as outlined by UL 845.

Defeat the Unit Door Interlock

See the following information to defeat the unit door lock.

Open the Door When the Operating Handle Is in the ON/I Position



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace.

When the unit door is closed and the operator handle is in the ON/I position, a defeater screw must be deliberately operated to open the unit door (for example, opening the door of an energized unit).

The defeater screw is just below (on units with a vertically mounted operator handle) or just to the right (on units with a horizontally mounted operator handle) of the pivot point of the operator handle. To operate the defeater mechanism and defeat the door interlock while the operator handle is in the

ON/I position, use a screwdriver to turn the defeater screw clockwise one-eighth to onequarter turn.



ATTENTION: Opening the door reduces arc flash safety.



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. Personal protective equipment (PPE) is not shown for clarity.

Figure 29 - Operating Handle Defeater for Vertical Operator Handle



Figure 30 - Operating Handle Defeater for Horizontal Operator Handle



Defeat the Unit Interlock Lever

See the following information to defeat the unit interlock lever.

Energize a Unit with the Unit Door Open



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. Personal protective equipment (PPE) is not shown for clarity.

When the unit door is open and the operator handle is in the OFF/O position, the defeater lever must be deliberately lifted on the vertical handles or pushed to the left for horizontal handles, to move the operator handle to the ON/I position, and energize the unit.

Figure 31 - Defeater Lever for Vertical Operator Handle





ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. Personal protective equipment (PPE) is not shown for clarity.

Figure 32 - Defeater Lever for Horizontal Operating Handle



Locking Provisions

See the following sections for locking provisions.

Lock Vertical Operating Handles in the OFF/O Position



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace.

To lock the small, medium, and large operator handle in the OFF/O position, put the shackle of the lock through the opening in the operator handle assembly. The opening can accommodate up to three padlocks.

Figure 33 - Locking Vertical Handles in OFF/O Position



Lock Horizontal Operating Handles in the OFF/O Position

Some units use a horizontal operating handle. The horizontal operating handle can be locked in the OFF/O position by putting the shackle of the lock through the open slotted area to the left of the operator handle.

Figure 34 - Locking a Horizontally Mounted Operating Handle in OFF/O Position



Lock Units with Operating Handles in the ON/I Position



ATTENTION: Locking an operating handle in the ON/I position can be in conflict with local codes and emergency shutdown requirements.

Follow this procedure to lock the operator handle in the ON/I position.

- 1. Drill out the hole to 3/8 in. (9.5 mm) diameter maximum.
- 2. Insert the shackle of the lock.

The following instructions assume that the handle is in the ON/I position:

- For units with small handles, the hole is in the upper portion of the operator handle assembly.
- For units with medium and large operator handles, the hole is underneath the operator handle on the handle assembly.
- For units with a horizontally mounted handle, the hole is on the left-hand side of the handle assembly.

Figure 35 - Locking Small Handle in ON/I POSITION, Vertical Operating Handle



Figure 36 - Locking the Medium Handle in ON/I Position



Figure 37 - Locking Large Handle in ON/I Position





Drill Out

Unit Interlocks

A unit interlock is provided with each plug-in unit. Unit interlocks help prevent units from being removed from or inserted into a vertical section when the operator handle is in the ON/I position.

Units can also be locked out with a padlock to help prevent unit installation into a vertical section. The lockout feature of the unit interlock uses a padlock to keep the interlock in an extended position, which helps prevent the unit from being inserted into an MCC section, see <u>Figure 40</u> and <u>Figure 42</u>. The unit interlock can also be used when the unit is installed in the section but partially removed; see <u>Figure 39</u> and <u>Figure 41</u>.

In this position, the unit is partially removed from the MCC and the slot in the interlock plate is in line with the flange of the unit support pan above this unit. When the unit is locked in this position, the unit power and ground stabs are disengaged. This position can be used to help prevent insertion of a unit into the MCC.



Figure 39 - Unit Interlock to Help Prevent Insertion - Vertical Operating Handler



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. When possible, perform maintenance on MCC units in a suitable work area away from the MCC.

Figure 40 - Unit Interlock to Help Prevent Insertion - Unit Completely Withdrawn



In this position, the unit is partially removed from the MCC and the intermediate slot in the interlock plate is in line with the bushing in the unit support pan. When the unit is locked in this position, the unit power and ground stabs are disengaged. This position can be used to help prevent insertion of a unit into the MCC.

Figure 41 - Unit Interlock to Help Prevent Insertion - Horizontal Operating Handle





ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. When possible, perform maintenance on MCC units in a suitable work area away from the MCC.



Figure 42 - Unit Interlock to Prevent Insertion - Unit Completely Withdrawn

Notes:

Final Checklist Before Energizing

Introduction

This section provides guidance for the startup of a newly installed MCC.

We recommend making an itemized list including the following:

- Serial number
- Number of sections
- Number of units and their corresponding voltage
- Current ratings
- Horsepower ratings
- Types of circuits
- Fuse sizes
- Circuit breaker ratings and trip settings
- Heater elements requirements
- Arc-resistant components
- Other important data

The itemized list could be modeled after the MCC layout drawings supplied with each MCC. Save this itemized list in a file along with other data for the MCC such as, component manuals, heater element instructions, MCC manuals, and wiring diagrams. Blank sample forms are provided at the end of this chapter.

Pre-energizing Check Procedure

Allow only a 'qualified person' to conduct the pre-energizing check. A qualified person is defined by NEMA Standards Publication / No. ICS 2.3, Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers, Section 1 as follows:

1.4 Qualified Person

For this guide, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, that person has the following qualifications:

- <u>1.4.1</u> Is trained and authorized to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
- <u>1.4.2</u> Is trained in the proper care and usage of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.

Perform the Pre-energizing Check Procedure



ATTENTION: To confirm the safety of personnel performing the preenergizing check, make sure that the MCC remote power sources are disconnected and locked in the OFF/O position. Use a voltmeter to verify that the MCC remote power sources are disconnected.



ATTENTION: Power factor correction capacitors (PFCCs) must be applied correctly. For application instructions refer to Power Factor Correction Capacitors for Bulletin 2100 MCC Starter Units Application Techniques, publication <u>2100-AT001</u>. When PFCCs are connected to the motor circuit and the start-up procedure requires the respective motors to be jogged, inched, or bumped (rotation direction check), temporarily disconnect PFCCs. For more information contact, Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.



ATTENTION: Verify that motor acceleration times are within specific application specifications.

Excessive starting currents and/or acceleration times can cause inverse time circuit breakers, power fuses, overload relays, and other components to overheat and/or shut down equipment.

- 1. Remove all blocks or temporary holding means used for shipping all component devices in the MCC.
- 2. Inspect the enclosure and units for damage.
 - a. If structural damage is present, contact MCC technical support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.
 - b. If no structural damage is visible, verify the electrical spacings.
 - For the required minimum electrical spacings, see the tables starting on page 77.
- 3. Check and verify that the MCC is properly installed, as described in <u>Chapter 2</u>, and inspect and verify that it is level, supported, and anchored.
- 4. For MCCs with the 100 ms arc-resistant rating, check that clearance height is at least 12 in. (305 mm).
- 5. Check the integrity of the bus splice connections.

Recommended torque values can be found on the information label on the interior of the vertical wireway door or on the interior right-hand side plate of frame-mounted units. See Joining and Splicing Vertical Sections, publication <u>2100-IN010</u>, for splicing information.

The factory-made power bus connections are tightened by a computer-controlled torquing system. The following connections do not require retorquing:

- · Vertical to horizontal bus connections.
- Power conductor to horizontal bus connections.

Factory-made horizontal to vertical bus connections do not require servicing for the life of the MCC.

6. Check and verify that all ground connections are made properly, based on local standards.

If ground bus is not provided or has been removed, check that the MCC sections are connected to provide a continuous ground path. Verify that 100 ms units are connected to the vertical equipment load ground bus.

- 7. Check the field wiring.
 - a. Check the field wiring for proper conductor sizing.

Use the National Electrical Code (NEC) 75 $^{\circ}\text{C}$ (167 $^{\circ}\text{F}$) wire tables to size the MCC field conductors.

b. Check that all barriers and parts that have been removed during installation have been reinstalled.

Some barriers can be required to be removed for field wiring.



We recommend that a barrier checklist is developed including such items as, unit location, and barrier location. Save this checklist for future reference.

- c. Check that all incoming and outgoing power wiring is secure and braced to withstand the effects of a fault current as detailed in <u>Chapter 3</u>.
- d. Check that conduit and cabling are well supported.

For incoming line compartments, 2.0 space factors, 26 in. (660.4 mm) or less, firmly secure the incoming cables halfway between the top of the section and the incoming line compartment terminals. In a full section (6.0 space factor) incoming line compartments, brace the cables every 12 in. (305 mm); if the system's available short circuit current is above 42,000 A but less than 65,000 A rms symmetrical. Above 65,000 A rms symmetrical available current bracing occurs every 6.5 in. (165 mm). This bracing is in accordance with the Underwriters Laboratories (UL) listing and is necessary to withstand forces resulting from high fault currents. For information on cable bracing methods, see <u>Chapter 3</u> of this publication.

e. Check the integrity of all field connections.

Recommended torque values that are not found on individual devices can be found on the unit wiring diagrams.

- f. Check field wired connections that are made to the MCC for agreement with wiring diagrams and verify that proper spacings between adjacent phases and/or phases to ground are being used. See page <u>77</u> for the minimum electrical spacing requirements.
- 8. Check that the voltage and horsepower ratings on the motor correspond with the MCC unit ratings.
- 9. Check that the overload relays or heater elements are selected, installed and/or adjusted to relative full-load current shown on the motor rating nameplate.
- 10. For applications requiring power fuses, install the fuses in the fusible switches in accordance with the NEC application requirements.

See CENTERLINE® Motor Control Centers Power Fuses Product Data, publication <u>2100-</u> <u>TD003</u> for fuse information. **Do not apply grease or NO-OX-ID to fuse ferrules.** All fuses must be completely inserted in the fuse clips. Recommended torque values for fuse clamp screws can be found on the unit wiring diagram. Verify that all fuses fit each application.

11. For circuit breaker applications, verify that the circuit breakers are in accordance with NEC application requirements, and have correct ampacity and trip settings.

For circuit breaker information in MCC units, see CENTERLINE 2100 Motor Circuit Protection Technical Data, publication <u>2100-TD032</u>.

IMPORTANT High efficiency motors can have higher locked rotor and inrush currents. Therefore, higher magnetic trip settings, than those required for equivalent standard motors, can be required.

12. See the device instruction sheets or manuals that are supplied with the MCC for specific start-up guidance. Component devices in MCC units such as transfer switches, PFCCs, transducers, motor protectors, line monitors, over and undervoltage relays, and motor windings heaters can require unique start-up procedures. Set and verify adjustable current, voltage, and other settings, according to device instructions or wiring diagrams.

Allen-Bradley AC drives and soft starter units are shipped with preset factory settings such as ramp speed, current limits, switch positions, and readouts. Preset factory settings are not suitable for many applications. See instruction manuals that are supplied with the MCC for specific startup guidance.



ATTENTION: Verify that the parameters of configurable devices, such as drives, soft starters, and overload relays, are suitable for the specific application and change them as needed for the specific application.

- Manually exercise all switches, control auxiliary switches, circuit breakers, their respective operators, unit interlocks, trip mechanisms (test by pushing the 'Push to Trip' button), and any other operating mechanisms to verify proper operation.
- 14. Check timing relay settings as required.
- 15. Check the vents and fans.
 - a. Check all vents to confirm they are free from obstructions.
 - b. Check all fans that are used for forced air cooling to confirm that the shaft rotates without obstructions.
 - Check that filters are in place and clean, and create an in-house program for scheduled cleaning or replacement.

If you have an MCC with arc-resistant design features, if a unit has been provided with arc-resistant baffles over door vents and fans, these baffles must be fastened securely in place to maintain the arc-resistant capabilities of the MCC. Do not install any type of filter to replace or add to the arc-resistant baffles.



ATTENTION: Current transformer secondaries are to be 'closed'. To avoid possible injury and electrical shock to personnel, do not energize a current transformer with its secondary open.

- 16. Check all current transformers for proper polarity and confirm that their secondaries are not 'open', but are either connected to their respective devices or 'shorted.'
- 17. Recheck that all barriers and parts that have been removed during installation have been reinstalled.

See your barrier checklist, see step 7.

 Before closing the enclosure and/or individual units, remove all tools, metal chips, scrap wire and other debris from the MCC interior.

If there is an accumulation of dust or dirt, clean out the MCC by using a brush, vacuum cleaner, or clean, lint-free rag. **Do not use compressed air; it redistributes contaminates on other surfaces.**



ATTENTION: When conducting an electrical insulation resistance test, isolate equipment sensitive to high test voltages, such as meters, solid-state devices, motor winding heaters, and capacitor units.
- 19. Conduct an electrical insulation resistance test to verify the MCC wiring integrity.
 - a. Conduct this test by using an insulation resistance tester with a potential of 500...1000V. Conduct this insulation resistance test phase-to-phase, phase-to-ground, and when applicable, phase-to-neutral on the MCC bus work. Conduct the test with all switches or circuit breakers in the open or OFF/O positions. Typical insulation resistance values are 50 MΩ or greater.
 - b. Next, check the field wiring; for example, motor cables and incoming line cables. Insulation resistance values are affected by temperature, humidity, or dampness, which can cause a considerably lower insulation resistance reading. If the insulation resistance values are below $1 M\Omega$ (for example, affected by dampness, temperature, or humidity) or the MCC has been stored in a damp or humid area, we recommend that the equipment be dried out. Dry out the motor cables by injecting a low voltage current or by using space heaters.
 - c. Once the equipment is dry, repeat the insulation resistance test. The minimum value for insulation resistance on a new installation at startup or energizing is 1 MΩ. Record these readings in <u>Table 9 on page 78</u>. Use this table to record additional insulation resistance reading during regular maintenance periods.
- 20. Check that all arc-resistant parts are installed.

See Figure 48 on page 76 for more information.

21. Ensure all units are fully installed in the MCC and that the unit latches are secure.Refer to <u>2100-IN014</u> and <u>2100-IN060</u> for more details.

See <u>Door Latch Position Diagrams</u> on this page for more information.

- 22. Check that all section closing plates are in place.
- Check that any SecureConnect[™] units are properly installed.
 See <u>SecureConnect Unit Checklist on page 77</u> for more information.
- 24. Close and latch all doors, and verify that no wires are pinched.

Certain applications can have latch requirements different from what was provided. If you have questions regarding proper latching, contact Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to Allen-Bradley > Low Voltage Motor Control Centers > Post Shipment Support.

See the following illustrations for various latch placements.

Door Latch Position Diagrams



Figure 43 - 0.5 Space Factor and Units with Horizontal Disconnect Handles



Standard Latches Arc-resistant Latches For most units, the center latch is a standard quarter-turn latch. For some units, a multi-turn latch is used.

Torque the latch to 20 lb•in +/- 2 lb•in.

Figure 45 - 6 Space Factor (full section) Units



When properly latched, the slots on all arc-resistant latches are vertical and the latch springs are compressed. The spacing of the spring coils is decreased.

Figure 46 - Spring Compression



ArcShield Components Checklist

ATTENTION: Arc-resistant CENTERLINE 2100 MCCs are provided with certain components to achieve the arc-resistant rating. These components must be in place before using the MCC to maintain the arc-resistant capabilities.



Not all components and features necessary for the arc-resistant rating are shown in these images.

Figure 47 - Arc-resistant MCC with Insulating Sheet (15 in. deep, right side visible)

Compressed Spring



Rockwell Automation Publication 2100-IN012M-EN-P - April 2024



SecureConnect Unit **Checklist**

Verify these items before using a SecureConnect[™] unit.

- Make sure that the stab lockout is pushed in. 1.
- 2. Verify that the disconnect handle is OFF/0.
- 3. Insert the tool in the shaft port and rotate the tool to the right. The status indicator changes from green to red.





ATTENTION: SecureConnect units are shipped inside the unit location with stabs in the disconnected position. Before powering your horizontal bus, you must place all SecureConnect units in the connected position.

Required Minimum Electrical Spacing

Table 7 - Electrical Spacing Requirements for MCCs⁽¹⁾

	Min Spacing, in. (mm)						
Voltage	Between Live Parts o	Between Live Parts and					
	Through Air	Over Surface	Through Air and Over Surface				
0150	0.5 in. (12.7 mm)	0.75 in. (19.1 mm)	0.5 in. (12.7 mm)				
151300	0.75 in. (19.1 mm)	1.25 in. (31.8 mm)	0.5 in. (12.7 mm)				
301600	1.0 in. (25.4 mm)	2.0 in. (50.8 mm)	1.0 in. (25.4 mm) ⁽²⁾				
6011000 ⁽³⁾	1.5 in. (38 mm)	2.5 in. (63 mm)	(4)				

An isolated dead metal part, such as a screw head or a washer, interposed between uninsulated parts of opposite polarity or between an uninsulated live part and grounded dead metal, is considered to reduce the spacing by an amount equal to the dimension of the interposed part along the path of measurement.
 A through-air spacing of not less than 0.5 in. (12.7 mm) is acceptable.

at a circuit breaker or fusible disconnecting means

between grounded dead metal and the neutral of a 3-phase, 4-wire motor control center

Applies only to rectified output >600V DC.

(3) (4) Through-air spacing required is 1.5 in. (38 mm); over-surface spacing required is 2.0 in. (50 mm). MCC Name / Number _

Table 8 - Spacing Requirements within n	111	UNITS
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	Min Spacing, in. (mm)						
Voltage	Between Uninsulated L Polarity and Between Part and an Exposed Metal Part other th	ive Parts of Opposite an Uninsulated Live or Uninsulated Dead nan the Enclosure	Between Uninsulated Live Parts and the Walls of a Metal Enclosure ⁽¹⁾ , Including Fittings for Conduit or Armored Cable				
	Through Air	Over Surface	Shortest Distance				
0150	0.125 in. (3.2 mm) ⁽²⁾	0.25 in. (6.4 mm)	0.5 in. (12.7 mm)				
151300	0.25 in. (6.4 mm)	0.375 in. (9.5 mm)	0.5 in. (12.7 mm)				
301600	0.375 in. (9.5 mm)	0.5 in. (12.7 mm)	0.5 in. (12.7 mm)				
6011000 ⁽³⁾	0.55 in. (14 mm)	0.85 in (21.6 mm)	(4)				

- The enclosure refers to the section enclosure. The spacing between wiring terminals of opposite polarity shall not be less than 0.25 in. (6.4 mm) if the terminals are in the same plane. A metal piece attached to the enclosure shall be considered to be a part of the enclosure for this note if deformation of the enclosure is likely to reduce the spacing between the metal piece and a live part. DC circuits derived from rectified AC circuits without increases to the peak nominal voltage can comply with the electrical spacings of the AC supply voltage. Through-air spacing required is 0.8 in. (20.3 mm); over-surface spacing required is 1.0 in. (25.4 mm). (1) (2)
- (3)
- (4)

Table 9 - Insulation Resistance Reading Recording

Data	Circuit / Unit Name / Number	Phase-to-phase		Phase-to-Ground			Phase-to-Neutral			
Date		A - B	B - C	C - A	A - Grd.	B - Grd.	C - Grd.	A - Neut.	B - Neut.	C - Neut.
									1	

Energize the Equipment





ATTENTION: Energizing an MCC for the first time is potentially dangerous. Serious damage and or personal injury can result when power is applied. Therefore, allow only qualified personnel to energize the equipment.



ATTENTION: When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace.

Energize the Equipment

To energize the equipment, follow these steps.

- 1. Review any additional instructions that are supplied for the proper operation of special units such as variable-frequency drives and soft starters with appropriate and qualified personnel.
- 2. Check that there is no load on the MCC when it is energized.
- 3. De-energize all main and unit disconnect devices.
- 4. Check to see if any associated remote devices are de-energized.
- 5. Energize the MCC remote power source.



ATTENTION: Operate the disconnect-device handles s with a firm, direct motion. Do not 'tease' the handles into the closed (ON/I) position.

6. Energize the main devices followed by the feeder devices and the branch circuit devices.

Always energize from the source of the system, working towards the loads.

- After all disconnects have been closed, energize loads such as, lighting circuits, motor starters, and contactors.
 - a. When power-factor correction capacitors are energized with the motor windings and the startup procedure requires that the respective motors be jogged or inched, temporarily disconnect the power factor correction capacitors.

For more information on power factor capacitors and MCC units, refer to the Power Factor Correction Capacitors for Bulletin 2100 Motor Control Center Starter Units Application Techniques, publication <u>2100-AT001</u>.

b. Verify that any acceleration times are within application specifications.

Excessive starting currents and acceleration times can cause inverse time circuit breakers, power fuses, overload relays, and other components to overheat and shut down the equipment.

Notes:

Maintenance

Establish a periodic maintenance program for MCCs to avoid unnecessary downtime. The frequency of service to the MCC depends on the equipment usage and the operating environment. The following is a suggested checklist and can be used to establish a maintenance program.



ATTENTION: De-energize the MCC before servicing.

Maintain the MCC

To maintain your MCC, follow these steps.

- 1. Inspect the MCCs once per year or per established maintenance program.
- 2. Carefully inspect doors and enclosure sides for evidence of excessive heat.
- 3. Check for moisture or any signs of dampness or drippings inside the MCC.

IMPORTANT Condensation in conduit or dripping from an outside source is a common cause of MCC failure. Eliminate any source of moisture.

- a. Seal off conduit, cracks, and openings that have let and/or could let moisture enter the MCC enclosure.
- b. Dry or replace and clean insulating material that is damp or wet or shows signs of moisture.
- c. Check devices such as contactors, circuit breakers, disconnect switches, relays, and push buttons for wetness or signs of moisture, corrosion, or contamination.
- d. Replace damaged or malfunctioning parts.
- 4. Check the integrity of bus splice connections.

Bus splices can be easily identified by the label on the interior of the vertical wireway door or on the interior right-hand side plate of frame-mounted units. Recommended torque values can be found on the information label on the interior of the vertical wireway door or on the interior right-hand side plate of frame-mounted units.

The factory-made power bus connections are tightened by a computer-controlled torquing system. The following connections do not require retorquing, vertical to horizontal bus connections and power conductor to horizontal bus connections. These factory-made connections do not require servicing for the life of the MCC.

- 5. Periodically clean or replace the air filters depending on the environmental conditions.
- 6. Check for the proper function and freedom of movement (no sticking or binding) for the disconnect handle operating and defeater mechanisms.
- 7. Replace broken, deformed, malfunctioning, or badly worn parts or assemblies.
- 8. Inspect unit bus-stab connections for wear or corrosion.

Wear and/or corrosion can increase resistance and cause an increased temperature of the contact point, leading to failure. Replace bus stabs if wear or corrosion is excessive. Lubricate bus stabs with NO-OX-ID grease (catalog number 2100H-N18 or 2100H-N18T) before installing the unit into the section.

IMPORTANT	 When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace. To help prevent injury or death to personnel lubricating disconnect switch contacts, make sure that the MCC power sources are disconnected and the respective disconnects are locked in the OFF/0 position. For plug-in units, remove the unit from the MCC.
	To help prevent personal injury or damage to equipment, make sure that the unit handle operator is in the OFF/O position before removing the unit.

- Inspect current carrying parts such as fuse clips, knife blades of disconnects, and line and load terminals of devices for discoloration, corrosion, or other signs of wear or possible failure.
- 10. Check locking or interlocking devices for proper working condition.
- 11. Adjust, repair, or replace any device if necessary.
- 12. Check power contacts for excessive wear and dirt accumulation and vacuum or wipe contacts with a soft cloth to remove dirt as needed.

Contacts are not harmed by discoloration and slight pitting. Never file contacts, which can reduce the life of the contacts. Do not use contact spray cleaners, as they cause sticking on magnetic pole faces or in operating mechanisms, interfering with the electrical continuity of the contacts. Replace contacts only after the silver has become badly worn. Always replace contacts in complete sets to avoid misalignment and uneven contact pressure.

13. Check for loose wire connections on power and control circuit terminals.

Loose connections can cause overheating, hot spots, or arcing faults that could lead to equipment malfunction or failure. Replace any damaged parts or wiring.

 Check contactor and relay coils for evidence of overheating, such as cracking, melting, or burning of insulation.

If there is evidence of overheating, the coil must be replaced. When replacing a coil, check and correct the overvoltage or undervoltage conditions that can cause the coil failure. Be sure to clean any residue of melted coil insulation from other parts of the device and replace as necessary.

- 15. Check all pilot lights and replace lamps and damaged lenses as necessary.
- 16. Check all fuses.

If replacing fuses, install the same type and rated fuse that was originally furnished with the MCC.

- Remove accumulated dust and dirt from structure and individual units by vacuuming. Do not use compressed air, as it can contain moisture and blow debris within the enclosure.
- See individual user policies, NFPA 70B, Recommended Practice for Electrical Equipment Maintenance for MCC Servicing Guidelines.

Disconnect Switch and Contact Lubrication



ATTENTION: Follow NFPA 70E safety guidelines when working on energized equipment.

To help prevent injury or death to personnel lubricating disconnect switch contacts, make sure that any MCC power sources are disconnected and the respective disconnects are locked in the OFF/O position. For plug-in units, remove the unit from the MCC.

To help prevent personal injury or damage to equipment, make sure that the unit handle operator is in the OFF/O position before removing the unit.

If a switch that is used frequently becomes difficult to operate or is in a highly corrosive or caustic environment, it can require lubrication. The lubricant to be used is NO-OX-ID

Compound (catalog number 2100H-N18 for a 1 pt can or catalog number 2100H-N18T for a 1 oz tube). To obtain the lubricant, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

1. Determine your unit type.

Plug-in Units

If a disconnect switch requires lubrication and is housed in a plug-in unit, remove the plug-in unit from the MCC (for unit removal, refer to <u>Chapter 4</u> before lubricating the switch).

Frame-mounted Units

If a disconnect switch requires lubrication and is housed in a frame-mounted unit, turn off the power sources to the MCC so the switch can be lubricated.



ATTENTION: To help prevent injury or death to personnel lubricating disconnect switch contacts, make sure that the MCC remote power sources are disconnected and the respective disconnects are locked in the OFF/O position.

Save all parts for reinstallation.

- 2. Remove the line guard from the disconnect.
- 3. For access to the disconnect's stationary contacts, remove the arc hood.
- 4. Generously apply the NO-OX-ID compound (sufficient enough to cover with a noticeable film) to both sides of the movable contact blades and to the adjacent insides stationary contacts and the hinge.
- 5. Reinstall the arc hood that was removed in <u>step 3</u>.
- 6. Reinstall the line guard cover that was removed in step 2.
- If the lubricated disconnect switch is housed in a plug-in unit, reinstall the unit. For installation of unit, refer to Installing Units with Vertical Operating Handles, publication <u>2100-IN014</u>.

If the unit requires lubrication because of corrosion (for example, a sulfuric environment), replacing the unit disconnect can be required to avoid overheating conditions. Lubrication can temporarily resolve overheating, however replacing the disconnect switch is the ideal, long-term solution.

Use Thermal Infrared or Other Temperature Measurement Techniques for Preventive Maintenance



ATTENTION: Temperature measuring techniques are often performed with the units fully energized and the doors and covers open.

Use extreme caution when performing these measurements so that energized parts are not shorted.

If care is not taken, electrical shock, severe injury or death can result. When working on or near energized electrical equipment, follow established electrical safety-related work practices. See NFPA 70E Standard for Electrical Safety in the Workplace.

Use the following procedure when using thermal infrared or other temperature measurement techniques as part of a periodic preventative maintenance program on CENTERLINE® 2100 Low Voltage MCCs.

- 1. Use test equipment to determine the temperature differential and the temperature rise of accessible components within the unit.
- 2. Determine the services and repair recommendations based on the temperature category in the following guidance chart.

Table 10 - Temperature Guidance

Category	Temperature Differential ⁽¹⁾		Temperature Rise ⁽²⁾		Repair/Service	
	°C °F °C °F Service Interval		Recommended Action			
1	<10	<18	<70	<126	No service or repair required.	See <u>step 1</u> in <u>Inspect the</u> <u>Units for Signs of</u> <u>Overheating</u> below.
2	1025	1845	70100	126180	Service or repair the unit at next maintenance schedule(not greater than six months but continue monitoring as a part of preventive maintenance.)	
3	2550	4590	100115	180207	Service or repair the unit within the next two weeks and monitor the unit at the next maintenance interval.	See <u>step 2</u> in <u>Inspect the</u> <u>Units for Signs of</u> Overheating on page 84.
4	>50	>90	>115	>207	Shut down the unit and repair. Verify that the temperature is reduced after re-energization.	

Temperature (measured or rise) differential between adjacent phases or like elements. Load between phases must be balanced with a normal variation not exceeding seven percent. (1) (2)

Measured temperature less ambient. Due to difficulty obtaining accurate infrared temperature measurements from highly reflective surfaces, we recommend using temperature differential readings in determining the Service/Repair guidelines, for example, emissivity of tin or silver plated material.

Inspect the Units for Signs of Overheating

1. If there are no signs of overheating and thermal infrared tests indicate that service is not necessary, document the units as acceptable.

Use this information for reviewing the mean time to maintenance for preventative maintenance for the specific facility.



ATTENTION: To service the units, make sure that the MCC remote power sources are disconnected and that the respective disconnects are locked in the OFF/O position.

If servicing a plug-in unit, remove it from the MCC to facilitate servicing. For unit removal quidelines, see Chapter 4.

When plugging units back in, refer to CENTERLINE 2100 Motor Control Centers (MCC) Units with Vertical Operating Handles Installation Instructions, publication 2100-IN014, and CENTERLINE 2100 Motor Control Center (MCC) Units with Horizontal Operating Handles Installation Instructions, publication 2100-IN060.

- 2. If there are no signs of overheating, but thermal infrared tests indicate that service is required, check the power connections for proper torque.
 - a. On disconnect switches, service the knife blades with a Scotch-Brite cleansing pad.
 - b. Remove all hardened grease.

Take care not to distort the disconnect jaw (stationary contact).

c. Lubricate with a fine film of NO-OX-ID (catalog number 2100H-N18 for a 0.47 L (1 pt) can, or catalog number 2100H-N18T for a 29.5 ml (1 oz) tube).

If the disconnect is subject to environmental conditions causing chronic tarnishing, it can be necessary to determine if there is an incompatibility in the plating material, for example, hydrogen sulfide and silver plating.

On fuses and fuse clips, service by polishing with a Scotch-Brite cleansing pad. Do not lubricate the fuses or the fuse clips.

3. If overheating has occurred as indicated by severe tarnishing, infrared test results, crystallization of insulation on conductors, discoloration of the components, darkening of the molding materials, brittle conductor insulation, or deformation and melting of parts, replace the components that are suspect.

For more information contact, Rockwell Automation LV MCC Technical Support at 1.440.646.5800 and follow the prompts to login for Post Shipment Support.

Notes:

Maintenance after Fault Condition

Maintain the MCC after a Fault Condition



ATTENTION: Make sure that the MCC remote power sources are disconnected and that the respective disconnects are locked in the OFF/O position.

The opening of the short circuit protective device (such as fuses or circuit breakers) in a properly coordinated motor branch circuit is an indication of a fault condition in excess of operating overload and must be corrected.

Fault conditions can damage control equipment. When a fault occurs, follow this procedure.

- 1. De-energize the MCC.
- Investigate the cause of the fault and inspect all equipment thoroughly per NEMA Standards publication ICS 2.3, Instructions for the handling installation operator and maintenance of MCCs not rated more than 600V, Section 11, Maintenance after a Fault has Occurred.
- Make necessary repairs to units, components, and structures as required, before reenergizing the equipment.

Be sure that replacement parts are suitably rated for the application.

An insulation resistance test can be required; see Chapter 7.

Notes:

Renewal Parts

A Renewal Parts Stocking Program for MCCs is recommended with a maintenance program. A stocking program is important to minimize expensive downtime and to facilitate critical repairs.

Factors to consider when developing an effective Renewal Parts Stocking Program include the following:

- The frequency of ON-OFF cycling and the amount of ON or operating time.
- The need for items such as continuous operation, inherent design limitations, and environmental considerations.
- The total number of similar devices that are supplied as original equipment within the MCC.
- Individual user policies governing spare parts.

Consider stocking complete units when the job site is in an area remote from a distributor or district sales office or when it is critical to maintain continuous operation of a system.

Order Information

The following information is required when ordering renewal parts:

- Description of part or unit
- Series letter
- Part or catalog number
- Quantity
- Shipping address
- MCC serial number and complete nameplate data

See <u>Chapter 12</u>, Parts Illustration, for pictures and descriptions of common section and unit parts.

Notes:

Parts Illustrations





Figure 50 - Typical Construction of a Unit with a Vertical Operating Handle



Figure 51 - Typical Construction of a Half Space Factor Unit with a Horizontal Operating Handle and Door-mounted Pilot Devices



Bulletin 2413, IEC Style Shown

Bulletin 140G Unit Assembly Instructions

Vertical Handle Units

These procedures show how to remove, install, verify, and adjust a Bulletin 140G circuit breaker in a vertical handle unit. Some items of the unit are not shown in the illustrations for clarity.

Required Tools

You need a screwdriver, a Phillips screwdriver, a socket set with extension, and a torque wrench to complete the installation.

Remove Circuit Breaker

To remove a circuit breaker, follow these steps.

- 1. See <u>Chapter 4</u> for how to remove a unit from the MCC.
- 2. Place the unit on a clean, flat surface.

IMPORTANT Use caution not to bend power stabs if the unit is resting on a table.

- 3. Remove the top plate and handle assembly.
 - a. Remove the unit interlock screw (5/16 in.), press the tabs together, and remove the unit interlock.
 - b. To remove the top plate, remove the top plate screws.

For SecureConnect[™] units, cut wire tie and to remove wires.

c. Optional - remove handle assembly from the right side.

There are two screws on bottom and two screws on the inside top and bottom (5/16 in.).

d. Remove the linkage from the bail.



- 4. Disconnect the circuit breaker wiring.
 - a. Remove terminal cover mounting screw and slide the terminal cover forward (click when pulling).
 - b. To remove the line side connection (top wires), use a hex key (G and H-frame 5 mm hex, J-frame 6 mm).

Make note of the phasing of the cables.

- c. To remove the load side connection (bottom wires), use a hex key (G and H-frame 5 mm hex, J-frame 6 mm).
- Place the circuit breaker in the ON position.
 Use a large slotted screwdriver (we recommend a 3/8 or 1/2 in. wide blade) to remove the bail.
- 6. To remove the bail, place the screwdriver flat on the left side of the bail and rotate the screwdriver.
- 7. To remove the circuit breaker, remove two Phillips screws. Save the lock washers and screws.



Install Circuit Breaker

To install the Bulletin 140G circuit breaker in a vertical handle unit, follow these steps.

- 1. Attach the handle assembly to the mounting plate by using #10-32 x 0.38 threadforming screws and tighten to 20...40 lb•in (2.25...4.50 N•m).
- 2. If optional external auxiliary contacts are used, attach the external auxiliary bracket (not included in the kit) to the circuit breaker base.

IMPORTANT Keep the base flat during assembly; do not support it on the side. Keep the left screw on the bracket base loose to adjust the bracket later.

- 3. Position the base on the mounting plate. Use the vertical mounting holes (2100V).
- 4. Mount the base to the mounting plate by using #8-32 x 1.62 Pan head screws (G frame units); #8-32 x 0.81 Pan head screws (H and J frame units).
- 5. Tighten to 18 lb•in (2.03 N•m).



The wires from internal accessories on the right side of the circuit breaker are routed under the circuit breaker in the 'trough' in the base so they exit on the left.

- 6. Mount the circuit breaker to the base by using screws (included with the circuit breaker), split lock washers, and flat washers (use washers from the existing unit).
- 7. Tighten to 10 lb•in (1.13 N•m).



- 8. Put the circuit breaker ON/OFF switch to the 'ON' position.
- 9. Install the bail on to the circuit breaker base.

IMPORTANT The circuit breaker must be in the 'ON' position to install the bail.

The bail snaps into place on both sides of the circuit breaker base. (If the bail does not snap in easily, check the orientation of the bail.)

- 10. Move the circuit breaker/bail to the 'OFF' position.
- 11. Engage the linkage to the bail.



If wired accessories are included in the circuit breaker, route accessory wires under the circuit breaker in the 'trough' in the base. Verify that all accessory wires exit on the left side of the assembly, above the bail connection point. Use wire ties to avoid tangled wires in the unit.

- Verify that the circuit breaker operates correctly.
 See <u>Verify Operation</u> and <u>Adjust Circuit Breaker Position</u>, both on this page.
- 13. Snap the auxiliary contacts to the bracket.
- 14. Attach the line-side wiring and tighten to 53 lb•in (6 N•m) for G and H frame units; tighten to 71 lb•in (8 N•m) for J Frame units.
- 15. Add the line terminal cover to the line side (not included in the kit).
- Insert the terminal cover screw (not provided with the kit), and tighten to 8 lb•in (0.90 N•m).
- 17. Attach the load-side wiring and tighten to 53 lb•in (6 N•m) for G and H frame units; tighten to 71 lb•in(8 N•m) for J frame units.
- 18. Install the load side phase separators on the load side (not supplied with the kit). Verify that the phase separators are pushed down completely so that they are flush with the cover.

Verify Operation

To verify operation, follow these steps.

- Make sure the circuit breaker/bail is in the 'ON' position, push the 'Trip' button on the circuit breaker, and observe that the toggle on the circuit breaker and the switch on the handle have moved to the tripped position.
- 2. Attempt to move the handle from the tripped position to the 'OFF' position and back again to 'ON' to verify reset of the circuit breaker.

If the handle does not move to the 'ON' position, adjust the circuit breaker position and retry the trip sequence.

Adjust Circuit Breaker Position

To adjust the circuit breaker position, follow these steps.

- 1. Loosen the two circuit breaker mounting screws.
- 2. To raise the circuit breaker in the unit, turn the adjustment screw on the top of the base assembly to the right (clockwise).

To lower the circuit breaker in the unit, turn the adjustment screw on the top of the base assembly to the left (counter-clockwise).



The adjustment distance is limited. If you feel resistance when you turn the adjustment screw (and you confirmed that you have already loosened the circuit breaker mounting screws), you have reached the adjustment limit.

- 3. If optional external auxiliary contacts are used, after the external contacts have been snapped on, adjust the auxiliary bracket until the bail contacts the plunger on the front contact when in the 'ON' position and tighten to 20 lb•in (2.25 N•m).
- 4. Tighten the two circuit breaker mounting screws to 10 lb•in (1.13 N•m).

Horizontal Handle and Space Saving Design

These procedures show how to remove, install, verify, and adjust a Bulletin 140G circuit breaker in a horizontal handle unit. Some items of the unit are not shown in the illustrations for clarity.

Required Tools

You need a screwdriver, a Phillips screwdriver, a socket set with extension, and a torque wrench to complete the installation.

Remove Circuit Breaker

To remove a circuit breaker, follow these steps.

- 1. To remove a unit from the MCC, see <u>Chapter 4</u>.
- 2. Place the removed unit on a clean, flat surface.

IMPORTANT Use caution not to bend power stabs if the unit is resting on a table.

- 3. Remove the white mounting screw from under the handle assembly.
- 4. Disconnect any terminal blocks if necessary.
- 5. For space saving design, remove the auxiliary bracket.



- 6. Disengage linkage from the bail under the circuit breaker.
- 7. Place the circuit breaker in the ON position.

Use a large slotted screwdriver (we recommend a 3/8 or 1/2 in. wide blade) to remove the bail.

- 8. To remove the bail, on the top side of the bail, place the screwdriver flat on the side and rotate the screwdriver.
- 9. Disconnect the circuit breaker wiring.
 - a. Remove terminal cover mounting screw and slide the terminal cover forward (click when pulling).
 - b. To remove the line side connection, use a hex key (G and H-frame 5 mm hex, J-frame 6 mm).

Make note of the phasing of the cables.

- c. To remove the load side connection, use a hex key (G and H-frame 5 mm hex, J-frame 6 mm).
- 10. To remove the circuit breaker, remove two Phillips screws. Save the lock washers and screws.



Install Circuit Breaker

Follow these steps to install the Bulletin 140G circuit breaker in a horizontal handle unit.

- Mount the circuit breaker base to the mounting plate by using #8-32 x 1.62 Pan head screws (G frame units); #8-32 x 0.81 Pan head screw (H and J frame units). Use the horizontal mounting holes (2100H).
- 2. Tighten to 18 lb•in (2.03 N•m)
- 3. Mount the circuit breaker to the base by using screws (included with the circuit breaker), split lock washers, and flat washers (use washers from the existing unit) and tighten to 10 lb•in (1.13 N•m).



4. Put the circuit breaker ON/OFF switch to the 'ON' position.

5. Install the bail on to the circuit breaker base.

IMPORTANT The circuit breaker must be in the 'ON' position to install the bail

The bail snaps into place on both sides of the circuit breaker base. (If the bail does not snap in easily, check the orientation of the bail.)



- 6. Attach the line-side wiring and tighten to 53 lb•in (6 N•m) for G and H frame units; tighten to 71 lb•in (8 N•m) for J Frame units.
- 7. Add the line terminal cover to the line side (not included in the kit).
- Insert the terminal cover screw and washer (not provided with the kit), and tighten to 8 Ib•in (0.90 N•m).
- 9. Attach the load-side wiring and tighten to 53 lb•in (6 N•m) for G and H frame units; tighten to 71 lb•in (8 N•m) for J frame units.
- 10. Install the load-side phase separators on the load side (not supplied with the kit). Verify that the phase separators are pushed down completely so that they are flush with the cover.
- 11. Attach the handle assembly to the base plate by using #10-32 x 0.38 hex head threadforming screws and tighten to 24...40 lb•in (2.7...4.5 N•m).
- 12. With the handle in the 'OFF' position, align the tab on the bail with the slot in the mounting plate and secure with a #10-32 x 0.38 hex head thread-forming screw.
- 13. With the handle and the circuit breaker in the 'OFF' position, engage the linkage to the notch in the bail.



14. Attach the external auxiliary contacts to the bracket.

Verify Operation

- 1. Make sure the circuit breaker/bail is in the 'ON' position, push the 'Trip' button on the circuit breaker, and observe that the toggle on the circuit breaker and the switch on the handle have moved to the tripped position.
- 2. Attempt to move the handle from the tripped position to the 'OFF' position and back again to 'ON' to verify reset of the circuit breaker.

If the handle does not move to the 'ON' position, adjust the circuit breaker position and retry the trip sequence.

Adjust the Circuit Breaker Position

Follow these steps to adjust the circuit breaker position.

- 1. Loosen the two circuit breaker mounting screws.
- 2. To raise the circuit breaker in the unit, turn the adjustment screw on the top of the base assembly to the right (clockwise).

To lower the circuit breaker in the unit, turn the adjustment screw on the top of the base assembly to the left (counter-clockwise).



The adjustment distance is limited. If you feel resistance when you turn the adjustment screw (and you confirmed that you have already loosened the circuit breaker mounting screws), you have reached the adjustment limit.

- 3. After the external contacts have been snapped on, adjust the auxiliary bracket until the bail contacts the plunger on the front contact when in the 'ON' position and tighten to these values:
 - 32 lb•in (3.62 N•m) for #8 screws
 - 18 lb•in (2.0 N•m) for #6 screws
- 4. Tighten the two circuit breaker mounting screws to 10 lb•in (1.13 N•m).

Auxiliary Contact Adapters

Use these instructions to install an external auxiliary contact adapter in CENTERLINE® 2100 Series Z and later units with circuit breakers (Bulletin 140G and 140MG).

The auxiliary contact kits are to be used with the following auxiliary contacts: Catalog Numbers 800F-X10, 800F-X01, 800F-X20D, 800F-X11D, and 800F-X02D.



ATTENTION: De-energize all power sources to the motor control center before installing the auxiliary contact adapter. Failure to de-energize all power sources can result in severe injury or death.

Install External Auxiliary Contact Adapter on G, H, and J Frame Horizontal Units

Follow these instructions for installing auxiliary contacts on G, H, and J frame horizontal units.

These kits contain parts to install external auxiliary contacts in units that are the following types:

- Units with a horizontal operating handle
- Have one of the following circuit breakers: Bulletin 140G, 140MG
- Bulletin 2100 Series Z and later



ATTENTION: De-energize all power sources before installing auxiliary contact. Failure to de-energize all power sources can result in severe injury or death.

Required Tools

You need a screwdriver, a Phillips screwdriver, and a hexalobular T-15 screwdriver to complete the installation.

Install the Auxiliary Contact Adapter

Follow these steps and refer to Figure 55 on page 108 to install the auxiliary contact adapter.



These external auxiliary contacts are actuated by only the unit operating handle, and do not reflect a circuit breaker trip.

1. Before you install the auxiliary contacts, first remove the unit by the instructions in Remove a Plug-in Unit with a Horizontal Operating Handle from a Section on page 47.

- 2. To verify the parts list, see Figure 55 on page 108.
- 3. Attach the auxiliary contact assembly to the handle mounting plate by using two #6-32 x 0.25 hexalobular T-15 pan-head screws.
- 4. Attach the horizontal handle auxiliary bracket to the unit by using two #8-32 x 0.38 thread forming screws.
- 5. Tighten to these values:
 - 32 lb•in (3.62 N•m) for #8 screws

- 18 lb•in (2.0 N•m) for #6 screws
- 6. Turn the operator handle to the ON/I position to verify that the auxiliary contacts change state.
- 7. Check continuity to verify proper operation of the auxiliary contacts.



Install External Auxiliary Contact Adapter on G, H, J, and K Frame Units

Follow these instructions to install an external auxiliary contact adapter in Bulletin 2100 Series Z or later units with circuit breakers (Bulletin 140G and 140MG). The instructions are the same for single and dual units.

This auxiliary contact kit is to be used with the following auxiliary contacts: Catalog numbers 800F-X10, 800F-X01, 800F-X20D, 800F-X11D, and 800F-X02D.



De-energize all power sources to the motor control center before installing auxiliary contact adapter. Failure to de-energize all power sources can result in severe injury or death.

Required Tools

You need a screwdriver, a 1/4" wrench or socket, a 5/16" wrench or socket, and a torque wrench.

Installation

See <u>Figure 54</u> and use the following steps to install external auxiliary contact adapter.

- 1. Make sure that all power has been disconnected.
- 2. Verify the parts list.
- 3. Install auxiliary contacts.
- 4. Attach the external auxiliary contact assembly to the mounting plate by using one #8-32 x 0.38 inch thread-rolling screw.
- 5. Tighten to these values:
 - 20 lb•in (2.2 N•m) for #6-20 screws
 - 32 lb•in (3.6 N•m) for #8-32 screws
- 6. Check continuity to confirm proper operation of auxiliary contacts.

Figure 54 - External Auxiliary Contact Adapter on G, H, J, and K Frame Units





Install External Auxiliary Contact Adapter on M and N Frame Units

Follow these instructions for installing the auxiliary contact adapters on M and N frame units.

Required Tools

You need a socket set with extension and a torque wrench to complete the installation.

Install the Auxiliary Contact Adapter

Follow these steps to install the auxiliary contact adapter.

- 1. Verify that all power has been disconnected and turn the operator handle to the OFF/O position.
- 2. To verify the parts list, see Figure 55.
- 3. Attach the external auxiliary contact assembly to the mounting plate by using two 1/4-20 thread-rolling screws and tighten to 55 lb•in (6.2 N•m).

See <u>Figure 55.</u>

- 4. Attach the actuator to the circuit breaker bail by using two 1/4-20 thread-rolling screws.
- 5. Position the actuator so the screws are centered in the slots and tighten to 55 lb•in (6.2 N•m).
- 6. Install the auxiliary contacts (Catalog numbers 800F-X10, 800F-X01, 800F-X20D, 800F-X11D, and 800F-X02D).
- 7. Turn the operator handle to the ON/I position to verify that the auxiliary contacts change state.
- 8. Check continuity to verify the proper operation of auxiliary contacts.

Figure 55 - Assembly of External Auxiliary Contact Parts


Low Voltage Motor Control Center Security

The architecture with CENTERLINE $^{\circ}$ 2100 Low Voltage Motor Control Centers (LVMCCs) supports IEC-62443-3-3 SL 1 security requirements. To help meet these requirements, reference these publications.

For This Information	See the Following Publications
Network architecture recommendations	Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication <u>ENET-TD001</u>
Windows infrastructure recommendations How to configure and use these Rockwell Automation products: • FactoryTalk® Directory • FactoryTalk Activation Manager • FactoryTalk Security • FactoryTalk AssetCentre	Security Configuration User Manual, publication <u>SECURE-UM001</u>
How to configure and implement CIP Security™	CIP Security with Rockwell Automation Products Application Technique, publication SECURE-AT001
System Security Concepts	System Security Design Guidelines Reference Manual, publication SECURE-RM001
Overview of the PlantPAx $^{\odot}$ responses for the IEC-62443-3-3 SL1 requirements	Securing your PlantPAx system in The Connected Enterprise, publication <u>PROCES-WP024</u>
System Feature Checklist to meet IEC-62443-3-3 SL1 requirements when using a PlantPAx architecture	 PlantPAx Distributed Control System Configuration and Implementation User Manual, publication <u>PROCES-UM100</u> PlantPAx Security Certification-Appendix A of publication <u>PROCES-UM100</u>

LVMCC Security Architectures

An LVMCC is a collection of intelligent and non-intelligent devices. Proper management of the physical and network access to these devices are key to manage the integrity of the devices and system.

This section covers two possible architectures to implement an IEC-62443-3-3 SL 1 system that includes one or multiple LVMCCs.

ISA-99/IEC 62443 is based on seven foundational requirements that cover a defense in depth approach that is suited for an Industrial Automation Control System (IACS). These foundational requirements are:

- FR1: Identification and authentication control (IAC)
- FR2: Use control (UC)
- FR3: System integrity (SI)
- FR4: Data confidentiality (DC)
- FR5: Restricted data flow (RDF)
- FR6: Timely response to events (TRE)
- FR7: Resource availability (RA)

Trusted Zones

ISA-99/IEC 62443-3-3 SL1 requires the capability to separate trusted and untrusted zones. You can use a standard firewall implementation to separate trusted traffic and untrusted traffic. Standard implementation creates two basic security zones, which are known as inside and outside. The inside, or trusted zone, is also referred to as the private zone. The outside, or untrusted zone, is also known as the public zone. The public zone is outside the control of an organization and can be thought of as simply the public Internet.

LVMCC As a Secure Control System

The first architecture considers placing the LVMCC in a separate and distinct security zone. The LVMCC is considered a secure control system; for an example, see <u>Figure 56 on page 110</u>. It is a smaller system where the Engineering Station is outside of the trusted boundary of the system and, therefore, it is an external access to the system. This approach is scalable, since you can start small and then expand the system.

A 1756-EN4TR module provides a CIP Security firewall to access devices over the network. The ControlLogix[®] backplane act as a firewall that blocks all non-EtherNet/IP[™] traffic. There is a security conduit between the engineering workstation and the 1756-EN4TR module. The Engineering Station uses Studio 5000[®] AOP to configure the devices over the network. The 1756-ENTR, engineering workstation, Studio 5000[®] AOP, FactoryTalk Security, FactoryTalk Asset Centre, and Domain Controller are compensating countermeasures to the LVMCC as a system.

The trusted boundary defines the limit of the IACS security zone. The following conduits cross the trusted boundary:

- Input power to the LVMCC
- Input control power to the UPS
- Communication cables
- Control wiring
- Motor cable output

Figure 56 - LVMCC Security Zone In A Secure Control System



The LVMCC as Part of a Security Zone in a Larger PlantPAx Distributed Control System

The second architecture considers the LVMCC as part of a security zone that includes other components of the process control. The LVMCC and its devices are considered components of a larger PlantPAx industrial zone; for an example, see <u>Figure 57 on page 112</u>.

PlantPAx SL1 IEC 62443-3-3 certified architecture provides a standard, prescriptive reference design.

In situations where untrusted networks are part of the system, PlantPAx creates a zone boundary by implementing industrial-level firewalls. Wireless and external communication connections are monitored and controlled through the industrial demilitarized zone (IDMZ) firewall.

Appendix A of the publication <u>PROCES-UM100</u>, PlantPAx Distributed Control System Configuration and Implementation User Manual, provides guidelines and checklists for a collective strategy to meet the ISA-99/IEC 62443-3-3 SL1 requirements in a conformant PlantPAx system.



Figure 57 - LVMCC Security Zone In a Larger PlantPAx Distributed Control System

System Security Features

If your LVMCC is used as a Secure Control System architecture, then use the following checklists to secure your system.

If your LVMCC is part of a security zone in a larger PlantPAx distributed control system, then use the checklist available in Appendix A of the PlantPAx Distributed Control System Configuration and Implementation User Manual, publication <u>PROCES-UM100</u>.

Identify and authenticate all users.

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	Windows infrastructure	Yes	 Configure and use the following: Create Active Directory groups and unique users. Password strength and recommendations Enable system notifications. No wireless access For more information, see: Configure System Security Features User Manual, publication <u>SECURE-UM001</u> System Security Design Guidelines Reference Manual, publication <u>SECURE-RM001</u>
	Windows domain	Yes	Configure the domain controller. Configure all operating system clients as domain members. For more information, see: • Configure System Security Features User Manual, publication <u>SECURE-UM001</u> • System Security Design Guidelines Reference Manual, publication <u>SECURE-RM001</u>
	FactoryTalk Directory software FactoryTalk Security software	Yes	Configure appropriate: Users, groups, roles Policies For more information, see Configure System Security Features User Manual, publication <u>SECURE-UM001</u>
	Physical access controls	Yes	 Place the LVMCC in a room with proper access control and/or install and configure the following: Locking latches; for more information, see <u>Wireless Interfaces on page 116</u>

Enforce the assigned privileges of the authenticated user.

Table 12 - Requirements for Use Control

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	Windows infrastructure	Yes	Configure and use the following: • Session lock • Disable Remote Desktop Services • Interactive login policy • Notifications for unsuccessful login attempts • Windows application blocker For more information, see: • Configure System Security Features User Manual, publication <u>SECURE-UM001</u> • System Security Design Guidelines Reference Manual, publication <u>SECURE-RM001</u>
	FactoryTalk Directory software FactoryTalk Security software	Yes	Configure appropriate: Users, groups, roles Policies For more information, see Configure System Security Features User Manual, publication <u>SECURE-UM001</u> .
	FactoryTalk AssetCentre software	Yes	Configure and use the following: • Auditable events • Audit storage capacity • Diagnostics and health log • Time stamps For more information, see Configure System Security Features User Manual, publication <u>SECURE-UM001</u> .
	Physical access controls	Optional	 Place the LVMCC in a room with proper access control and/or install and configure the following: Locking latches; for more information, see <u>Wireless Interfaces on page 116</u>. These components that are built in a system help provide access authorization to energized equipment based on proper electrical training.

Confirm the integrity of the system to help prevent unauthorized manipulation.

Table 13 - Requirements for System Integrity

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	Windows infrastructure	Yes	Configure and use the Active Directory and domain structure to handle authorization. For more information, see System Security Design Guidelines Reference Manual, publication <u>SECURE-RMOD1</u> .
	Antivirus software	Yes	Use antivirus and anti-malware software to harden workstations. For more information, see System Security Design Guidelines Reference Manual, publication <u>SECURE-RMOD1</u> .
	CIP Security	Yes	Use FactoryTalk Policy Manager software to define communication between zones. Engineering Station is in the untrusted zone and 1756-EN4Tx is in the trusted zone. For more information, see CIP Security with Rockwell Automation Products Application Technique, publication <u>SECURE-AT001</u> .
	FactoryTalk AssetCentre software	Yes	 Configure and use the following: Change detection and reporting Scheduled backups For more information, see: Configure System Security Features User Manual, publication <u>SECURE-UM001.</u> System Security Design Guidelines Reference Manual, publication <u>SECURE-RM001.</u>

Confirm the confidentiality of communication and data to help prevent unauthorized disclosure.

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	CIP Security	Yes	Use FactoryTalk Policy Manager software to define conduit from Engineering Station in the untrusted zone to the 1756-EN4Tx is in the trusted zone. For more information, see CIP Security with Rockwell Automation Products Application Technique, publication <u>SECURE-UM001</u> .
	CIP Security Cryptography	Recommended	Use FactoryTalk Policy Manager to enable CIP Security Cryptography For more information, see CIP Security with Rockwell Automation Products Application Technique, publication <u>SECURE-AT001</u> .
	Physical access controls	Yes	 Install and configure the following: Electrical requirements Emergency power requirements (UPS) to help avoid the boot up of the firewall components (ControlLogix® rack) that increases surface attack. For more information, see <u>Electrical Requirements on page 117</u>. Emergency power requirements (UPS) to help avoid the loss of physical access control access essential function. For more information, see <u>Electrical Requirements on page 117</u>.
	Disable devices webpages	Recommended	 Install and configure the following: Disable webpages Webpages for diagnostics are read-only and enabled by default. Disable the webpages if required by the system design, threat model, or risk assessment. For more information, see <u>Disable Webpages on page 117</u>.

Segment the control system via zones and conduits to limit the unnecessary flow of data.

Table 15 - Requirements for Restricted Data Flow

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	CIP Security	Yes	 Use FactoryTalk Policy Manager software to define conduit from Engineering Station in the untrusted zone to the 1756-EN4Tx is in the trusted zone. For more information, see: CIP Security with Rockwell Automation Products Application Technique, publication <u>SECURE-AT001.</u> EtherNet/IP Network Devices User Manual, publication <u>ENET-UM006.</u>
	ControlLogix rack with 1756-EN4Tx and a second EtherNet/IP communication module	Yes	Install the 1756-EN4Tx in the ControlLogix® rack to communicate with Engineering Station and a second EtherNet/IP module to communicate with the LVMCC devices. The ControlLogix rack blocks all non-EtherNet/IP traffic. For more information, see EtherNet/IP Network Devices User Manual, publication <u>ENET-UM006</u> .
	Managed switches	Optional	The standard Stratix [®] Ethernet switch inside MCCs comes factory configured. You can choose to enable the Smartport from factory. Smartport for automation device implements MAC address-based port security. For more information, see Stratix [®] Managed Switches User Manual, publication <u>1783-UM012</u> .

Respond to security violations and take timely corrective action.

Table 16 - Requirements for Timely Response to Events

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	FactoryTalk AssetCentre software	Yes	Configure and use the following: • Audit log accessibility • Continuous monitoring For more information, see: • Configure System Security Features User Manual, publication <u>SECURE-UM001</u> . • System Security Design Guidelines Reference Manual, publication <u>SECURE-RM001</u> .
	Individual products in the system	Yes	Protect the internally stored audit logs in individual products in the system. Configure the FactoryTalk AssetCentre audit log to collect these individual audit logs. For more information, see the user documentation for the individual products.

Confirm the availability of the system against the degradation or denial of essential services.

Table 17 - Requirements for Resource Availability

Add Check Mark When Completed	Product	Required to Meet IEC- 62443-3-3 SL 1	Details
	Windows infrastructure	Yes	Configure the operating system to prioritize control system functionality over antivirus checks and patching. Download software patches from trusted sources. For more information, see: • System Security Design Guidelines Reference Manual, publication <u>SECURE-RMOO1</u> . • Ethernet (CPwE) Design and Implementation Guide, publication <u>ENET-TDOO1</u> .
	FactoryTalk AssetCentre software	Yes	Configure and use the following: • Asset inventory • Control system backup • Disaster recovery For more information, see Configure System Security Features User Manual, publication <u>SECURE-UM001</u> .
	UPS	Yes	Provide your own UPS with separate battery unit and redundant supplies. Size the UPS so that is correctly supports the system and provides enough power to shut down servers and workstations, ControlLogix rack, and an LVMCC access control system if used.

Wireless Interfaces

Locking Latches

To maintain the IEC-62443-3-3 SL 1 certification described in this appendix, wireless interfaces, such as Bluetooth, should be disabled in the firmware. If the wireless interface cannot be disabled, the wireless interfaces should be turned off, with the means to turn them on protected by physical barriers and passwords/passcodes.

If a wireless interface needs to be used, it should be enabled only as long as necessary to complete the required tasks and then be disabled again or turned back off.

Consult the instruction manuals for the components which have wireless interfaces for additional information regarding security. It is possible that only the component manufacturer or their field service personnel have the ability to disable the wireless interface and it will be necessary to work with the component manufacturer to have the wireless interface disabled.

A Stratix[®] Ethernet switch unit (2100-ESW) offers the '-144' locking latch option as shown in <u>Figure 58</u>.

The locking latches are available as options for all units and wireway sections. <u>Figure 59</u> shows a locking latch for a vertical wireway section.

Figure 58 - Unit Locking Latch



Figure 59 - Wireway Locking Latch



IMPORTANT Power to the LVMCC access control system must be available even when the LVMCC is powered down and the voltage is only 24V DC to minimize electrical risk.

Disable Webpages

Devices within the LVMCC with EtherNet/IP connectivity support embedded web servers.

Devices	Embedded Web Server
E300 EtherNet/IP communication module	The web server is disabled by default. For more information, see E300™ Electronic Overload Relay User Manual, publication <u>193-UM015</u> .
1756-EN4TR EtherNet/IP communication module	The web server is enabled by default Formoreinformation,seeControlLogixEtherNet/IPNetworkDevices, publication <u>1756-UM004</u> .
The standard Stratix Ethernet switch	The web server is enabled by default. For more information, see Stratix Managed Switches User Manual, publication <u>1783-UM012</u> .

Before you disable the web server for a device:

- Save the configuration file
- Schedule disaster recovery in a FactoryTalk AssetCentre project
- Disable the embedded web server

Electrical Requirements The secure LVMCC provides the following features to meet electrical requirements for resource availability.

The power supply unit has an input for an alternative control power source so that the 24V DC is available to the LVMCC devices or only to the LVMCC access control system components, even if the main control power source is lost.

The power supply unit has an input for an alternative control power source so that the 24V DC is available to the LVMCC devices even if the main control power source is lost.

The redundant power supply unit has two 24V DC power supplies in parallel fed from two different 110...240V AC power control sources. Each 24V DC power supply can feed the circuit without the help of the other 24V DC power supply.

The EtherNet/IP power supply unit 2100-EPSR8x is an example of an existing standard unit that can meet the emergency power requirements with or without minor modifications.

Products in the Security Architecture

Element	Required Components (Minimum Version)
Domain controller	 Microsoft Windows[®] Server 2016 - Version 1607 (OS Build 14393.1884) Active Directory
Engineering workstation	 Microsoft Windows 10 - Version 1809 Studio 5000 Logix Designer - Version 32.00.00 (CPR 9 SR 11) FactoryTalk Asset Centre Client - Version 9.00.00.231 FactoryTalk Asset Centre Agent - Version 9.00.00.231 ControlFLASHTM - Version 15.01.00 FactoryTalk Services Platform - Version 6.11.00 (CPR 9 SR 11.1) FactoryTalk Alarms and Events FactoryTalk Diagnostics FactoryTalk Security FactoryTalk Directory FactoryTalk Linx FactoryTalk Policy Manager FactoryTalk System Services
FactoryTalk AssetCentre server	 Microsoft Windows Server 2016 - Version 1607 (0S Build 14393.1884) Microsoft® SQL Server 2016 - Version 13.0.5292.0 (X64) Microsoft SQL Server Management Studio - Version 17.9.1 FactoryTalk Asset Centre Server - Version 9.00.00.231 FactoryTalk Asset Centre Agent - Version 9.00.00.231 FactoryTalk Services Platform - Version 6.11.00 (CPR 9 SR 11.1) FactoryTalk Alarms and Events FactoryTalk Diagnostics FactoryTalk Directory FactoryTalk Directory FactoryTalk Linx FactoryTalk Policy Manager FactoryTalk System Services
LVMCC security zone	 1756-EN4TR EtherNet/IP communication adapter with CIP Security 1756-EN2TR EtherNet/IP communication adapter 1756 ControlLogix rack 1756 ControlLogix power supply UPS power supply

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Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	<u>rok.auto/support</u>
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	<u>rok.auto/literature</u>
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	<u>rok.auto/pcdc</u>

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Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

Allen-Bradley, ArcShield, Bulletin 194R, CENTERLINE, ControlFLASH, ControlLogix, E1 Plus, E300, expanding human possibility, FactoryTalk, GuardLink, GuardLogix, Guardmaster, IntelliCENTER, Logix 5000, PlantPAx, PowerFlex, Rockwell Automation, SecureConnect, SMC, SMP, Stratix, and Studio 5000 are trademarks of Rockwell Automation, Inc.

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