Switchgear

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

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Everything under control.

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About c3controls

Since 1976 c3controls (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 36-month 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.

Contactor:
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:

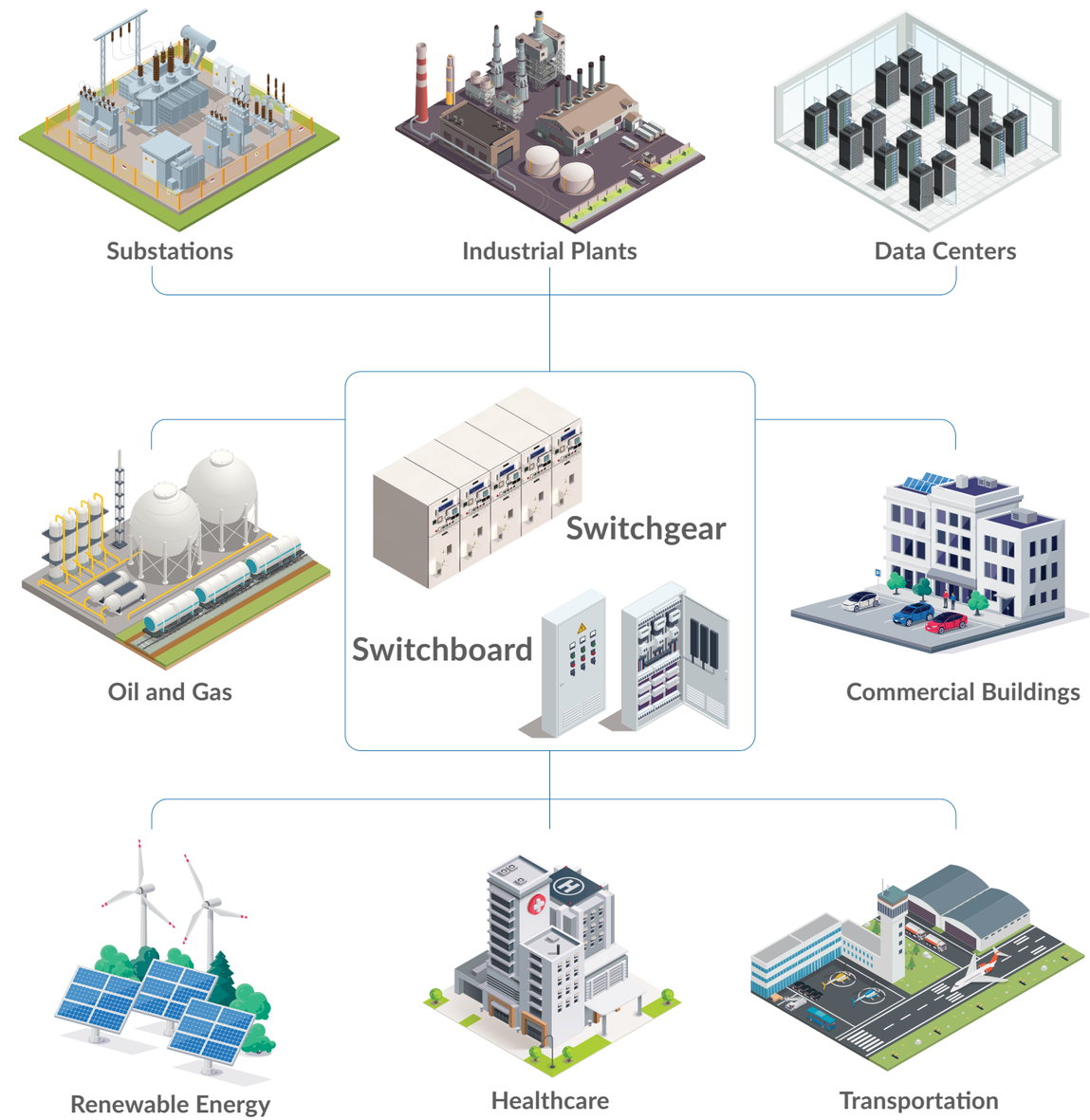
- **Innovation:** Advanced technologies that are flexible and scalable while offering real-time monitoring, control, and integration.
- **Energy Efficiency:** Maximum energy utilization of components to minimize power losses and reduce environmental impact.
- **Safety:** The top priority. New advanced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

With over seventeen million product configurations from c3controls and custom UL 508A-certified panel solutions from Covenant Panelworks (CPW), you have a trusted source for complete electrical control solutions. With more than 50 years of experience and a vertically integrated approach, we operate efficiently, respond quickly to changing market demands, and provide fast, reliable delivery. Contact us today and discover how our expertise can help you modernize your switchgear systems with the reliable control solutions you need to succeed.

Application Isometrics

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



Switchgear Products

Disconnect Switches

- 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

AC Rated Miniature Circuit Breakers (+Busbars)

- UL 489 & UL 1077
- 1, 2 and 3 Pole combinations
- 10kA SCCR @ 480Y/277VAC
- Current ratings up to 63 Amps
- B, C and D curve ratings

DC Rated Miniature Circuit Breakers (+Busbars)

- UL Listed per UL489B, the standard for DC photovoltaic systems
- 1, 2 and 4 Pole combinations
- 10kA SCCR on all constructions
- Current ratings up to 63 Amps
- Rated 250VDC per pole for up to 1000VDC
- Dual trip curves: C and D

Electronic Timing Relays

- Compact design, sizes in 17.5mm, 22.5mm, and 45mm wide
- Single, dual and multi-functions
- Timing ranges from 0.01 seconds to 9,999 hours
- DIN Rail, Panel, Socket, and enclosure door mountings
- Voltage inputs 20-240 VAC and 12-240 VDC

Control Power Transformers

- Open-type control transformers ranging from 50 to 5000VA
- Integrated terminal blocks and a finger-safe terminal guard, with IP20 protection on primary and secondary sides
- Each transformer variant features a Class H insulation system
- Capable of handling dynamic loads effectively, suitable for applications with fluctuating power demands
- Ability to provide multiple voltage outputs from a single unit

Control Circuit Transformers

- Ratings from 20 to 300VA
- Operating voltages from 120V to 480V on primary side, and 24V on secondary side
- Over-current protection options; inherent or non-inherent, or manual resettable circuit breaker
- Integrated grounding system and space-saving footprint
- Versatile for Class 2, Class 3, and general purpose applications

IEC Contactors

- 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)

IEC Control Relays (Miniature)

- 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

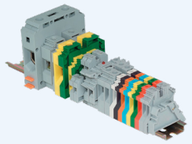
Pilot Devices

- Modular range of 30mm, 22mm, 16mm & 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

Electrical Panels

- Custom electrical panel solutions are available through Covenant Panelworks (CPW), a UL 508A-certified panel shop specializing in complete finished assemblies and value-added projects.

IEC Terminal Blocks



- 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

High Density & CT Shorting Terminal Blocks

- 2, 4, 6, and 12-point in a single molded housing
- 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

Cam Switches

- 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

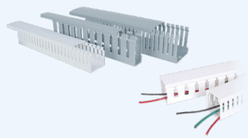
22mm IEC E-Stops

- 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

General Purpose Relays

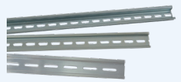
- Octal Base with pin terminals and Square Base with blade-style terminals
- Various pole combinations and coil voltages
- Color-coded push buttons for distinguishing AC and DC
- Built-in retainer clips in relay sockets
- Marking plates on relays and sockets

Wire / Cable Duct



- 13 Selectable dimensions from 25mm wide up to 80mm, and up to 2m in length
- Narrow and Wide Slot
- Rigid "U" shaped duct with non-slip cover in gray or white
- Optional adhesive backing

DIN Rail



- 35mm rails in steel and aluminum
- 1m (3.28ft) or 2m (6.56ft) lengths
- Each simply fasten by screws to the mounting surface
- Standard package quantities, or pallet options available

Product Portfolio

Our 17 million+ product configurations deliver durability and reliability—even in the most punishing environments—meeting and exceeding global standards for quality and safety.

series DS — DISCONNECT SWITCHES
NON-FUSED & ENCLOSED

series 1100 series 1110 — MINIATURE CIRCUIT BREAKERS

series 300 (non-reversing) series 310 (reversing) — CONTACTORS & CONTROL RELAYS

series 320 — OVERLOAD RELAYS

series 620 — DIRECT-ON-LINE STARTERS
CONTACTOR + OVERLOAD RELAY

series E620 — ENCLOSED DIRECT-ON-LINE STARTERS
CONTACTOR + OVERLOAD RELAY

series 330 series E330 — MOTOR PROTECTION CIRCUIT BREAKERS
OPEN & ENCLOSED

series 630 — DIRECT-ON-LINE STARTERS
MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR

series E630 — ENCLOSED DIRECT-ON-LINE STARTERS
MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR

series 30 (industrial) series 30 (hazardous) — 30MM PILOT DEVICES
FOR INDUSTRIAL & HAZARDOUS LOCATION

series 22 (iec) series 22 (nema) — 22MM PILOT DEVICES
IEC & NEMA

series WTL — WORLD TOWER LIGHTS

series CS — CAM SWITCHES

series 16 — 16MM PILOT LIGHTS

series 13 — 13MM PILOT LIGHTS

series EC — CONTROL STATION ENCLOSURES

series ECP 300 — ENCLOSED UL508A COMBINATION MOTOR STARTERS

series EPS — ENCLOSED POWER SUPPLIES

series ECP BP — VFD BYPASS PANELS

series IPS — INDUSTRIAL POWER SUPPLIES

series CCT — CONTROL CIRCUIT TRANSFORMERS

series CPT — CONTROL POWER TRANSFORMERS

series TB — TERMINAL BLOCKS

series TBR — TERMINAL BLOCK RELAYS

series ETR — ELECTRONIC TIMING RELAYS

series 200 series 210 — GENERAL PURPOSE RELAYS

series WD — WIRING DUCT

series DIN — DIN RAIL

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

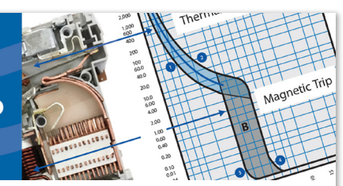
Replacing Control Circuit Fuses with Circuit Breakers

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

Why choose c3controls

Integrated Manufacturing

Vertical integration is the cornerstone of c3controls as it places innovation, development, design, manufacturing, testing, and shipping all within our control. With Everything Under Control, we can ensure the highest quality and customer satisfaction.

Innovation

Product innovation is in our DNA. We approach our products as solutions. Unlike our competition, our business model allows us to provide customers with premium controls without the premium price.

Same-Day Shipping

Reduce inventory. Improve cash-flow. Save money. Our customers enjoy peace of mind knowing they'll get what they need, when they need it. Our promise, guaranteed!

36-Month Warranty

With total control over engineering and manufacturing, we are able to guarantee the highest quality products on the market—products free of defects in material, workmanship, and design.

Advantage Pricing

Total control means lower overhead and direct sales. For our customers, this translates to savings of up to 40+% on c3controls premium products.

Customer First

Commitment to the success of our customers is a core value and the driving force behind all we do. We promise concierge style service that makes doing business easy, personalized, and responsive.

Notes

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