# Boilers & Burners

*The OEM and Installer Guide to Control Components for Boilers and Burners*



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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 ver-tically integrated approach coupled with a direct sales model brings c3 closer to the end-user, fostering a degree of inno-vation that leads the industry.




*We are proud to be ISO 9001:2015 certified for our quality management system.*



# Glossary of Terms

**ABMA:**
Industry association representing boiler manufacturers and suppliers, providing advocacy, education, and technical resources.

**ASME:**
Engineering organization that publishes widely adopted codes governing boiler and pressure vessel design and construction.

**Blowdown System:**
Removes dissolved solids and impurities from boiler water to maintain efficiency and prevent scale buildup.

**Boiler Control Panel:**
Central enclosure housing electrical controls used to monitor, sequence, and protect boiler operations.

**Boiler Economizer:**
Heat recovery device that captures exhaust energy to preheat feedwater and improve system efficiency.

**Burner Management System (BMS):**
Safety system that sequences burner startup, monitors operation, and initiates shutdown during unsafe conditions.

**Combustion Control System (CCS):**
Regulates fuel and air mixture to maintain efficient, stable combustion across boiler load ranges.

**Condensing Boiler:**
High-efficiency boiler that captures latent heat from exhaust gases to maximize thermal performance.

**Deaerator System:**
Removes oxygen and dissolved gases from feedwater to prevent corrosion in boilers and piping.

**Draft Control System:**
Regulates combustion air and exhaust flow to maintain proper furnace pressure and combustion stability.

**Dual-Fuel Burner:**
Burner capable of operating on gas or oil fuels for operational flexibility and redundancy.

**Electric Boiler:**
Electrically powered boiler producing steam or hot water without on-site fuel combustion.

**Feedwater Control System:**
Manages boiler water levels by controlling feed pumps and valves for safe, continuous operation.

**Firetube Boiler:**
Boiler design where hot combustion gases pass through tubes surrounded by water.

**Flame Safeguard Controller:**
Device that verifies flame presence and shuts off fuel supply if flame failure occurs.

**Fuel Train Control System:**
Controls fuel delivery components including valves, regulators, and safety shutoff devices.

**Industrial Boiler:**
Large-capacity boiler used in manufacturing, processing, and institutional steam or heating applications.

**Industrial Burner:**
Combustion device engineered for high-capacity industrial heating and steam generation systems.

**Low NOx Burner:**
Burner designed to minimize nitrogen oxide emissions through staged combustion and airflow control.

**NFPA 85:**
Safety standard governing boiler and combustion system design, operation, and protective controls.

**Packaged Boiler:**
Factory-assembled boiler system delivered pre-engineered for faster installation and commissioning.

**Power Burner (Forced Draft):**
Burner using a fan to supply combustion air for controlled, high-efficiency combustion.

**Register Burner:**
Burner with adjustable air registers to fine-tune airflow and combustion characteristics.

**UL 508A:**
Certification standard for industrial control panels ensuring electrical safety and construction compliance.

**Watertube Boiler:**
Boiler where water flows inside tubes heated externally by combustion gases.

# Market Outlook

Industrial boilers and burners are essential to modern manufacturing, processing, and institutional infrastructure. From food production and chemical processing to power generation, refining, and large facilities, these systems generate the steam and thermal energy that keep operations running. In a typical boiler room, combustion, fuel delivery, draft, and feedwater systems work together to produce reliable heat and pressure for critical processes. Because these systems often operate continuously, uptime, safety, and control reliability are vital.

The industry remains stable, supported by consistent demand for steam and process heat. Replacement cycles, plant expansions, and infrastructure upgrades continue to drive investment. At the same time, facilities face increasing pressure to improve efficiency, reduce emissions, and modernize aging equipment. This has accelerated adoption of high-efficiency boilers, advanced combustion controls, oxygen trim systems, and heat recovery technologies such as economizers.

Looking ahead, regulatory compliance and operating cost management will shape purchasing decisions. Stricter emissions standards are driving low-NOx burners and enhanced control strategies.

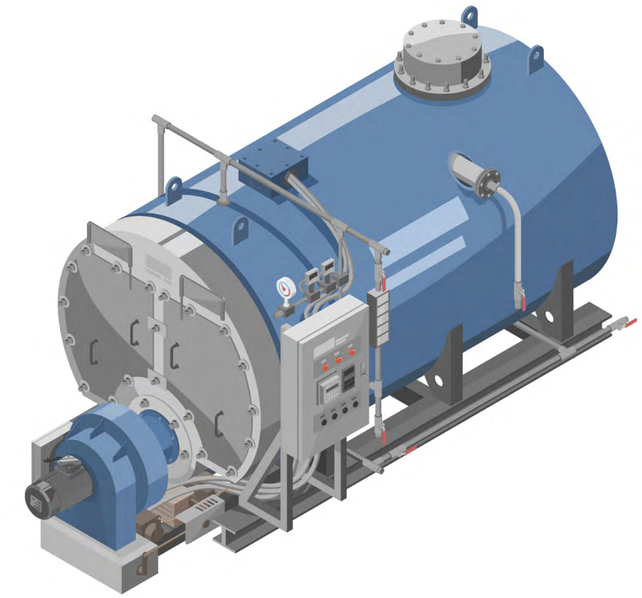
c3controls can help you meet the demanding requirements of boiler and burner equipment. With more than 50 years of experience manufacturing quality electrical controls, we provide reliable products designed to support critical combustion and process heating applications. Our vertically integrated approach allows us to operate efficiently, respond quickly to changing market conditions, and provide the electrical control products you need with fast delivery. Our solutions support a wide range of boiler and burner applications, including:

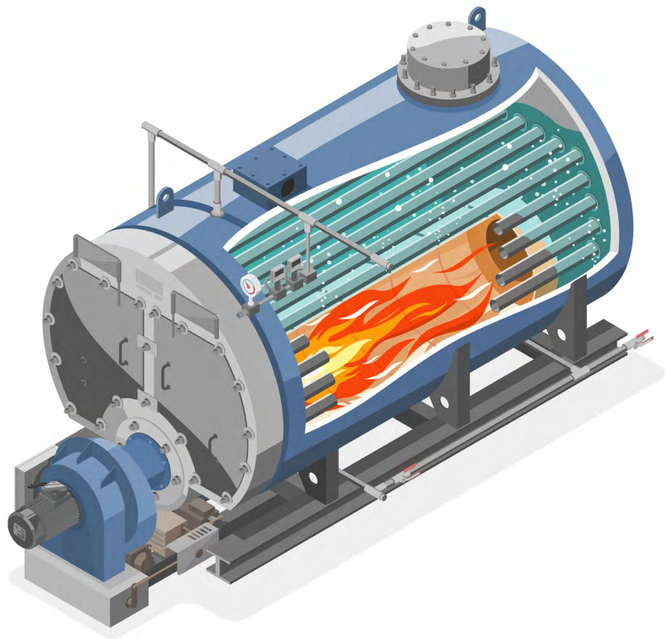
- **Burner management systems (BMS)**
- **Boiler control panels**
- **Combustion control systems**
- **Draft and fan control systems**
- **& more!**

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. Contact us today and discover how our expertise can help you improve the safety, reliability, efficiency, and performance of your boiler and burner systems.

# Boiler and Burner Isometric

*Here is an example of a system with a firetube boiler and power burner.*





# Electrical Controls

## Pilot Devices



- Modular range of 30mm, 22mm, 16mm, 13mm, and cam-operated rotary switches
- Maintained and momentary operations in both non-illuminated, illuminated, and keyed versions
- Type 1, 2, 3, 3R, 4/4X, 12, and 13
- Color-coded, snap-on contact blocks
- Full voltage, multi-voltage, resistor, and dual input light units in a wide range of voltages up to 600VAC/VDC
- Cam switch operators are certified as Manual Motor Controllers per UL

## Control Stations (+ E-Stops and Alarm Silence Stations)



- Standard pre-configured assemblies of 30mm and 22mm pilot devices (customizable configurations available)
- Enclosure constructions in Polycarbonate, Polyester, and Die Cast Aluminum
- Operator options in both non-illuminated and illuminated
- Each assembly comes with laminated, laser engraved legend plates
- Fully assembled and ready to use out of the box

## 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

## 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

## Terminal Block Relays



- Rated load: 6A, 250VAC/30VDC
- Single-Pole, Double-Throw contacts
- Screw termination
- Most common AC/DC coil voltages: 12V, 24V, 110-125V, 220-240V

## Industrial Power Supplies



- Designed to deliver the power with up to 93% efficiency
- Adjustable voltage options in 12, 24, and 48V
- Output power range from 60W to 480W
- DC OK relay contacts are standard on 240W and 480W
- Compact design - 43mm wide, up to 60mm

## Miniature Circuit Breakers



- 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

## Contactors and Control Relays



- Contactors: 9 to 105 Amps
- Contactors: 100kA SCCR @ 480V and 600V with Class J fuses
- Contactors: AC and DC - electronic coil control on DC devices
- Control Relays: Bifurcated contacts
- Control Relays: Rated 16A AC-1, A600, and Q600 for applications up to 600V

## Overload Relays



- Available in five frame sizes with a current adjustment range of 0.28 - 112A
- High fault SCCR of 100kA @ 480V and 600V with Class J fuses
- Full load current adjustment ratio of approx. 1:1.5 enables relay to be set to exact FLA of motor
- Single phase sensitivity to protect motors against damaging phase loss conditions
- Manual or automatic reset and test modes, and stop button all in a single device

## 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

## Tower Lights



- Stackable design for up to 5 modules in a single assembly
- Mounting options in three styles: 50mm direct mount, 50mm panel-mount short base, and 50mm panel-mount tall base
- Voltage options available in 24V AC/DC, 120V AC, and 240V AC
- Three styles of illumination: continuous, flashing and rotary
- Continuous or intermittent sound modules with 80dB or 100dB sound output

## 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

## Motor Protection Circuit Breakers



- Multi-Function: Manual Motor Controller, Motor Disconnect, Group Motor Installations
- 50kA SCCR @ 480V
- Self-protected Type E up to 50kA @ 460V
- FLC up to 32 Amps
- Trip Class 10 Thermal and Magnetic Elements

## Direct-On-Line Starters



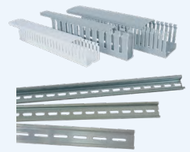
- Open-style starters consist of either a Contactor & Overload Relay, or a Motor Protection Circuit Breaker & Contactor
- Enclosed starters come pre-wired with a variety of pilot device options
- Factory assemblies provide the convenience of a single catalog number and shorter control panel bill of material

## 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 Duct & DIN Rail



- 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

## Custom 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 such as:

- Motor Overload Panels (MOV)
- Circuit Breaker Panels
- Relay Panels
- & more!

# c3controls 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.*

**DISCONNECT SWITCHES**
NON-FUSED & ENCLOSED

**MINIATURE CIRCUIT BREAKERS**

**CONTACTORS & CONTROL RELAYS**

**OVERLOAD RELAYS**

**DIRECT-ON-LINE STARTERS**
CONTACTOR + OVERLOAD RELAY

**ENCLOSED DIRECT-ON-LINE STARTERS**
CONTACTOR + OVERLOAD RELAY

**MOTOR PROTECTION CIRCUIT BREAKERS**
OPEN & ENCLOSED

**DIRECT-ON-LINE STARTERS**
MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR

**ENCLOSED DIRECT-ON-LINE STARTERS**
MOTOR PROTECTION CIRCUIT BREAKER + CONTACTOR

**30MM PILOT DEVICES**
FOR INDUSTRIAL & HAZARDOUS LOCATION

**22MM PILOT DEVICES**
IEC & NEMA

**WORLD TOWER LIGHTS**

**CAM SWITCHES**

**16MM PILOT LIGHTS**

**13MM PILOT LIGHTS**

**CONTROL STATION ENCLOSURES**

**ENCLOSED UL508A COMBINATION MOTOR STARTERS**

**ENCLOSED POWER SUPPLIES**

**VFD BYPASS PANELS**

**INDUSTRIAL POWER SUPPLIES**

**CONTROL CIRCUIT TRANSFORMERS**

**CONTROL POWER TRANSFORMERS**

**TERMINAL BLOCKS**

**TERMINAL BLOCK RELAYS**

**ELECTRONIC TIMING RELAYS**

**GENERAL PURPOSE RELAYS**

**WIRING DUCT**

**DIN RAIL**



# White Papers

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




## Commercial Boiler Trends: Exploring the Latest Innovations in the Industry

Discover the latest technological advancements reshaping the commercial boiler industry. Stay ahead with insights into innovative trends.

READ WHITEPAPER




## New Trends in Industrial Burner Industry

We often talk about the industrial revolution, and what allowed it to happen. It was steam powered, long before the electrification of the planet. When did it really begin? Looking back through the...

READ WHITEPAPER




## New Trends in HVAC Industry You Need To Know

HVAC has evolved and grown over the past 120 years and there are numerous facets of developing technology still emerging.

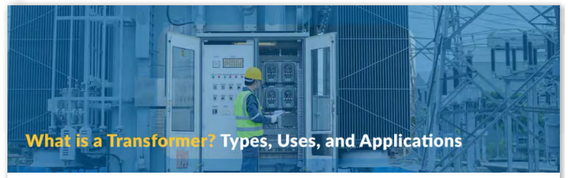
READ WHITEPAPER




## Industrial Pilot Devices Explained

Discover the essential guide to industrial pilot devices at c3controls. Learn about their types, functions, and applications in automation systems. Equip yourself with the knowledge to enhance your industrial operations effectively. Continue reading for more!

READ WHITEPAPER




## What is a Transformer? Types, Uses, and Applications

Learn what a transformer is, how it works, and its key types and applications. Explore step-up, step-down, isolation, and instrument transformers used in power generation, transmission, distribution, and industrial systems.

READ WHITEPAPER




## Understanding UL Standards for Industrial Electrical Controls

Searching for information about UL standards? Our complete guide will inform you of everything you need to know.

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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