

Power supplies with integrated circuit breaker

For the machine building industry: Simplicity, reliability, availability, and flexibility

Learn more about

- The high power reliability demands of the machine building industry
- How the TRIO3 power supply’s integrated circuit breaker can minimize control cabinet space
- The benefits of IO-Link and NEC Class 2 approvals

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Introduction

With the ever-increasing demand in the machine building industry, control cabinets must accommodate more functions. A sturdy mechanical design, resilient input circuits, high overload capacity, and a stable output characteristic are crucial.

Additionally, the devices should be user-friendly, without complicated special features. Installation, labeling, and commissioning should also be fast and effortless. Nevertheless, design engineers strive to shrink the size of the cabinet, even as the number of functions grows.

New power supplies on the market combine reliable and robust power supply with the overload and short-circuit protection of circuit breakers into one simple product, offering both functionalities in a compact form factor.

The TRIO3 power supply from Phoenix Contact is equipped with built-in circuit breakers, making it a simple choice for machine-building applications. It also includes channel prioritization and IO-Link communication on its circuit breakers, providing higher functionality for the system. In addition, each circuit breaker channel can be configured as a NEC Class 2 circuit for superior system design and flexibility (Figure 1).

Figure 1: TRIO3 power supply with integrated circuit breaker for machine building applications.



Integrated circuit breakers save space

The simplest configuration of a protected power supply system consists of a power supply and a circuit breaker to protect against short-circuit and overload of the downstream components. This simple configuration becomes more complex as the number of downstream components increases, particularly if the downstream components' current consumption varies greatly. In this case, several circuit breakers must be used. In most cases, these circuit breakers will be sized differently. This results in complicated wiring, difficult installation, and cabinet space constraints.

For machine builders with numerous downstream components, a power supply with integrated circuit breakers minimizes cabinet space usage. For example, when compared with the conventional configuration of power supplies and circuit breakers, the TRIO3 with integrated circuit breakers can save up to 60% of space in the cabinet (Figure 2.1 and 2.2). In addition, it meets the requirements of UL 2367 and features four or eight channels, making it ideal for machine builders.

During installation, the intuitive design of the channel dials and the current setting buttons help the installer to easily customize the built-in circuit breakers for various downstream load sizes. Optional seal plugs can protect the system from unwanted tampering during operation.

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Integrated circuit breakers save space **continued** →



Figure 2.1: Space of a conventional 20 A power supply with eight circuit breakers.



Figure 2.2: TRIO3 20 A power supply with eight integrated circuit breakers saves up to 60% of space.

Intelligent load detection technology is especially helpful for applications with heavy loads downstream. During start-up, the circuit breakers can maintain the current supply up to 150% of the rated current for a maximum period of five seconds, enabling the start-up of heavy loads even with electronic circuit breakers.

During operation, the integrated circuit breakers with preventive monitoring function and multicolor LED will notify the user before the failure occurs (Figure 3). At the first stage, the integrated circuit breakers will detect potential overload when the load downstream has reached 80% of the rated current, giving out a yellow color as a pre-warning before the overcurrent event occurs. In the second stage, when the load is above 120% of the rated current, the LED will blink yellow to indicate that the channel is about to cut off the circuit. Once the circuit is cut, the channel will show red to indicate no more supply through the channel. ■

Higher system availability with channel prioritization

In machine building systems, certain downstream loads may have higher priority than others. In cases of overall system overload, a conventional system with a power supply and separate circuit breakers may respond by cutting off the circuit that exceeds the designed load current, even if it is a high-priority load.

The TRIO3 power supply comes with two load prioritization options. At default, during overall system overload, the circuit breakers will turn off circuits with the highest load to ensure the overall system availability. With IO-Link, the TRIO3 can also be set to channel prioritization option, providing superior system availability. During an overall system overload, it will sequentially turn off problematic circuits, starting with the least-priority channel, thus ensuring that high-priority circuits remain operational. ■

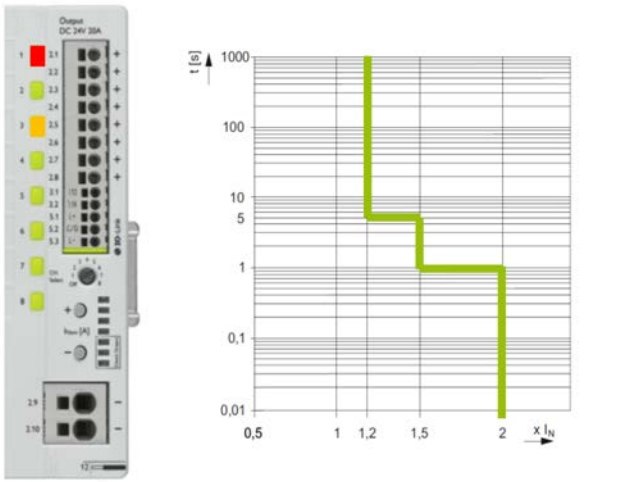


Figure 3: Multicolor LED (left) and tripping characteristics (right) of the TRIO3 with integrated circuit breakers.

Easier system monitoring with IO-Link

As the machine-building industry becomes more complex, circuit breakers need to do more than provide simple overcurrent protection. A self-diagnosis function can make it easier to monitor system health and plan maintenance. IO-Link communication is widely used in the machine building industry, so a power supply that can communicate over this protocol can be easily integrated into many existing and future systems.

Setting up IO-Link devices is simple, with a straightforward process that does not require extensive training. The IO-Link interface also enables the early detection of error states and exceeded threshold values, allowing maintenance to be planned at an earlier stage (Figure 4). ■

Table 1: Example of TRIO3 IO-Link functions.

IO-Link Setting		IO-Link Monitoring
1	Set output voltage	Channel voltage
2	Set circuit breakers channel nominal current	Channel current
3	Set channel prioritization	Channel status (Overload/Tripped)
4	Remote switching of channels	Power supply voltage
5	Lock manual settings	Power supply operating hours

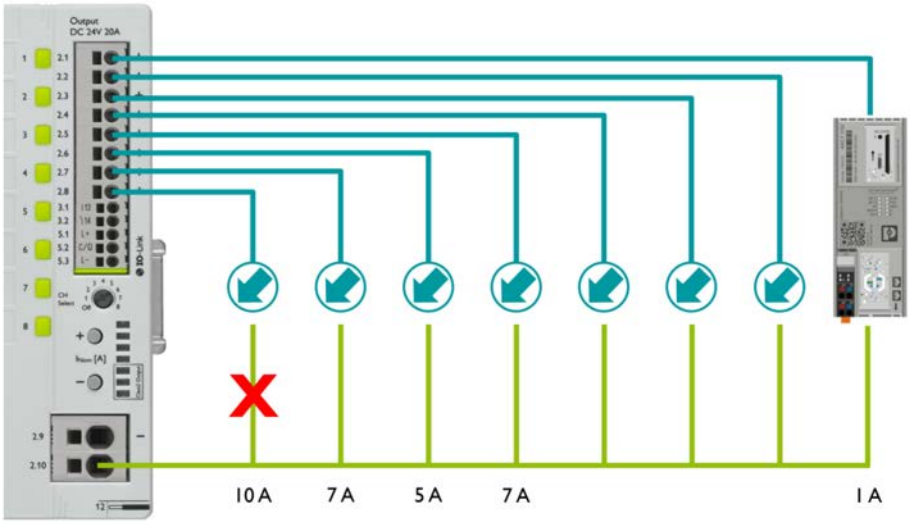


Figure 4: By default, TRIO3 will cut off the circuit with the heaviest load when the system overloads the power supply. This setting can be changed to channel prioritization through the IO-Link.

Greater flexibility with NEC Class 2 channels

Machine builders rely on established methods to ensure reliable and effective systems. For automated equipment and systems intended for the North American market, machine builders might opt for the special National Electrical Code (NEC) classification known as a “Class 2” circuit. Circuits and devices operating under the Class 2 classification do not need additional protection against fire or shock hazards. This allows for the use of smaller devices and conductors, which simplifies the circuitry.

There are several ways to implement Class 2 power sources, one of which is using power supplies specifically designed for Class 2 applications. However, these power supplies are limited to a maximum output current of 4 A at 24 V DC, which often requires multiple power supplies for control panels that need a higher current (Figures 5.1 and 5.2).

Greater flexibility with NEC Class 2 channels **continued** →

Another option is to use electronic circuit breakers designed for Class 2 applications, allowing up to 40 A of bulk upstream power to be distributed to many individual Class 2 downstream circuits.

A power supply, like the TRIO3, that meets the requirements of NEC Class 2 (UL 1310) can work as a stand-alone solution for NEC Class 2 circuits (Figure 6). When dealing with downstream loads that require high-current consumption, instead of using several NEC Class 2 power supplies or circuit breakers, a single TRIO3 can be used by configuring each channel to classify its downstream circuit as Class 2.

This provides additional design flexibility by enabling the combination of NEC Class 2 circuits with non-energy-limited circuits within one power supply system. ■

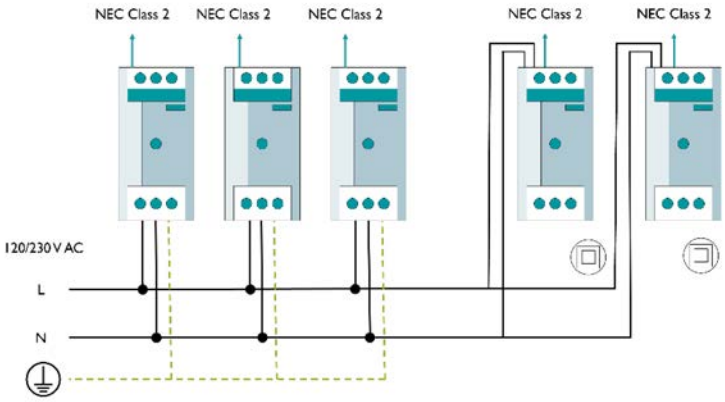


Figure 5.1: Several NEC Class 2 control circuits each supplied via a separate NEC Class 2 power supply.

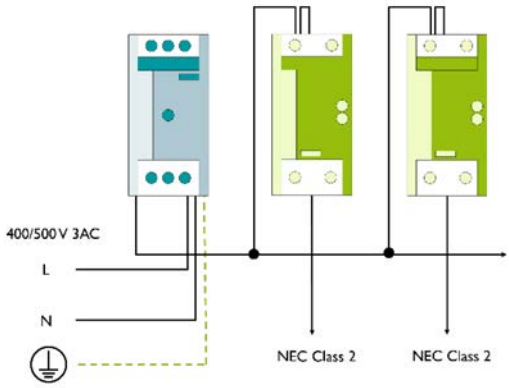


Figure 5.2: Several NEC Class 2 control circuits each supplied via a separate NEC Class 2 circuit breaker.

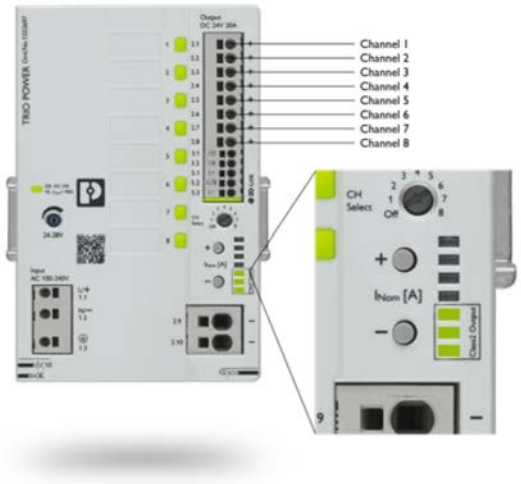


Figure 6: Each channel can be easily adjusted to meet NEC Class 2 with LED indicator.

International approval package

Electrical Safety:

- UL/IEC 61010-2-201
- UL/IEC 61010-1
- IEC 62368-1
- UL/ANSI/ISA 12.12.01 (HazLoc)
- Maritime: DNV GL
- NEC Class 2: UL 1310
- Electronic Circuit Breaker: UL 2367

Conclusion

Raising the benchmark

The TRIO3 power supply with integrated circuit breakers can solve many issues that today's machine builders face. The integrated circuit breakers allow the builders to combine multiple downstream overcurrent protection in a simple and easily installed solution. In addition, with channel prioritization, IO-Link communication capabilities, NEC Class 2 approval, and built-in circuit breaker channels, the TRIO3 power supply has raised the benchmark for a simple, reliable, and flexible power supply in the machine-building industry. ■

Learn more at www.phoenixcontact.com/triopower.
Experience a virtual demo of the TRIO3 power supply at www.phoenixcontact.com/demo-triopower.

About Phoenix Contact

Phoenix Contact is a global market leader based in Germany. Since 1923, Phoenix Contact has created products to connect, distribute, and control power and data flows. Our products are found in nearly all industrial settings, but we have a strong focus on the energy, infrastructure, process, factory automation, and e-mobility markets. Sustainability and responsibility guide every action we take, and we're proud to work with our customers to empower a smart and sustainable world for future generations. Our global network includes 22,000 employees in 100+ countries. Phoenix Contact USA has headquarters near Harrisburg, Pa., and employs more than 1,100 people across the U.S.

For more information about Phoenix Contact or its products, visit **www.phoenixcontact.com**, call technical service at **800-322-3225**, or email **info@phoenixcontact.com**.



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