



# Compact Circuit Protector (CCP)

## Application Note

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Illustrations courtesy of IAEI

## Compact Circuit Protector

### Objective:

This application note explains the use and application of the Cooper Bussmann® Compact Circuit Protector (CCP) in industrial control applications, such as industrial control panels, industrial machinery and HVAC equipment. The CCP is a disconnect switch that incorporates the benefits of fusible overcurrent protection in the smallest footprint available in the industry. The CCP is available in four different fusible variations: Class CC, Low-Peak® CUBEFuse® (with Class J performance characteristics), 10X38, and DC. There are many possible considerations in the selection of

disconnecting means and overcurrent protection for industrial control applications. The most important considerations depend upon the specific application for initial and possible future installations. The CCP offers increased voltage ratings, higher interrupting ratings (IR), enhanced short-circuit current ratings (SCCR), superior protection of circuit components, improved reliability, and flexibility of application, as well as decreased size and cost when compared to equivalently rated alternatives. For industrial control applications, the CCP is the smaller, simpler, better solution as shown in Table 1.

**Table 1 – Features and Benefits of the CCP**

	Feature	Benefit
<b>Smaller</b>	<ul style="list-style-type: none"> <li>• 1/3 the space (footprint) of equivalent rated circuit breaker</li> <li>• 2/3 the space (footprint) of equivalent rated traditional fusible disconnects</li> </ul>	<ul style="list-style-type: none"> <li>• Space-saving design for reduced cost</li> </ul>
<b>Simpler</b>	<b>All Versions</b>	
	<ul style="list-style-type: none"> <li>• DIN-rail mounted</li> </ul>	<ul style="list-style-type: none"> <li>• Ease of installation</li> </ul>
	<ul style="list-style-type: none"> <li>• Local open-fuse indication</li> </ul>	<ul style="list-style-type: none"> <li>• Ease of maintenance</li> </ul>
	<ul style="list-style-type: none"> <li>• Load-break disconnect rated</li> <li>• Lock-out/tag-out provisions</li> <li>• Finger-safe - IP20 compliant with 10AWG or larger</li> </ul>	<ul style="list-style-type: none"> <li>• Disconnecting means, isolation of equipment and enhanced safety</li> </ul>
	<ul style="list-style-type: none"> <li>• DIN 43880 compliant</li> </ul>	<ul style="list-style-type: none"> <li>• Device interchangeability for global design capabilities</li> </ul>
	<b>CCP-Class CC or CCP-CUBEFuse</b>	
	<ul style="list-style-type: none"> <li>• UL 98 Listed and cULus Certified</li> <li>• HP rated</li> </ul>	<ul style="list-style-type: none"> <li>• Suitable for use on main, feeder and branch circuits</li> </ul>
	<ul style="list-style-type: none"> <li>• 30A (Class CC version), 30A or 60A (CUBEFuse version), 600Vac, (straight rated not slash rated)</li> </ul>	<ul style="list-style-type: none"> <li>• Use on any low voltage AC system (solidly grounded, resistance grounded, corner grounded or ungrounded)</li> </ul>
	<ul style="list-style-type: none"> <li>• 200kA IR</li> </ul>	<ul style="list-style-type: none"> <li>• Highest possible interrupting rating</li> </ul>
	<ul style="list-style-type: none"> <li>• Accepts only Class CC fuses or CUBEFuse</li> </ul>	<ul style="list-style-type: none"> <li>• Rejects fuses with lower voltage and interrupting ratings</li> </ul>
	<ul style="list-style-type: none"> <li>• Current-limiting overcurrent protection</li> </ul>	<ul style="list-style-type: none"> <li>• Increased component SCCR combination ratings</li> </ul>
	<ul style="list-style-type: none"> <li>• Meets NFPA 79 and UL 508A requirements for utilization of 16AWG and 18AWG conductors</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced wiring costs for NPFA 79 and UL 508A industrial machinery applications</li> </ul>
	<b>CCP-10x38</b>	
	<ul style="list-style-type: none"> <li>• 30A, 250Vac or less (voltage and IR varies with installed midget fuse)</li> <li>• UL 508 Listed and cULus</li> <li>• 32A, 600Vac or less, (voltage and IR varies with installed 10x38 IEC fuse)</li> <li>• IEC 60947-3 AC23A with 32A aM or 25A gG IEC fuse</li> </ul>	<ul style="list-style-type: none"> <li>• Flexibility of use for IEC applications or UL supplemental protection applications</li> </ul>
<b>CCP-DC</b>		
<ul style="list-style-type: none"> <li>• 80Vdc or less, (voltage and IR varies with installed fuse rating)</li> </ul>	<ul style="list-style-type: none"> <li>• Low-cost DC rated disconnect with overcurrent protection</li> </ul>	
<ul style="list-style-type: none"> <li>• UL 98 Listed and cULus Certified (Class CC version), 20kA IR</li> </ul>	<ul style="list-style-type: none"> <li>• Branch Circuit overcurrent protection available with Class CC version</li> </ul>	
<b>Better</b>	<ul style="list-style-type: none"> <li>• Higher ratings: voltage, interrupting rating and SCCR</li> </ul>	<ul style="list-style-type: none"> <li>• Ease of design, flexibility of use and reduced misapplications</li> </ul>
	<ul style="list-style-type: none"> <li>• Increased component protection</li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced safety and equipment SCCR</li> </ul>
	<ul style="list-style-type: none"> <li>• Reliability of overcurrent protection</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance is not required for fuses</li> </ul>
	<ul style="list-style-type: none"> <li>• Accessories – auxiliary contacts and open-fuse indication options</li> </ul>	<ul style="list-style-type: none"> <li>• Instant remote communication (switch and fuse status)</li> </ul>

## Compact Circuit Protector - Product Overview & Accessories

### CCP-Class CC (AC applications)



Catalog number:  
CCP-1-30CC (1-Pole),  
CCP-2-30CC (2-Pole),  
CCP-3-30CC (3-Pole)



Recommended  
Fuses:  
LP-CC, KTK-R  
or FNQ-R

### CCP-CUBEFuse (AC applications)



Catalog number:  
30A maximum  
CCP-1-30CF (1-Pole),  
CCP-2-30CF (2-Pole),  
CCP-3-30CF (3-Pole)

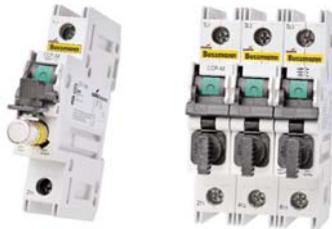


Recommended  
Fuses:  
TCF  
(indicating)

60A maximum  
CCP-1-60CF (1-Pole),  
CCP-2-60CF (2-Pole),  
CCP-3-60CF (3-Pole)

TCF\_RN  
(non-indicating)

### CCP-10x38 (AC applications)



Catalog number:  
CCP-1-30M (1-Pole),  
CCP-2-30M (2-Pole),  
CCP-3-30M (3-Pole)



Recommended  
Fuses:  
KTK, FNQ, FNM,  
C10G or C10M

### CCP-DC (DC applications)



Catalog number:  
CCP-1-DCC  
(Class CC fuse, 1-pole)

Recommended  
Fuse:  
LP-CC



Catalog number:  
CCP-1-DCM  
(Midget fuse,  
1-pole)

Recommended  
Fuse:  
KLM

## Accessories



Catalog number:  
CCP-PLC-IND

Wired remote fuse  
indication for PLC  
applications



Catalog number:  
CCP-AUX

Auxiliary contacts  
NO+NC  
for switch status



Catalog number:  
ICM-DIN

Intelligent circuit monitor for  
Cooper InVision™  
Downtime Reduction System

## General Overcurrent Protection Considerations:

The CCP provides a simple, compact, cost-effective solution with reliable overcurrent protection and load-break disconnect capabilities not possible with existing fuseholders, fusible switches or mechanical overcurrent devices.

## Comparison – Fusible Solutions:

The CCP is very versatile since it is the smallest, most cost effective UL 98 branch circuit disconnect with branch circuit rated overcurrent protection. The CCP can replace Class CC

or J fuse holders with the added benefit of providing a disconnecting means. It can be used to replace a UL 508 disconnect (marked manual motor controller) combined with fuses providing a motor circuit disconnect. Compared to existing Class CC or J fusible UL 98 disconnects, the CCP has the same ratings and capabilities but with smaller size and lower cost. Table 2 illustrates the size and application comparison of fusible overcurrent devices.

Red Italic text indicates limitations of devices.

**Table 2 – CCP Compared to Fuse Holder, Disconnect with Fuses, and Fusible Disconnect**

	UL 98 Listed CCP with Class CC Fuses or CUBEFuse®	UL 4248 Listed Class CC Fuse Holder with Class CC Fuses or CUBEFuse with Fuse Holder	UL 4248 Listed Class CC Fuse Holder with Class CC Fuses and UL 508 Listed Disconnect (Manual Motor Controller)	UL 508 Listed Disconnect (Manual Motor Controller) with Integral Class CC Fuses	UL 98 Listed Disconnect with UL 4248 Listed Class CC Fuse Holder with Class CC Fuses	UL 98 Listed Class CC Fusible Disconnect with Class CC or J Fuses
Relative Size Comparison						
Branch Circuit Overcurrent Protection	Yes	Yes	Yes	Yes	Yes	Yes
Branch Circuit Disconnect	Yes	<i>No</i>	<i>No</i>	<i>No</i>	Yes	Yes
Motor Circuit Disconnect	Yes	<i>No</i>	Yes*	Yes*	Yes	Yes
Feeder Circuit Overcurrent Protection	Yes	Yes	<i>N/A**</i>	<i>N/A**</i>	Yes	Yes
Feeder Circuit Disconnect	Yes	<i>No</i>	<i>No</i>	<i>No</i>	Yes	Yes
Cost	\$\$-\$\$\$	\$\$-\$	\$\$\$***	\$\$\$	\$\$\$\$***	\$\$\$\$\$

\*Manual motor controller must be additionally marked "Suitable as Motor Disconnect" and be installed on the loadside of the final Branch Circuit overcurrent protective device

\*\* Class CC fuse can provide feeder circuit overcurrent protection but UL 508 manual motor controller cannot be applied in a feeder circuit

\*\*\*CUBEFuse with fuse holder could be used in place of Class CC fuse holder with Class CC fuses at additional cost

## Comparison - Circuit Breaker Solutions:

The CCP can replace low rated circuit breakers or misapplied supplementary protectors in branch circuit applications and provide a higher short-circuit current rating at a similar or lower cost. The CCP is a cost-effective solution similar in size to a supplementary protector or lighting style circuit breaker, but with higher voltage ratings and higher interrupting ratings while providing better

current-limiting overcurrent protection. Compared to an equivalently rated industrial circuit breaker, the CCP is one-third the size. Table 3 shows the size and rating differences between the CCP and a supplementary protector, lighting circuit breaker (240V, 480/277V or 600/347V) and fully rated (600V) industrial circuit breaker. Red Italic text indicates devices limitations.

**Table 3 – CCP Compared to Supplementary Protector, Lighting Circuit Breakers, and Fully Rated Industrial Circuit Breakers**

	UL 98 Listed CCP with Class CC Fuses or CUBEFuse®	UL 1077 Recognized Supplementary Protector	UL 489 Listed Circuit Breaker	UL 489 Listed Circuit Breaker	UL 489 Listed Circuit Breaker
Relative Size Comparison					
Branch or Feeder Circuit Overcurrent Protection	Yes	<i>No</i>	Yes	Yes	Yes
Branch or Feeder Circuit Disconnect	Yes	<i>No</i>	Yes	Yes	Yes
Voltage Rating (AC)	600V	<i>Typically 277V or less</i>	<i>Typically 240V or less</i>	<i>Typically 480/277V or 600/347V†</i>	Typically 600V or less
Interrupting Rating	200kA	<i>Typically 5-10kA</i>	<i>Typically 10-14kA</i>	<i>Typically 14kA-18kA</i>	<i>Varies 14kA -100kA*</i>
Overcurrent Protection Method	Class CC fuse or CUBEFuse	Thermal magnetic trip	Thermal magnetic trip	Thermal magnetic trip	Thermal magnetic trip
Cost	\$\$-\$\$\$	\$	\$\$	\$\$\$	\$\$\$\$

\*Cost increases as interrupting rating increases

†Limits application to solidly grounded wye systems only, not permitted on ungrounded, resistance grounded or corner grounded systems

## Control Circuit Applications:

When control circuit transformers or power supplies are tapped from the feeder circuit, UL 508A requires protection of the control circuit by a branch circuit overcurrent device. When tapped from the branch circuit, only supplemental overcurrent protection is required. However, in both cases, the equipment SCCR cannot be higher than the interrupting rating of the control circuit overcurrent device.

The CCP can be used in these applications to provide cost-effective overcurrent protection, high interrupting rating and increased equipment SCCR. Where supplemental protectors and standard circuit breakers are used, the voltage rating and interrupting rating limits the application of equipment unless more expensive circuit breakers with higher ratings are used. Table 4 compares the CCP with supplemental protectors and circuit breakers for these applications.

**Table 4 – CCP Compared to Circuit Breakers in Protection of Control Circuits**

Control Circuit Tapped from Branch Circuit	
Equipment SCCR = 200kA	Equipment SCCR = 5kA
<p>Motor branch circuit overcurrent device</p> <p>Supplemental overcurrent device permitted but may lower SCCR</p> <p>For higher SCCR utilize 200kA CCP-Class CC or CCP-CUBEFuse®</p> <p>Motor</p> <p>Power supply or control transformer</p>	<p>Motor branch circuit overcurrent device</p> <p>Supplemental overcurrent device permitted 5kA Supplementary protector</p> <p>Motor</p> <p>Power supply or control transformer</p>

Control Circuit Tapped from Feeder Circuit	
Equipment SCCR = 200kA	Equipment SCCR = 14kA - 100kA*
<p>Feeder overcurrent device</p> <p>Branch circuit overcurrent device required 200kA CCP-Class CC or CCP-CUBEFuse®</p> <p>Branch circuit overcurrent device</p> <p>Motor</p> <p>Power supply or control transformer</p>	<p>Feeder overcurrent device</p> <p>Branch circuit overcurrent device required 14kA Circuit breaker</p> <p>Branch circuit overcurrent device</p> <p>Motor</p> <p>Power supply or control transformer</p>

Note: Power supplies must be listed for use with the overcurrent device selected. A manual motor protector cannot be used for overcurrent protection of power supplies tapped from the feeder circuit or the branch circuit.

\*Cost increases with higher interrupting rating

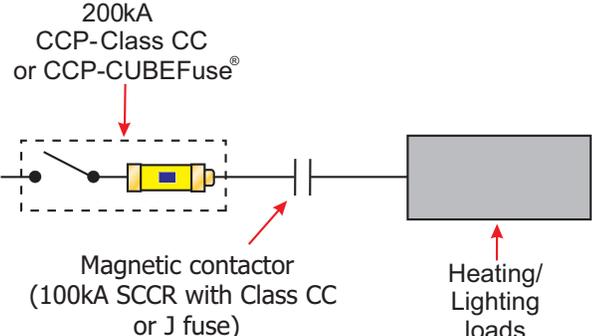
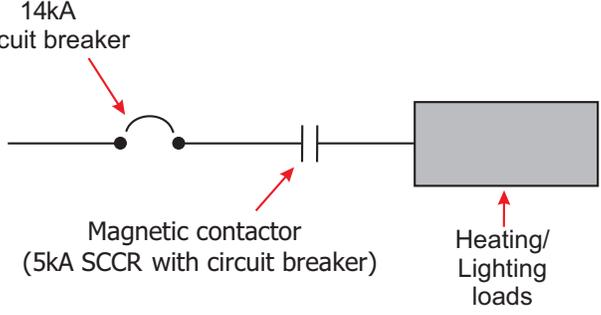
## Resistive Heating and Lighting Circuit

### Applications:

Branch circuit overcurrent devices are required for protection of resistive heating and lighting circuits. Low rated circuit breakers or misapplied supplementary protectors are sometimes used in these applications. Although the voltage and interrupting rating of the circuit breaker can be increased (resulting in increased cost), other circuit components, such as magnetic contactors, may have low short-circuit current ratings when protected by circuit breakers. The low interrupting ratings or low component SCCR will limit the equipment SCCR.

As shown in Table 5, with circuit breaker protection, the equipment is limited to an SCCR of 5kA due to the 5kA SCCR rating of the magnetic contactor when protected by a circuit breaker. The CCP is a cost-effective solution that does not limit the SCCR and can be used to raise the SCCR of components such as a magnetic contactor. Therefore, it is easier to achieve higher equipment SCCR utilizing the CCP.

**Table 5 – CCP Compared to Circuit Breakers in Protection of Heating/Lighting Circuits**

Equipment SCCR = 100kA	Equipment SCCR = 5kA
 <p>200kA CCP-Class CC or CCP-CUBEFuse®</p> <p>Magnetic contactor (100kA SCCR with Class CC or J fuse)</p> <p>Heating/ Lighting loads</p>	 <p>14kA Circuit breaker</p> <p>Magnetic contactor (5kA SCCR with circuit breaker)</p> <p>Heating/ Lighting loads</p>

## Common Misapplications in Branch Circuits

### Misuse of IEC Protective Devices and Disconnects

Sometime equipment designed and assembled to IEC electrical system and equipment standards (intended for installation in countries using the IEC electrical safety system) is shipped to the United States. This equipment may not meet the North American electrical safety system requirements, which includes the National Electrical Code®, North American product standards/certifications, such as to UL, and local installation codes/inspection by the authority having jurisdiction (AHJ). For such equipment, it is common to have IEC overcurrent protective devices protecting branch circuits. This can create issues since these IEC devices are typically not rated for overcurrent protection of branch circuits for North American electrical systems and equipment. However, if the equipment is installed in the United States, all branch circuits must be protected by UL Listed branch circuit overcurrent devices and disconnects suitably rated for the application. The CCP can be used to retrofit IEC overcurrent protection and disconnect devices in equipment for proper

installation in the United States. If done, the sizing of the CCP and overcurrent protection should be per the NEC® (National Electrical Code) and other applicable codes and standards.

### Misuse of Manual Motor Starters and Self-Protected Starters

Manual motor starters (also known as Manual Motor Protectors or MMP), are permitted to provide overload protection for motor circuits. Self-protected starters (SPS) are permitted to provide overload and short-circuit protection for motor branch circuits. However, it is not uncommon to see these devices misapplied as protection of non-motor loads and even feeder circuits. Manual motor protectors and self-protected starters can never be used for branch circuit overcurrent protection of non-motor loads such as resistive heating, lighting, power supplies, or general-purpose circuits. Also, these devices can not be used for feeder circuit protection. The CCP can replace misapplied manual motor protectors and self-protected starters in non-motor applications.

## Motor Circuit Solution Comparison:

The CCP with a magnetic starter is a cost-effective, compact solution for motor circuits. Table 6 is a size and application comparison of the CCP with a magnetic starter compared to fuse and fuseholder with a magnetic starter, self-protected starter with a magnetic contactor, fuse and fuseholder with a

manual motor protector and magnetic contactor, instantaneous-trip circuit breaker (also known as motor circuit protector or MCP) with magnetic starter, and inverse-time circuit breaker with magnetic starter.

Red italic text indicates limitations of devices.

**Table 6 – CCP and Magnetic Starter Compared to Other Motor Circuit Protective Devices**

	UL 98 Listed CCP with Class CC Fuses or CUBEFuse® and Magnetic Starter	UL 4248 Listed Class CC Fuse Holder with Class CC Fuses or CUBEFuse with Fuse Holder and Magnetic Starter	UL 508 Listed Self-Protected Starter (SPS) and Magnetic Contactor	UL 4248 Listed Class CC Fuse Holder with Class CC Fuses or CUBEFuse with Fuse Holder and Manual Motor Protector (MMP) and Magnetic Contactor	UL 489 Recognized Motor Circuit Protector (MCP) and Magnetic Starter**	UL 489 Listed Circuit Breaker and Magnetic Starter
Branch Circuit Overcurrent Protection	Yes	Yes	Yes†††	Yes	Yes**	Yes
Motor Circuit Disconnect	Yes	No	Yes	Yes*	Yes**	Yes
Voltage Rating	600V	600V	Typically 480/277V† or 600/347V†	Typically 480V or 600V	Typically 600V	Typically 600V
SCCR	Typically 100kA	Typically 100kA	Typically 30kA or 65kA††	Typically 30kA or 65kA††	Varies 14kA to 100kA***	Varies 14kA to 100kA***
High SCCR with Multiple Manufacturers	Yes	Yes	No	No	No	No
Cost	\$\$-\$\$\$	\$\$-	\$\$-	\$\$\$-\$\$\$\$	\$\$\$\$	\$\$\$\$\$

\* If on loadside of the final Branch Circuit overcurrent device and MMP is marked "Suitable as Motor Disconnect"

\*\* Must be part of a listed combination, typically from same manufacturer

\*\*\* Cost increases as interrupting rating increases

† Limits application to solidly grounded wye systems only, not permitted on ungrounded, resistance grounded or corner grounded systems

†† SCCR is lower at higher voltage rating

††† May require additional accessories such as line side terminals, to be used as a self-protected starter

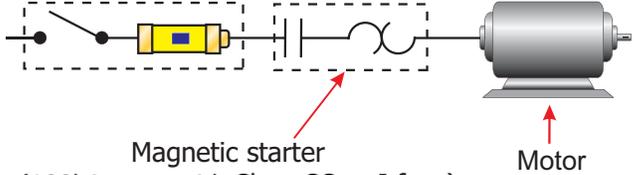
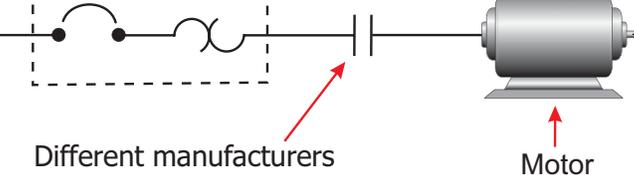
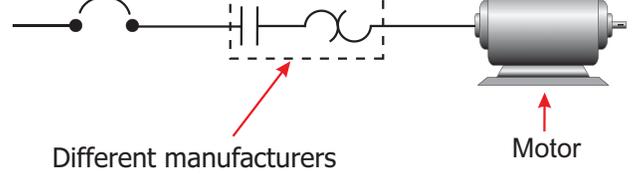
## Motor Circuit Applications:

In motor circuit applications, several important considerations must be analyzed to determine the best solution for the specific application. The first consideration is the ability to disconnect, isolate and lockout/tagout the motor for maintenance and enhanced safety. Other important considerations to assure flexibility of design and applications for motor circuits are:

- Increased interrupting ratings and short-circuit current ratings
- Increased voltage ratings
- Ratings with variety of components and manufacturers

Table 7 compares the three most common motor circuit alternatives that provide disconnection, isolation and lockout/tagout capabilities and the effect on the other important considerations.

**Table 7 – CCP and Magnetic Starter Compared with Other Motor Circuit Protective Devices**

CCP with Magnetic Starter – Equipment SCCR = 100kA	
<ul style="list-style-type: none"> <li>• The CCP-Class CC or CCP-CUBEFuse® (with Class J performance characteristics) and magnetic starter can achieve a high SCCR (100kA) at a full voltage rating (600V) with many magnetic starter manufacturers in a smaller footprint.</li> </ul>	<p>200kA CCP-Class CC or CCP-CUBEFuse®</p>  <p>Magnetic starter (100kA SCCR with Class CC or J fuse)</p> <p>Motor</p>
Self-Protected Starter with Contactor – Equipment SCCR = 5kA-65kA	
<ul style="list-style-type: none"> <li>• Self-protected starters generally have a relatively high SCCR but the corresponding voltage rating is typically slash rated (480/277V). Slash rated devices (480/277V) cannot be used on 480V (or higher) ungrounded, corner grounded or resistance grounded systems (which are becoming more common).</li> <li>• If a magnetic contactor from a different manufacturer is utilized, the magnetic contactor will limit the equipment SCCR, since devices from different manufacturers have not typically been tested above the standard short-circuit current rating (5kA). Similarly, some manufacturers have not tested magnetic contactors with self-protected starters at higher short-circuit current ratings.</li> </ul>	<p>65kA 480Y/277V Self-protected starter</p>  <p>Different manufacturers magnetic contactor (5kA SCCR with SPS)</p> <p>Motor</p>
Circuit Breaker or MCP with Magnetic Starter – Equipment SCCR = 5kA-100kA	
<ul style="list-style-type: none"> <li>• Circuit breakers and magnetic starters can be used, but the SCCR ratings will be limited (typically 5kA) if the magnetic starter is from a different manufacturer than the circuit breaker.</li> <li>• MCPs and magnetic starters can be used only if part of a listed combination (typically must be from the same manufacturer).</li> <li>• Circuit breakers and MCPs can have a high SCCR if a high interrupting rating circuit breaker or MCP is selected for use with a magnetic starter from the same manufacturer. However, this can greatly increase the cost, and locks the user into only one manufacturer.</li> </ul>	<p>14kA Circuit breaker</p>  <p>Different manufacturers magnetic starter (5kA SCCR with circuit breaker)</p> <p>Motor</p>

## Power Electronics Solution Comparison:

The CCP with a drive is a cost-effective, compact solution for protection of power electronic devices, such as variable frequency drives (VFD). Table 8 is a size and application

comparison of the CCP with a drive compared to fuse and fuse holder with a drive, self-protected starter with a drive, MCP with a drive, and a circuit breaker with a drive. Red italic text indicates limitations of devices.

**Table 8 – CCP and Drive Compared with Other Overcurrent Protective Devices and Drives**

	UL 98 Listed CCP-Class CC or CCP-CUBEFuse® and VFD	UL 4248 Listed Class CC Fuse Holder with Class CC Fuses or CUBEFuse with Fuse Holder and VFD	UL 508 Listed Self-Protected Starter (SPS) and and VFD	UL 489 Recognized Motor Circuit Protector (MCP) and and VFD*	UL 489 Listed Circuit Breaker and VFD
Branch Circuit Overcurrent Protection	Yes	Yes	Yes	Yes*	Yes
Motor Circuit Disconnect	Yes	<i>No</i>	Yes	Yes*	Yes
Voltage Rating	600V	600V	<i>Typically 480/277V††</i>	Typically 600V	Typically 600V
SCCR	Typically 100kA**	Typically 100kA**	<i>Typically 5kA-65kA***</i>	<i>Typically 5kA†</i>	<i>Typically 5kA</i>
High SCCR With Multiple	Yes	Yes	<i>No</i>	<i>No</i>	<i>No</i>
Manufacturers Cost	\$\$-\$\$\$	\$\$-\$\$	\$\$	\$\$\$\$	\$\$\$\$

\* Must be part of a listed combination

\*\* Verify SCCR rating with drive manufacturer

\*\*\* 65kA SCCR may be available if self-protected starter is from the same manufacturer as the drive and tested above standard short-circuit current ratings

† Only if MCP is from the same manufacturer and listed for use with the drive

†† Limits application to solidly grounded wye systems only, not permitted on ungrounded, resistance grounded or corner grounded systems

## Power Electronics Applications:

In power electronics applications, the same considerations exist as motor circuit applications. Table 9 compares the three most common power electronic overcurrent protective

device options and the impact on the SCCR and other important considerations.

**Table 9 – CCP and Drive Compared with Other Overcurrent Protective Devices and Drives**

<b>CCP with Drive – Equipment SCCR = 100kA</b>	
<ul style="list-style-type: none"> <li>The CCP-Class CC or CCP-CUBEFuse® (with Class J performance characteristics) in combination with a VFD and magnetic contactor can achieve a high SCCR (100kA) at a full voltage rating (600V) in a smaller footprint. Consult Cooper Bussmann for drives with high SCCR ratings.</li> </ul>	<p>200kA CCP-Class CC or CCP-CUBEFuse®</p> <p>VFD (200kA SCCR with Class CC or J fuse)</p> <p>Magnetic contactor (100kA SCCR with Class CC fuse)</p>
<b>Self Protected Starter with Drive – Equipment SCCR = 5kA-65kA</b>	
<ul style="list-style-type: none"> <li>If the drive manufacturer has not tested the drive with self-protected starters and contactors, the SCCR is typically 5kA.</li> <li>If the drive manufacturer additionally offers self-protected starters and magnetic contactors, it may be possible to use the combination of these components to increase the SCCR (65kA typical). However, while the SCCR may be increased, the voltage rating is typically slash rated (480/277V) which limits the application to only solidly grounded wye systems (480/277V or less) as well as locking the user into one manufacturer.</li> </ul>	<p>65kA 480Y/277V Self-protected starter</p> <p>VFD and magnetic contactor (5kA SCCR with self-protected starter)</p>
<b>Circuit Breaker or MCP with Drive – Equipment SCCR = 5kA</b>	
<ul style="list-style-type: none"> <li>If circuit breakers are used, especially if different than the manufacturer of the VFD and magnetic contactor, the SCCR of the VFD and magnetic contactor, is typically limited to 5kA. Motor circuit protectors can only be used where listed for use with the VFD.</li> </ul>	<p>14kA Circuit breaker</p> <p>VFD (5kA SCCR with circuit breaker)</p> <p>Magnetic contactor (5kA SCCR with circuit breaker)</p>

## 16AWG and 18AWG Conductors in Industrial Machinery:

Typically 14AWG conductors or larger are required for use in power circuits. However, 16AWG and 18AWG conductors are permitted for motor and non-motor circuits under specified conditions per NFPA 79 (12.6.1.1 and 12.6.1.2) and UL 508A (66.5.4 Exception and Table 66.1A). The use of

16AWG and 18AWG conductors reduces wiring costs in industrial machinery. Table 10 below illustrates where Class CC or J fuses (including CUBEFuse<sup>®</sup>) can be utilized for protection of 16AWG and 18AWG conductors in power circuits per NFPA 79 and UL 508A.

**Table 10 – Sizing Chart for Class CC or J Fuse Protection of 16AWG and 18AWG Conductors in Power Circuits of Industrial Machinery per NFPA 79 and UL 508A**

Conductor Size	Max Load Ampacity	Load Type	Max LP-CC Fuse Size	Max LPJ or CUBEFuse Fuse Size	Motor Overload Relay Trip Class
16AWG	8	Non-motor	10A	10A	–
	8	Motor	300% of motor FLA or next standard size*	175% of motor FLA or next standard size*	Class 10
	5.5	Motor	300% of motor FLA or next standard size*	175% of motor FLA or next standard size*	Class 20
18AWG	5.6	Non-motor	7A	7A	–
	5	Motor	300% of motor FLA or next standard size*	175% of motor FLA or next standard size*	Class 10
	3.5	Motor	300% of motor FLA or next standard size*	175% of motor FLA or next standard size*	Class 20

\*Standard size for fuses are 1, 3, 6, 10, 15, 20, 25 and 30. Where the starting current of the motor opens the fuse, the maximum setting can be increased, but not exceed 400% for LP-CC or 225% for LPJ or CUBEFuse.

Note: 16AWG and 18AWG conductors are easily damaged due to fault currents. Many overcurrent protective devices are unable to protect these small conductors. However, the Small Wire Working Group of the NFPA 79 technical committee performed tests and evaluated criteria to demonstrate that Class CC or J fuses (including CUBEFuse) are among those able to provide protection. For more information see Cooper Bussmann publication SPD (Selecting Protective Devices). UL issued a Special Service Investigation, *An Investigation of the Use of 16AWG and*

*18AWG Conductors for Power Branch Circuits in Industrial Machinery Applications*, file number E4273 to verify the test results. The analysis, test program and results can also be viewed in an IEEE paper presented at the 2002 IEEE Industrial and Commercial Power Systems Technical Conference titled, *An Investigation of the Use of 16AWG and 18AWG Conductors for Branch Circuits in Industrial Machinery Built to NFPA 79 2002*. The report and paper can be found on [www.cooperbussmann.com](http://www.cooperbussmann.com).

## Global Applications:

The CCP-Class CC and CCP-10x38 versions have the same dimensions and mounting footprint, therefore making it easier to design for global applications. The CCP-10x38 can be used with an IEC fuse where industrial equipment is shipped to a location that requires IEC rated devices. The CCP-10x38 can also be used with UL Midget fuses where UL Recognized components are allowed. The CCP-Class CC can be used with a Class CC fuse where industrial equipment is shipped to a location requiring UL Listed products.

## DC Applications:

The CCP-DC can protect, disconnect and isolate loads, up to 30A for UL applications or 32A for IEC applications at 80Vdc.

## Remote Indication Accessories:

Switch Status for the CCP can be monitored via NO+NC Auxiliary Contacts rated 5A/240Vac. The Auxiliary Contact accessory mounts on the right side of the CCP, and mechanically interlocks with the CCP switch handle. The device is a UL 98 Recognized accessory for the CCP only.

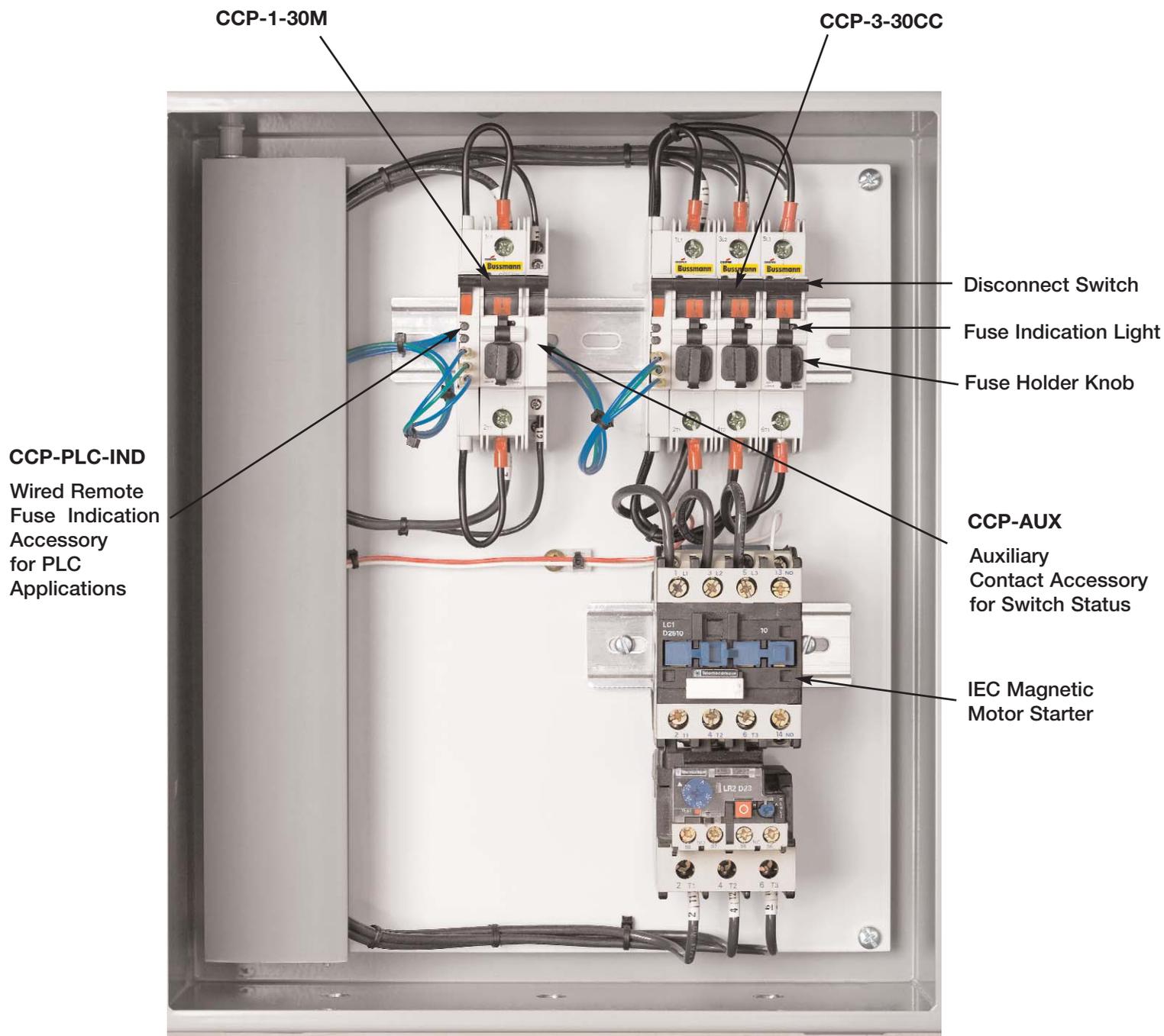
Fuse Indication can be monitored remotely via the wired remote fuse indicator. Inputs to the device are 24Vdc power and ground. Output is 30mA/24Vdc. This device mounts to the left side of the CCP with pre-wired spade connections. Two distinct LEDs indicate unit power (green) and open fuse (red). The output signal latches upon fuse opening, and is reset upon replacement of the fuse and actuation of the switch. Minimum circuit voltage required across the CCP is 100Vac for the remote indication device to operate. The device is a UL 98 Recognized accessory for the CCP only.

Fuse indication can also be monitored remotely by the Intelligent Circuit Monitor and the Cooper InVision™ Downtime Reduction System. Refer to the Cooper InVision user manual for installation information.

## Resources:

For more information on the Cooper Bussmann® CCP, visit [www.cooperbussmann.com](http://www.cooperbussmann.com).

## Example Installation of CCP & Accessories



# Cooper Bussmann: Leading Industry in Downtime Reduction, Workplace Safety & Code Compliance Solutions

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### Customer Satisfaction Team

Available to answer questions regarding Cooper Bussmann products & services Monday-Friday, 8:00 a.m. – 4:30 p.m. for all US time zones. Contact:

- Phone: 636-527-3877
- Toll-free fax: 800-544-2570
- E-mail: [busscustsat@cooperindustries.com](mailto:busscustsat@cooperindustries.com)

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## Application Engineering

Technical assistance is available to all customers. Staffed by degreed electrical engineers, this application support is available Monday-Friday, 8:00 a.m. – 5:00 p.m. Central Time. Contact:

- Phone: 636-527-1270
- Fax: 636-527-1607
- E-mail: [fusetech@cooperindustries.com](mailto:fusetech@cooperindustries.com)
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## Online Resources

Visit [www.cooperbussmann.com](http://www.cooperbussmann.com) for the following resources:

- Product search & cross-reference
- Product & technical materials
- Solutions centers for information on topical issues including arc-flash, selective coordination & short-circuit current rating
- Technical tools, like our arc-flash calculator
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