



# **CENTERLINE<sup>®</sup> Low Voltage Motor Control Centers**

## **General Information**

The motor control center (MCC) is constructed to meet or exceed the requirements within NEMA ICS-18, UL845, CSA C22.2 No. 14 and EN 60439-1 for motor control centers.

The MCC meets the requirements for Uniform Building Code (UBC) Zone 4 seismic applications.

The altitude class of the MCC is 6600 feet(2km).

The MCC has an ambient operating temperature of 0-40°C (32-104 °F) with up to 95% non-condensing humidity.

The MCC is designed, manufactured and tested in facilities registered to ISO9001 quality standards.

The MCC is dead front construction incorporating horizontal and vertical power bus, including neutral bus as required, and horizontal and vertical ground bus as required.

The MCC consists of one or more vertical sections bolted together forming a rigid, free-standing assembly designed to permit future addition of vertical sections and interchanging of the units.

## **MCC Structure**

### **Vertical Sections**

Vertical sections are rigid, free standing structures with heavy duty internal mounting angles running continuous within the shipping block. Two clearance holes are provided in each section for bolting or welding to the prepared mounting site. Optional external mounting channels 1-1/2" x 3" (38.1mm x 76.2mm) are available. A removable continuous steel lifting angle is provided on all shipping blocks, except for NEMA Type 3R and Type 4 where the lifting angle is optional.

The standard dimensions of a vertical section are 90"H x 20"W x 15"D (2286mm x 508mm x 381mm). Vertical sections are also available as 20"D (508mm). Some vertical sections may be wider than 20" (508mm) due to larger equipment or optional vertical wireway.

Optional 71" reduced height vertical sections are available. The actual height of the vertical section is 70.48" (1791mm). These sections can be either 15" (381mm) or 20" (508mm) deep and each 71" high vertical section accommodates standard plug-in units up to and including 4.5 space factors.

Two 71" high styles are available:

### *Standard Height*

The center height of the horizontal power bus is 45" (1143mm) from the bottom. This style is capable of joining with the standard 90" (2286mm) vertical section and is required for bottom incoming configurations.

### *Lower Height*

The center point of the horizontal power bus is 25-1/2" (647mm) from the bottom. This style is required for top incoming configurations.

Refer to Publication 2100-TD024x-EN-P for more details on the 71" reduced height vertical sections.

Back-to-back vertical sections are made up of two separate vertical sections. The front and back sections have separate horizontal and vertical power bus providing the same phasing on units, both front and back. Full usage of unit space is available for front and back section. There is no back plate between the sections. The horizontal power bus is linked, front to rear, with a factory installed U-shaped bus splice assembly.

The maximum standard number of sections per shipping block for front mounted section is three. The maximum standard number of section for back-to-back sections is six.

Generally, any section wider than 20" (508mm) requires its own shipping block, but sections with 9" (229mm) vertical wireway are available in a 2-section shipping block.

Vertical sections are equipped with a removable one piece top plate and full metal side sheets (one on each side) to isolate each vertical section. Removable end plates are used to cover the horizontal power bus and horizontal wireway openings at each end of the MCC.

Vertical sections contain 6.0 space factor or 78" (1981mm) of plug-in space.

All enclosure metal work has rounded edges and is tightly fitted with no visible air gaps. Gasketing made of closed cell neoprene material is used. Available NEMA Type enclosures are:

- NEMA Type 1 (IP20, IP30, IP40)
- NEMA Type 1 with gasketing around perimeter of unit doors (IP20, IP30, IP40)
- NEMA Type 12 (IP54)
- NEMA Type 3R non walk-in (IP44)
- NEMA Type 4 non walk-in (IP65)

All structural metal parts undergo a multi-step cleaning, rinsing and painting process resulting in complete paint coverage of uniform thickness. The process is maintained and controlled by ISO9001 quality standards.

All interior and exterior surfaces are painted ANSI 49 medium light gray. The interior vertical wireways and unit back plates are painted high visibility gloss white. The exterior of NEMA Type 3R MCCs are painted ultraviolet resistant, high gloss white, recognized by UL for outdoor use.

All unpainted surfaces are plated for corrosion resistance.

Stainless steel structural parts are not painted.

## MCC Construction

The following table lists the approximate gauges of the components that make up the MCC structure.

Major Structural Components	Nominal		Approximate Gauge (AWG)
	Inches	mm	
Side Plates	0.075	1.905	14
Reinforcing "C" Channel	0.105	2.667	12
Backplate 20" Wide	0.075	1.905	14
Backplate 25" - 40" Wide	0.105	2.667	12
Bottom Mounting Angle	0.164	4.166	8
Right-Hand Unit Support	0.075	1.905	14
<b>Covers and Panels</b>			
Top Plate (all widths)	0.075	1.905	14
Bottom Plate	0.075	1.905	14
External End Plate	0.075	1.905	14
Horizontal Wireway Cover	0.060	1.524	16
Wireway Baffle	0.075	1.905	14
Top Horizontal Wireway Pan	0.060	1.524	16
<b>Doors</b>			
Unit Door (1.0 - 5.0 Space Factor)	0.075	1.905	14
Unit Door (6.0 Space Factor)	0.105	2.667	12
Vertical Wireway Door	0.060	1.524	16
<b>Other Steel</b>			
Pull Box Parts	0.075	1.905	14
Unit Wrap Around	0.075	1.905	14
Unit Support Pan	0.075	1.905	14

## MCC Approximate Weights

The following table lists the approximate weight for a typical MCC Section.

MCC Section Dimensions	Lbs. (kg) per section <sup>(1)</sup>
15"/20" D, 20" W	750 (340)
15"/20" D, 25" W	750 (340)
15"/20" D, 30" W	800 (363)
15"/20" D, 35" W	800 (363)

<sup>(1)</sup> Weights are based on worst case approximations.

## Horizontal Wireways

Top and bottom horizontal wireways extend the full depth of the MCC. Horizontal wireways are 6" (152.4mm) high and extend the length of the MCC with at least one 25 square inch (16129mm<sup>2</sup>) opening between sections. A

single opening is provided for 15" (381mm) deep sections, and two openings are provided for 20" (508mm) deep sections. Horizontal wireways are isolated from all power bus bars. Horizontal wireways of back-to-back sections allow complete access front to rear. Horizontal wireways have removable covers held closed by captive screws.

Horizontal wireways for incoming line sections are 6"H x 7"D (152mm x 178mm) isolating the wireway from the incoming line area.

## Vertical Wireways

An integral full height (78" [1981mm]) vertical wireway is provided in each standard vertical section isolated from the horizontal and vertical power bus. Vertical wireways are independent of the plug-in unit space. Standard vertical wireways are 4 -3/8"W x 7"D (111mm x 178mm). An optional 9" (228mm) wide vertical wireway is available, making the section 25" (635mm) wide. A removable hinged door with 1/4-turn pawl type latches covers the vertical wireway. Tie bars are available for the vertical wireway.

## Power Bus

The power bus system is supported, braced and isolated by a bus support molded of high strength, non-tracking glass polyester material. Horizontal and vertical power bus is fastened together with a bus clamp assembly. Minimum bus bracing is 42kA rms symmetrical with optional 65kA and 100kA rms symmetrical available.

## Horizontal Power Bus

The horizontal power bus is continuous in each shipping block and mounted near the vertical center of the structure providing optimum heat distribution, power distribution and ease of maintenance and splicing. The horizontal power bus is mounted on-edge in a vertical plane providing maximum strength to magnetic forces. It is mounted in recessed channels of the bus support to protect against accumulation of dust and tracking between phases.

Splicing horizontal power buses is accomplished using a splice kit of the same ampere rating as the horizontal power bus. Double stud clamp assemblies made up of flat washers and pre-assembled nuts and conical washers are used. These assemblies provide a minimum of two (2) 3/8" (9.52mm) bolted connections on each side of the splice. The splice connections are front accessible for servicing. The location of splices is indicated by a label on the inside of the vertical wireway door.

## Vertical Power Bus

Vertical power bus bars are cylindrical providing optimum contact with the unit plug-in stabs. Vertical power bus bars are continuously braced by a high

strength, non-tracking glass polyester material and sandwiched by a glass filled polycarbonate molded bus cover isolating the vertical power bus from the other vertical phases and the horizontal power bus.

The standard vertical power bus is a copper tube rated 300A above and below the horizontal power bus for an effective 600A rating. An optional copper rod rated 600A above and below the horizontal power bus for an effective 1200A rating is available.

The vertical power bus is tin-plated or silver-plated. The plating of the vertical power bus matches the plating of the horizontal power bus.

### **Horizontal Ground Bus**

The horizontal ground bus is unplated copper or optional tin-plated copper and can be located in the top and/or bottom horizontal wireway.

The 1/4" x 1" (6.35mm x 25.4mm) horizontal ground bus has an effective 500A continuous rating and the 1/4" x 2" (6.35mm x 50.8mm) has an effective 900A continuous rating.

The horizontal ground bus has various sized holes evenly spaced along the length for making ground connections.

A pressure type mechanical lug is mounted on the horizontal ground bus in the incoming line section.

An optional outgoing equipment ground lug can also be mounted on horizontal ground bus.

### **Vertical Ground Bus**

A 3/16" x 3/4" (4.74mm x 19.05mm) zinc-plated vertical plug-in ground bus is provided in each standard vertical section. Optional 3/16" x 3/4" (4.74mm x 19.05mm) unplated copper or tin-plated copper vertical plug-in ground bus is available. The vertical plug-in ground bus is mechanically connected to the horizontal ground bus forming a complete internal grounding system.

The vertical plug-in ground bus in combination with the unit ground stab establishes a first make, last break operation of the ground connection with respect to the power connects.

An optional 3/16" x 3/4" (4.74mm x 19.05mm) unplated or tin-plated copper vertical unit load is available. The vertical unit load ground bus is mechanically connected to the horizontal ground bus.

The vertical unit load ground bus in combination with the unit load connector provides a termination point for the load ground cable at the unit. This fixed

connection does not need to be removed when withdrawing the unit from the MCC.

## Horizontal Neutral Bus

The horizontal neutral bus, when specified for four-wire systems, is provided across the full width of the MCC and located above or below the horizontal power bus. Connections to the neutral bus are made through neutral connection plates mounted in the horizontal wireways of various vertical sections. A neutral connection plate is also provided for the termination of the incoming neutral line.

An optional vertical neutral bus which replaces the collection of neutral connection plates is available. This vertical neutral bus is located in a 9" (228mm) wide vertical wireway and mechanically connected to the horizontal neutral bus.

## Incoming Line Lug Compartment

Main incoming line lug compartments are available in either top or bottom incoming and utilize mechanical or crimp compression lugs. Compartments are front accessible.

NEMA 2-hole spacing (1-3/4" [44.45mm] between hole centers) and lugs for either aluminum or copper conductors are used.

Refer to Publication 2100-CA001x-EN-P for the complete offering of incoming line lug compartments for the MCC.

## Main Fusible Disconnect

Main fusible disconnect units consist of a heavy duty switch and fuse block assembly. The unit is front accessible and has removable protective barriers on the line side reducing the possibility of accidental contact with line terminals. Main fusible disconnect units are frame mounted (hardwired to horizontal power bus) and must be located at top or bottom of the vertical section.

Main fusible disconnects through 600A are supplied with either Class J, R or H fuse blocks while mains 800A and above are supplied with Class L fuse blocks

Main fusible disconnect switches rated through 400A have visible blade type movable contacts.

Main fusible disconnects rate 600-2000A incorporate a bolted pressure contact switch with visible blades and viewing window.

Main fusible disconnect switches rated through 800A are suitable for service entrance equipment while mains rated 1200A and above may require ground fault protection for service entrance labeling.

Refer to Publication 2100-CA001<sub>x</sub>-EN-P for the complete offering of main fusible disconnect switches for the MCC.

## Main Circuit Breaker

Main circuit breaker units have inverse time (thermal magnetic or electronic) circuit breakers. The unit is front accessible and has removable protective barriers on the line side reducing the possibility of accidental contact with line terminals. Main circuit breaker units are frame mounted and must be located at top or bottom of section.

Refer to Publication 2100-CA001<sub>x</sub>-EN-P for the complete offering of main circuit breakers for the MCC.

## MCC Unit Design

Plug-in units consist of unit assembly, unit support pan and unit door assembly.

Plug-in units are supported and guided by removable unit support pans. Rearranging unit support pans can be accomplished without the use of tools.

Units are designed in 0.5 space factor increments. Each 0.5 space factor is 6.5" (165.1mm) high.

Units are held securely in the section when inserted. Units are also designed so they cannot be inserted or withdrawn when the disconnect means is in the ON position.

- 0.5 space factor units use a single latch /interlock mechanism. This mechanism allows the unit to be held secure in two positions: Normal operating - where the power stabs are engaged with the vertical power bus, and service position - where the power stabs are disconnected from the vertical power bus, but separate control power can still be connected. With the unit fully inserted in the normal operating position, the latch/interlock mechanism is engaged with a bushing on the unit support pan. This securely holds the unit in the vertical section and doesn't allow the unit to be removed with the handle in the ON position.
- 1.0 space factor and larger units use front mounted latches to secure the unit in the vertical section. There is at least one latch at the top and one latch at the bottom of the unit. Additionally, an interlock mechanism linked to the disconnect handle engages with the unit support pan above preventing the unit from being removed when the disconnect means is in the ON position. The interlock can also be used to secure the unit in a service position.



The interlock mechanisms can be padlocked in the service position. They can also be padlocked when the unit is withdrawn to prevent the insertion of the unit into a vertical section.

## Power Stab Assembly

The two-piece stab housing is made of high strength, non-tracking glass polyester material and provides a separate isolated pathway for each phase.

The power cable connection at the plug-in stab is made with a maintenance free crimp style connection. There is no exposed wiring at the back of the unit between the disconnecting means and the plug-in stabs.

Unit plug-in power stabs are free-floating and self aligning.

Unit plug-in power stabs rated 240A are tin-plated copper for a low resistance connection and are designed to tighten during heavy current surges.

Unit plug-in power stabs are backed by stainless steel spring clips to provide and maintain a high pressure, four-point connection to the vertical power bus.

## Disconnect Handle Mechanism

An industrial, heavy duty, flange mounted handle mechanism is supplied for the control of the disconnecting means in each unit. The handle mechanism is engaged with the disconnecting means at all times as an integral part of the unit regardless of the position of the door.

The disconnect handle is made of non-conductive, 30% glass filled Type 6 nylon material.

The disconnect handle operates in the vertical plane for 1.0 space factor and larger units and in the horizontal plane for 0.5 space factor units.

The ON-OFF condition for the disconnect means is indicated by:

- Handle position
- Red and green colored indicators
- The words ON and OFF
- International symbols I (ON) and O (OFF)
- Pictorials representing handle positions (ON, OFF, and TRIPPED) for circuit breaker units

The disconnect handle can be locked in the OFF position with up to three (3) 3/8" (9.5mm) diameter shackle padlocks and in the ON position with one (1) 3/8" (9.5mm) shackle padlock.

The disconnect handle of all units is interlocked with the unit door so the disconnect means cannot be switched to the ON position unless the door is closed. This interlock also prevents opening the door unless the disconnect means is in the OFF position. An externally operated defeater is provided for access to the unit without interrupting service.

The disconnect handle is interlocked with the unit so the unit cannot be inserted or withdrawn with the disconnect handle in the ON position.

## Disconnecting Means

Fusible disconnect switches are available in MCC units. The fusible disconnect switches have visible blade type movable contacts and supplied with Class J, R, H, L, HRCII-C or CC fuse clips. Fusible disconnect requirements above 400A use a bolted pressure contact switch with visible blade disconnect mechanism.

Circuit breaker disconnects are available in MCC units. Horsepower rated MCC units are provided with instantaneous circuit breakers (HMCP) or with inverse time (thermal magnetic or electronic) circuit breakers. Current rated MCC units are provided with inverse time (thermal magnetic or electronic) circuit breakers.

## Terminal Blocks

Control terminal blocks, when specified, are front accessible in the unit and located at the bottom. The terminal blocks are pull-apart type, rated 25A, 600V (#12 AWG max), for plug-in units and fixed type, 55A, 600V (#8 AWG max), for frame mounted units. The exception is 0.5 space factor Bulletin 2100 and 2400 units where the pull-apart terminal blocks are rated 10A, 300V (#14 AWG max). Terminal markings are provided.

Pull-apart type power terminal blocks rated 60A, 600V (#4 AWG max) are supplied for Bulletin 2100 NEMA Size 1 and 2 starter units. Fixed type power terminal blocks rated 175A, 600V (2/0 AWG max) are supplied for Bulletin 2100 NEMA Size 3 starter units. Power terminal blocks are not provided in Bulletin 2100 0.5 space factor units, Bulletin 2100 NEMA Size 4 and larger starter units or Bulletin 2400 units.

## Control Wiring

Standard control wire for Bulletin 2100 units is copper #16 AWG MTW (TEW) 90°C (194°F), VW-1 rated. Optional copper #14 AWG (tinned) MTW (TEW) 90°C (194°F), VW-1 rated and copper #14 AWG (tinned) SIS 90°C (194°F) control wire is available.

Standard control wire for Bulletin 2400 units is copper #18 AWG MTW 90°C (194°F). Optional copper #16 AWG MTW 90°C (194°F) control wire is available.

Standard wire numbers are ink-jet printed on both ends of the control wire. Optional Brady Datab, heat shrink or sleeve type wire markers are available.

## Power Wire

Power wire is 90°C (194°F) minimum, VW-1 rated. Minimum size used is #10 AWG.

## Control Power

Unit control power is provided by a control circuit transformer, a separate control source, or common control.

- The control circuit transformer is mounted in the unit. The secondary side of the control circuit transformer has one leg fused and the other leg grounded. Primary protection is provided by primary fusing.
- The separate control source has an available auxiliary contact on the disconnect means and an option for separate control fuse.
- The common control source operates at line voltage with an option for common control fusing.

## Pilot Devices

Pilot devices, when specified, will be mounted through the door for 0.5 space factor units and in a door mounted polyester control station for 1.0 space factor and larger units. The control station is easily removed using captive screws.

Generally, Bulletin 800T pilot devices are used for Bulletin 2100 units, except when four or more pilot devices are required, then Bulletin 800E pilot devices are used. Up to three Bulletin 800T or six Bulletin 800E pilot devices can be mounted in the control station. Bulletin 2100 0.5 space factor units can have up to three Bulletin 800E pilot devices.

Bulletin 800E pilot devices are used for Bulletin 2400 units. Up to three Bulletin 800E pilot devices can be specified for Bulletin 2400 0.5 space factor units. Up to six Bulletin 800E pilot devices can be specified for Bulletin 2400 1.0 space factor and larger units.

## Unit Doors

Each unit is provided with a removable door mounted on removable pin type hinges which allow the door to open at least 110 degrees. The unit doors are removable from any location in the MCC without disturbing any other unit doors. The unit door is fastened to the structure so it can be closed to cover the unit space when the unit is removed. The unit doors are held closed with ¼-turn pawl type latches. Units with overload relays will have a low profile external reset button.

## Nameplates

The MCC master nameplate, when specified, is located on the top vertical wireway cover.

The MCC master nameplate is 6" x 2" (152.5mm x 50.8mm) with black lettering on a white background. The nameplate can have up to five lines of engraving.

Unit nameplates are provided. The dimensions are 3-5/8" x 1-1/8" (92.07mm x 28.57mm).

- As standard, clear cardholders are provided. Printed cards can be inserted into the cardholder.
- Optional engraved acrylic nameplates are available. They can be white with black lettering or black with white lettering.
- Optional engraved phenolic nameplates are available. They can be white with black lettering, black with white lettering or red with white lettering.
- Engraved unit nameplates can have three or four lines of engraving as follows:

3-line nameplates:

- 0.22" (5.59mm) letter size
- 1st line 17 characters
- 2nd line 15 characters
- 3rd line 17 characters

4-line nameplates:

- 0.18" (4.57mm) letter size
- 1st line 25 characters
- 2nd line 22 characters
- 3rd line 22 characters
- 4th line 25 characters

Nameplates are secured using two steel self-tapping screws. Stainless steel screws are available.

## MCC Unit Types

Refer to Publication 2100-CA001x-EN-P for the complete offering of MCC units.

## DeviceNet™ in the MCC

### DeviceNet Cabling

The insulating rating of the DeviceNet cable is at least equal to that of the maximum circuit voltage applied to any conductor within the enclosure or

wireway per National Electrical Code [article 300-3(c)(1)] and the Canadian Electrical Code (Rule 12-904). No special separation, barriers or internal conduit is required.

The DeviceNet cable used for trunk lines is flat cable rated 8 amperes, 600V, Class 1.

The DeviceNet cable used for drop lines to connect DeviceNet units is round cable rated 8 amperes, 600V, Class 1.

## **DeviceNet Cable Layout**

The DeviceNet trunk line is routed through the MCC behind barriers that isolate the cable from the unit space and wireways to prevent accidental damage during MCC installation.

Six DeviceNet ports are provided in the rear of each standard vertical wireway.

Each DeviceNet component in an MCC unit is connected to a DeviceNet port located in the vertical wireway.

The addition or removal of a unit from the DeviceNet system does not interrupt the operation of other units in the system.

## **DeviceNet Power Supply**

The DeviceNet system within the MCC requires a power supply that provides 24Vdc rated no less than 8.0 amperes. Selection of a quality power supply is essential for reliable system operation. To ensure integrity, strong consideration should be given to using Allen-Bradley's 8A DeviceNet Power Supply unit (2100-DPS\_\_\_) and placing it in the MCC.

## **DeviceNet Scanner Modules**

The DeviceNet system in the MCC requires a DeviceNet scanner module in the MCC or mounted remotely.

As an alternative to a traditional DeviceNet scanner module, linking devices can be used to link different communication networks to the MCC DeviceNet system (such as linking ControlNet to DeviceNet or Ethernet to DeviceNet).

## **DeviceNet System Performance**

The DeviceNet system in the MCC is designed to operate at 500k Baud to maximize performance, unless precluded by the cumulative length of the trunk and drop lines.

The DeviceNet system in the MCC is qualified to communicate and perform under normal and adverse electrical environments (e.g., contactor electrical operation, contactor jogging duty, and unit short circuit fault).

## **DeviceNet Units**

Each unit is provided with a DeviceNet component.

Starter units are provided with E3 or E3 Plus overload relays or eutectic or solid-state overload relays with a DeviceNet Starter Auxiliary.

Contactor units are provided with a DeviceNet Starter Auxiliary.

Variable frequency drives are provided with a DeviceNet communication module.

Solid-state controllers are provided with DeviceNet communication modules and, in some instances, a DeviceNet Starter Auxiliary.

Fusible disconnect and circuit breaker feeder circuits are provided with a DeviceNet Starter Auxiliary.

## **Programming of Parameters**

The DeviceNet MAC ID number (node address) is programmed for each unit as specified by the user. All other parameters are left at the factory default setting.

The Device components are configured to operate at the specified baud rate.

## **Software**

As required, the DeviceNet MCC will be provided with the IntelliCENTER software. In these cases, the MCC is considered an IntelliCENTER MCC and labeled as such.

## **Testing**

The DeviceNet MCC is powered up, configured and tested to ensure each unit communicates properly.

For more information on DeviceNet MCCs refer to Publication 2100-TD019x-EN-P.

**Notes:**

**[www.rockwellautomation.com](http://www.rockwellautomation.com)**

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