

# Switchgear

*The OEM and Installers Guide to Control  
Components for Low/Medium  
Voltage Switchgear*



# Table of Contents

1	About c3controls	2
2	Glossary of Terms	3
3	Industry Outlook	4
4	Application Isometrics	5
5	Switchgear Products	6
6	Electrical Control Components Details	7
7	c3controls Product Portfolio	8
8	White Papers	9
9	Why choose c3controls	10

## About c3controls

Since 1976 c3controls ([c3controls.com](http://c3controls.com)) has provided OEMs and electrical equipment builders a comprehensive portfolio of industrial control products that meet the most demanding applications. By maintaining strict control over the development and manufacturing of all products, c3 can provide customers extraordinary value through unmatched quality, competitive pricing, same-day shipping and a lifetime product warranty. This vertically integrated approach coupled with a direct sales model brings c3 closer to the end-user, fostering a degree of innovation that leads the industry.



# Glossary of Terms

**American National Standards Institute (ANSI):**  
A non-profit organization that sets design-based standards for switchgear systems in the United States.

**Arc Resistant:**  
Switchgear that is designed to minimize the risks of arc flash: when an electric current passes through the air creating intense heat, light, and pressure.

**Busbar:**  
A metallic conductor, typically copper or aluminum, used to distribute electrical power within switchgear and electrical panels.

**Circuit Breaker:**  
A device that protects electrical circuits by automatically interrupting current in the event of an overload or short circuit.

**Contactors:**  
A device designed to control the flow of power to a load by establishing and interrupting the electrical current.

**Control Panel:**  
An enclosure with an assembly of switches, indicators, and other control devices used to operate and monitor electrical equipment.

**Disconnect Switch:**  
A device used to physically open or close an electrical circuit, isolating or de-energizing equipment for service.

**Fuse:**  
A device used for overcurrent protection that contains a wire or filament that melts when current exceeds a certain level to break the circuit and protect the equipment.

**High Voltage:**  
Switchgear that operates at voltage levels above 36,000 VAC / 51,000 VDC. Common applications include utility stations and grid interconnections.

**International Electrotechnical Commission (IEC):**  
An international organization that sets performance-based standards for switchgear systems.

**Insulation Medium:**  
A substance used to separate conductive parts within switchgear to prevent electrical contact and ensure safety. Common types include air, gas, and fluids.

**Low Voltage:**  
Switchgear that operates at voltage levels up to 1,000 VAC / 1,500 VDC. Common applications include commercial buildings, industrial plants, and data centers.

**Medium Voltage:**  
Switchgear that operates at voltage levels between 1,000 VAC / 1,500 VDC and 36,000 VAC / 51,000 VDC. Common applications include industrial plants, renewable energy, and oil and gas.

**Metal-clad:**  
Switchgear in which the electrical components are enclosed in separate metal compartments for added safety and accessibility.

**Metal-enclosed:**  
Switchgear in which all the electrical components are housed in a single metal enclosure.

**Motor Control:**  
Products specifically designed to control and protect electric motors. Motor controls work together with switchgear to ensure safe and efficient operation of electrical systems.

**Relay:**  
A device used to control larger electrical loads by detecting abnormal conditions in a circuit and initiating proper control actions.

**Short-Circuit Current Rating (SCCR):**  
The maximum short-circuit current an electrical component can safely withstand without causing a shock or fire hazard.

**Substation:**  
A facility with a transformer and switchgear combination used to distribute electricity at different voltage levels.

**Switchboard:**  
A panel that receives electrical power from the main supply or switchgear and distributes it to various circuits. Typical maximum voltage rating is 600 VAC / VDC.

**Switchgear:**  
A set of low, medium, or high voltage electrical equipment that is used to control, protect, and isolate electrical circuits. Common components include circuit breakers, fuses, relays, and more.

**Transformer:**  
A device that changes voltage levels and transfers electricity from one circuit to another.



# Industry Outlook

Switchgear plays a vital role in industrial and commercial settings to control, protect, and isolate electrical equipment. In addition to de-energizing equipment to allow work to be done or to clear faults downstream, switchgear automatically disconnects or “trips” the power in the event of an overload, preventing catastrophic damage to valuable equipment and infrastructure elements. Switchgear is also commonly used to route electricity to different subsystems and machines within a facility and to meter electricity use to support cost control measures.

The technology has been in existence almost as long as electricity, and the demand for new switchgear units is as strong today as ever. This is due to a large base of aging infrastructure rendering many facilities vulnerable to unplanned downtime or complete system failure. As new switchgear systems are designed, manufactured, and installed, there must be a focus on industry trends such as:

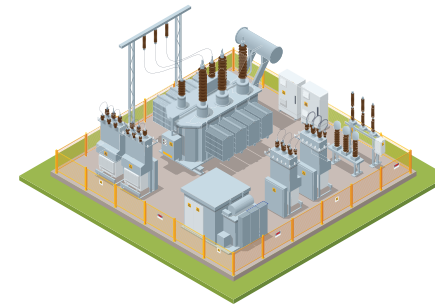
- **Innovation:** Advanced technologies that are flexible and scalable while offering real-time monitoring, control, and integration.
- **Energy Efficiency:** Maximum energy utilization of components to minimize power losses and reduce environmental impact.
- **Safety:** The top priority. New advanced safety features to protect personnel and equipment.

One way to upgrade aging switchgear is to modernize the operating system with the new, intelligent control technology that is integrated into today’s more advanced units, helping ensure reliable power and trouble-free operation well into the future. It is important that switchgear manufacturers and end-users seeking an upgrade specify robust control components that provide the necessary, long term reliability.

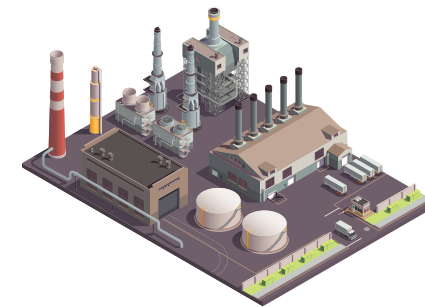
c3controls has been a leading manufacturer of switchgear controls for almost 50 years. Vertical integration allows us to operate more efficiently, respond to market conditions quicker, and provide fast delivery. Now is the ideal time to upgrade your switchgear systems, and c3controls has over fifteen million product configurations, and a complete UL508A panel shop to help you succeed!

# Application Isometrics

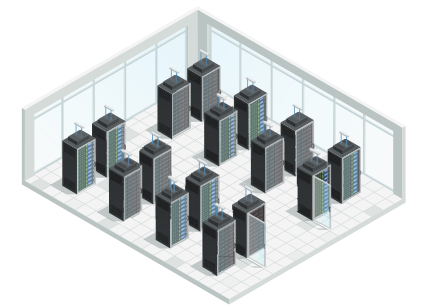
Switchgear and switchboards are used in a wide variety of industries and applications:



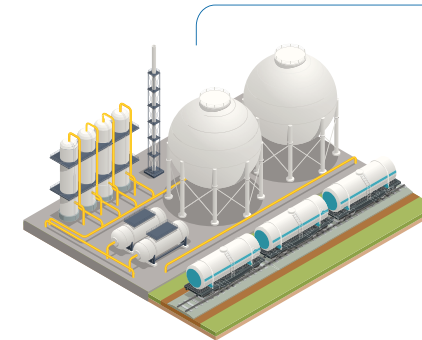
Substations



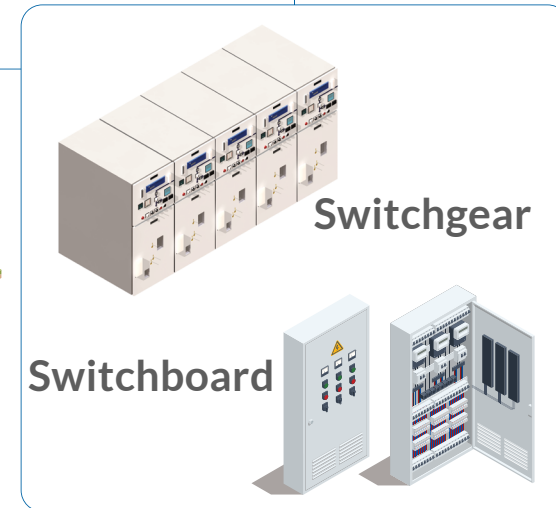
Industrial Plants



Data Centers



Oil and Gas



Switchgear

Switchboard



Commercial Buildings



Renewable Energy



Healthcare



Transportation

# Switchgear Products

c3controls can support all key function areas in your switchgear and/or switchboard application.


## Power & Actuation

Disconnect, control, and/or protect a circuit from a ground fault, short-circuit, or overload current.

## Human Machine Interface


Actuated by a person to direct the operation of another device and/or indicate the status of an operating system.

**1**




Miniature Circuit Breakers (+ Bus Bars)

**2**




Disconnect Switches

**3**




IEC Contactors

**4**



Control Relays


**5**



Pilot Devices

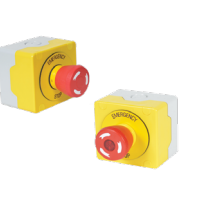
- 13mm
- 16mm
- 22mm IEC & NEMA
- 30mm Industrial & Hazardous Location

**6**



Cam Switches

**7**



E-Stops


## Control Logic

Devices that control other products in a control circuit in a logical sequence or based on a defined period of time.

## Panel Solutions

Support and protect electrical components that control and monitor a number of mechanical processes.

**8**



General Purpose Relays

**9**




High Density Terminal Blocks

**10**



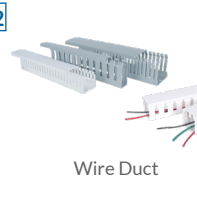
IEC Terminal Blocks

**11**



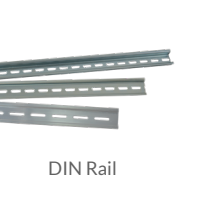
NEMA Terminal Blocks

**12**




Wire Duct

**12**




DIN Rail

**12**















Enclosures

**12**



Electrical Panels

<b>1</b>		<b>Miniature Circuit Breakers</b>	UL 489 & UL 1077 in 1, 2 and 3 pole combinations	Rated 60VDC single pole and 125VDC two pole (wired in series)	10kA SCCR @ 480Y/277VAC	Current ratings up to 63 Amps (non-derated)	B, C and D curve ratings
<b>2</b>		<b>UL 508 Disconnect Switches</b>	Door mount, panel-base mount, and panel mount with integral operator	Certified for use in Manual Motor Controller applications suitable as Motor Disconnects	16 - 125 Amps in 3, 4, and 5 pole configurations	Motor loads up to 40HP @ 480V (55kW @ 400V)	Operating handles rated for Type 1, 2, 3, 3R, 4/4X, 12, 13, IP55, and IP65
<b>3</b>		<b>IEC Contactors</b>	9 to 105 Amps	100kA SCCR @ 480V and 600V with Class J fuses	AC and DC - electronic coil control on DC devices	Integral auxiliary	Up to 75 HP @ 400V (55kW @ 400V)
<b>4</b>		<b>IEC Control Relays (Miniature)</b>	Bifurcated contacts	Rated 16A AC-1, A600, and Q600 for applications up to 600V	4 pole with NO and NC contact configurations	Printed circuit board mounting with an accessory link module	Universal ratings and markings
<b>5</b>		<b>Pilot Devices</b>	Modular range of 30mm, 22mm, 16mm, and 13mm	Type 1, 2, 3, 3R, 4/4X, 12, and 13	Non-Illuminated, Illuminated and Keyed Operators in both maintained and momentary operations	Color-coded, snap-on contact blocks with angled captive screws and pressure plates	Full voltage, multi-voltage, resistor, and dual input light units in a wide range of voltages up to 600VAC/VDC
<b>6</b>		<b>Cam Switches</b>	Certified as Manual Motor Controllers per UL	Rated 10A to 32A up to 690V AC	Switch configurations in 45°, 60° & 90° and up to 6 poles	A variety of operator types including key lock, lever, and lockable lever	Operators mount in a standard 22.5mm hole
<b>7</b>		<b>22mm IEC E-Stops</b>	Non-Illuminated and Illuminated versions	UL Listed Polycarbonate enclosure rated for Type 1, 2, 3, 3R, 4/4X, 12, 13, and IP66	Meets EN418 Safety of Machinery global compliance standards	Operating temperatures from -40 to +55° C (-40 to + 131° F)	UV and corrosion resistant
<b>8</b>		<b>General Purpose Relays</b>	Square base, flange mounted and miniature	Only 14mm wide	Transparent housing	Pole combinations available in SPDT, DPDT, 3PDT and 4PDT	Carrying current rating 5A-25A
<b>9</b>		<b>High Density Terminal Blocks</b>	4, 6, and 12 point in a single molded housing. 6-point shorting block available.	Rated for 600V, 30A continuous service	Replacement for GE CR151 and EB27B06S terminal blocks	Integrated 35mm DIN rail snap and panel mounting construction	Captive screws with spring-return open terminals
<b>10</b>		<b>IEC Terminal Blocks</b>	Screw Clamp, Spring Clamp, and Miniature	5mm - 25mm widths	25 - 230 Amps	Feed Through, Ground, Multi-Conductor, Double & Triple Level, Fuse Holder, Power Distribution, and more	DIN Rail mounting; snap-on, snap-off assembly
<b>11</b>		<b>NEMA Terminal Blocks</b>	Options available in Fusible and Feed Through in modular, flat top, and box type with copper collar	Rated 600V, 25-50 amperes	Accommodates #22 to two #12 AWG wires (0.34-4mm <sup>2</sup> ) per terminal	Simple mounting onto 35mm DIN rails	Terminal markers available for easy circuit identification
<b>12</b>		<b>Wire Duct &amp; DIN Rail</b>	Wire Duct: 13 dimensions from 25mm wide up to 80mm, and up to 2m in length	Wire Duct: Narrow and Wide Slot	DIN Rail: 35mm rails in steel and aluminum	DIN Rail: 1m (3.28ft) or 2m (6.56ft) lengths	DIN Rail: Standard package quantities, or pallet options available

For illustration purposes only. Other solutions may be applicable depending on your application design requirements.



# c3controls Product Portfolio

Our 15 million+ product configurations deliver durability and reliability—even in the most punishing environments—meeting and exceeding global standards for quality and safety.

 <p><b>DISCONNECT SWITCHES</b></p>	 <p><b>ENCLOSED DISCONNECT SWITCHES</b></p>	 <p><b>MINIATURE CIRCUIT BREAKERS</b></p>	 <p><b>DEFINITE PURPOSE CONTACTORS</b></p>
 <p><b>CONTACTORS</b></p>	 <p><b>MINIATURE CONTACTORS &amp; CONTROL RELAYS</b></p>	 <p><b>OVERLOAD RELAYS</b></p>	 <p><b>DIRECT-ON-LINE STARTERS</b> CONTACTOR + OVERLOAD RELAY</p>
 <p><b>ENCLOSED DIRECT-ON-LINE STARTERS</b> CONTACTOR + OVERLOAD RELAY</p>	 <p><b>MOTOR PROTECTION CIRCUIT BREAKERS</b></p>	 <p><b>ENCLOSED MOTOR PROTECTION CIRCUIT BREAKERS</b></p>	 <p><b>DIRECT-ON-LINE STARTERS</b> MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR</p>
 <p><b>ENCLOSED DIRECT-ON-LINE STARTERS</b> MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR</p>	 <p><b>30MM INDUSTRIAL PILOT DEVICES</b></p>	 <p><b>30MM PILOT DEVICES FOR HAZARDOUS LOCATION</b></p>	 <p><b>22MM IEC PILOT DEVICES</b></p>
 <p><b>WORLD TOWER LIGHTS</b></p>	 <p><b>CAM SWITCHES</b></p>	 <p><b>22MM NEMA PILOT DEVICES</b></p>	 <p><b>16MM PILOT LIGHTS</b></p>
 <p><b>13MM PILOT LIGHTS</b></p>	 <p><b>CONTROL STATION ENCLOSURES</b></p>	 <p><b>ENCLOSED UL508A COMBINATION MOTOR STARTERS</b></p>	 <p><b>TERMINAL BLOCKS</b></p>
 <p><b>TERMINAL BLOCK RELAYS</b></p>	 <p><b>ELECTRONIC TIMING RELAYS</b></p>	 <p><b>GENERAL PURPOSE RELAYS</b></p>	 <p><b>WIRING DUCT</b></p>

# White Papers

Product professionals AND subject experts!  
Check out c3controls' extensive library of white papers:

## How to Size a Disconnect Switch for Your Project

How to Size a Disconnect Switch for Your Project

Is your project calling for a disconnect switch? Check out this guide to learn how to find the perfect fit disconnect switch for your needs.

[READ WHITEPAPER](#)

## Pilot Devices for Indication and Actuation: Pilot Devices Indicator Lights

Pilot Devices for Indication and Actuation: Pilot Devices Indicator Lights

Pilot devices are types of selector switches, pushbuttons, pilot lights, signal beacons, and toggle switches and are used in industrial applications where human-to-machine interface is required.

[READ WHITEPAPER](#)

## Circuit Breaker Breakdown: Understanding the Different Circuit Breaker Types

Circuit Breaker Breakdown: Understanding the Different Circuit Breaker Types

Click here for a guide on how to identify the right circuit breaker for your application.

[READ WHITEPAPER](#)

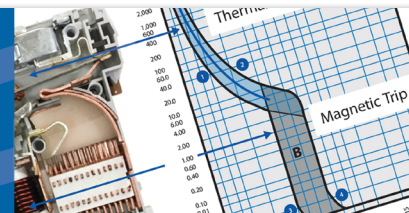
## Replacing Control Circuit Fuses with Circuit Breakers

Replacing Fuses with Circuit Breakers

Blew a fuse recently? Have no fear, we're here to help. Click here to find out how to change out fuses for circuit breakers.

[READ WHITEPAPER](#)

## Introduction to Trip Curves



Understanding Trip Curves

Trip Curves or Time Current Curves are an intimidating topic. This paper will introduce you to trip curves and explain how to read and understand them.

[READ WHITEPAPER](#)

## PANEL ESSENTIALS 3: UL508A Control Panel Design Considerations



Panel Essentials Series 3: UL508A Control Panel Design Considerations

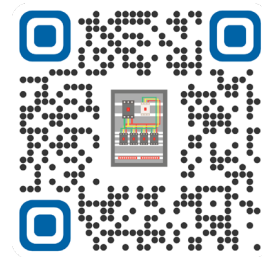
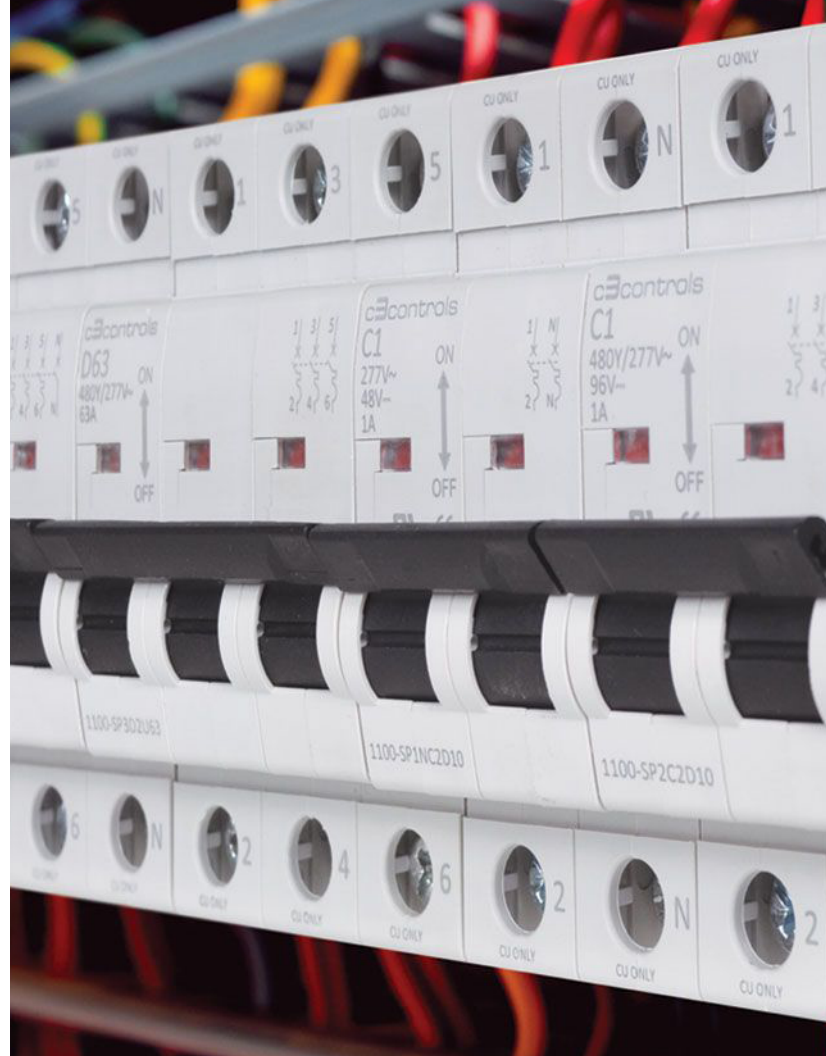
Find out the basic design considerations you need to know when building a UL 508A panel.

[READ WHITEPAPER](#)





724.775.7926  
www.c3controls.com



**c3controls**<sup>®</sup>  
*Everything under control.*