

CIRCUIT BREAKERS AND PROTECTORS BUYING GUIDE



WHAT DO THEY DO?

Circuit breakers and protectors are essential for safeguarding industrial electrical systems from damage caused by overloads, short circuits, and faults. They detect abnormal conditions and interrupt power flow to protect equipment and personnel.

Protection Functions

- **Short-Circuit Interruption:** Quickly interrupts dangerously high currents caused by short circuits. These currents are far above normal levels and can spike to the full capacity of the electrical supply (available fault current), posing immediate risks to wiring, devices, and personnel.
- **Overload Protection:** Prevents damage from moderate overcurrents that exceed normal operating levels. Unlike short circuits, these currents aren't immediate threats, but if sustained, can overheat wiring or equipment and create a fire risk.
- **Overvoltage Protection:** Protects circuits from voltages that exceed normal operating levels. High voltage can stress insulation, damage sensitive electronics, and increase the risk of fire.
- **Undervoltage Protection:** Protects circuits from voltages that drop below safe operating levels. Low voltage can cause motors to overheat, run inefficiently, and fail prematurely.

Topics

- » What do they do?
- » Types of Circuit Breakers and Protectors
- » Applications
- » Comparison with Fuses and Other Protective Devices
- » How to Choose
- » Selection Guide
- » Product Lineup

- **Phase Loss / Phase Failure Protection:** Detects when one or more phases in a three-phase system are lost or missing. Phase loss can cause motors to overheat, operate erratically, or seize, leading to mechanical damage or fire.
- **Ground Fault Protection:** Detects leakage current to ground and quickly interrupts the circuit to prevent electric shock or equipment damage. Ground faults occur when current takes an unintended path to ground, creating a shock hazard for people and a fire risk. This protection is especially important in wet locations, outdoor circuits, and industrial environments where personnel may be exposed to live parts.

Selecting the right circuit breakers and protectors is critical to ensure safety, equipment protection, and uninterrupted industrial operations.

TYPES OF CIRCUIT BREAKERS AND PROTECTORS

Industrial automation systems use several types of circuit breakers and protectors, suited to various load types, current ratings, and space constraints. These devices protect equipment and wiring from overloads and short circuits.

Primary Branch Circuit Protection

Molded Case Circuit Breakers (MCCBs) are the heavy-duty workhorses of industrial and commercial power systems. These UL 489–certified devices are engineered to manage large electrical loads by combining high interrupting capacities with adjustable trip settings. Because they are essential for main feeders and motor circuits, where managing high fault currents and ensuring proper coordination is critical, MCCBs are built with a robust mechanical design. They may also include lockout/tagout (LOTO) capabilities, serving as an NEC-compliant disconnecting means and supporting OSHA LOTO requirements for safe maintenance. MCCBs can be configured for selective coordination with upstream protection, so only the breaker closest to the fault trips, minimizing system downtime and preventing unnecessary disruption to other circuits.

Miniature Circuit Breakers (MCBs) provide compact, space-efficient branch circuit protection for smaller-scale applications. They are UL 489–compliant and can be DIN rail or panel mounted to safeguard lighting, receptacles, and small motor circuits from overloads and short circuits. MCBs provide reliable protection for residential and light industrial circuits. They are easier to maintain and replace than larger breakers, feature fixed-trip settings, and offer a range of trip curves to accommodate different load types and inrush currents.

Supplemental Circuit Protection

Miniature Supplementary Protectors (MSPs) are UL 1077 recognized devices that provide additional protection for circuits where branch circuit protection is already in place or not required. They are an ideal choice for control circuits, instrumentation, and low-current loads that do not



require the higher capacity or physical footprint of a full branch breaker. By providing localized defense, they prevent a single component fault from unnecessarily tripping the larger primary breaker. MSPs are especially valuable in distributed control panels or modular systems, where space is tight and fast replacement is important. Their compact design also allows designers to add circuit-level protection without significantly increasing panel size or cost.

Electronic Circuit Protection

Electronic Circuit Protectors (ECPs) represent the most technologically advanced tier of supplemental protection. These solid-state devices provide fast, precise overload and short-circuit protection at the individual-load level. Unlike mechanical breakers, ECPs isolate only the faulted load while keeping the rest of the control system energized, reducing unnecessary downtime and improving system availability.

ECPs feature configurable trip characteristics, electronic current limiting, and rapid fault response. They are ideal for protecting sensitive electronics, can support NEC Class 2 compliance, and provide features such as built-in diagnostics, remote monitoring, and real-time data feedback.

Selecting the right circuit protection depends on the functional demands of the application. While branch circuit breakers ensure fundamental system safety, supplemental and electronic protectors provide the precision needed to minimize downtime and protect sensitive equipment.

APPLICATIONS

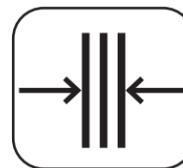
Circuit breakers and protectors safeguard electrical systems by interrupting current flow during overloads or faults to prevent equipment damage, downtime, and safety hazards. Their reliable operation is vital for protecting machinery, control panels, and wiring infrastructure across a wide range of industrial automation applications.



Molded Case Circuit Breakers: Ideal for power distribution and motor protection, these devices handle high currents and deliver reliable trip characteristics to ensure system safety.



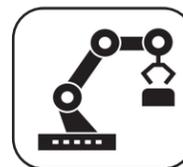
Miniature Circuit Breakers: Commonly used in control panels and small equipment, they provide dependable overcurrent protection with quick response times suitable for low-voltage circuits.



Miniature Supplementary Protectors: Designed for supplemental protection in machines and control systems where space is limited, these devices ensure specific sections of a branch circuit remain safeguarded.



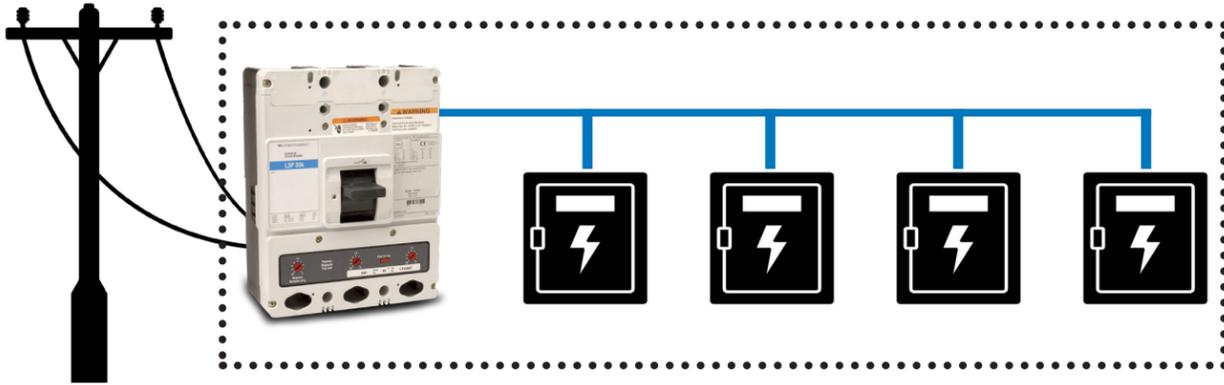
Electronic Circuit Protection Devices: Used for precise current interruption and fault detection in sensitive electronics and control devices.



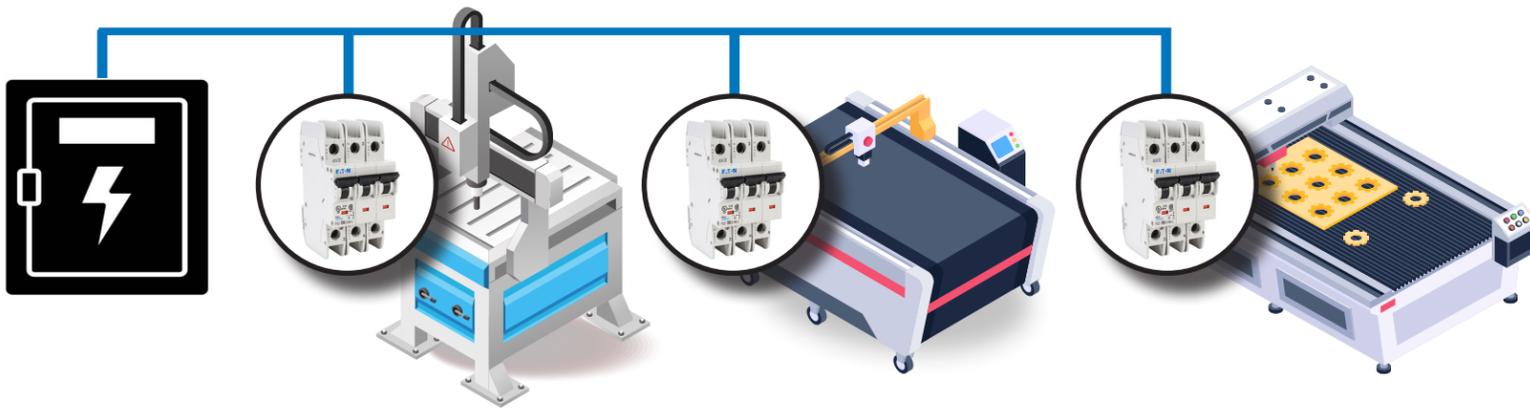
Circuit Breakers and Protectors Overall: Critical for the safe operation of industrial automation systems, they quickly detect faults and interrupt current to protect equipment, wiring, and personnel while minimizing downtime.

APPLICATIONS: EXAMPLES

- **Industrial Plant Power Distribution:** Molded Case Circuit Breakers, like the L3P-500-STDC, ensure reliable power protection across industrial facility panels, preventing equipment damage and downtime.



- **Machine Tool Protection:** Miniature Circuit Breakers, such as FAZ-D8-3-NA-L, safeguard critical machines from overloads and short circuits with fast response.



- **Control Panel Safety:** Miniature Supplementary Protectors, including GMCB-1B-15, provide additional circuit protection in control panels for precise, compact safeguarding of sensitive electrical components.



COMPARISON WITH FUSES AND OTHER PROTECTIVE DEVICES

Circuit breakers and other protective devices provide reusable protection suited for industrial automation, whereas fuses provide single-use protection that must be replaced after a fault occurs. Understanding their differences helps in selecting the most effective device for your system's safety and reliability.



1. **Reset Capability:** Circuit breakers can be reset after tripping, unlike fuses, which must be replaced once blown, reducing downtime in industrial environments.
2. **Protection Types:** Fuses provide fast-acting protection for short circuits, while circuit breakers can offer adjustable protection for overloads and faults.
3. **Response Time:** Fuses generally have quicker interruption times for severe faults, but modern circuit breakers balance speed and coordination capabilities.
4. **Maintenance:** Circuit breakers allow easy testing and diagnostics; fuses must be visually inspected and replaced after a fault.
5. **Coordination:** Circuit breakers provide better coordination with other protective devices due to adjustable trip settings.
6. **Physical Size:** Fuses are typically smaller and simpler, while circuit breakers are larger devices that include built-in switching mechanisms.
7. **Cost Considerations:** The initial cost of circuit breakers is usually higher, but is offset by lower maintenance and replacement expenses.
8. **Safety:** Circuit breakers include visible trip indicators and auxiliary contacts for integration with control systems, quickly alerting operators to tripped circuits.
9. **Current Limiting:** When current limiting or a higher interrupting rating is needed, fuses are generally the most effective choice.
10. **Surge Protection:** Electronic circuit protectors combine protective functions with surge suppression for enhanced protection.
11. **Integration:** Circuit breakers integrate readily with control and monitoring systems through accessories and electronic controls.
12. **Load Switching:** Circuit breakers can also act as manual control devices for safely turning circuits on or off during normal operation, providing flexibility beyond their protective function.
13. **Phase Loss:** In three-phase motor applications, a blown fuse on one phase can allow the motor to continue running on the other two, quickly causing it to overheat and fail. Circuit breakers avoid this risk by simultaneously tripping all poles, fully disconnecting the motor and preventing damage.

Selection between fuses and circuit breakers depends on application, cost, and maintenance considerations. For industrial automation, the resettable, versatile nature of circuit breakers often makes them the preferred choice.

HOW TO CHOOSE

Choosing the right circuit breaker or protector is crucial for system safety and reliability. Consider your application requirements, load type, and environmental conditions to ensure optimal protection and compliance.

- 1. Application Needs:** Evaluate your system's voltage, current, and interrupting capacity requirements to select suitable breakers or protectors.
- 2. Breaker Type:** Choose between molded case, miniature, or supplementary protectors based on the device size and application.
- 3. Current Rating:** Match the breaker's current rating to your load requirements to avoid nuisance trips while ensuring adequate protection for wiring and equipment.
- 4. Voltage Rating:** Ensure the breaker's voltage rating is compatible with your system voltage type and level.
- 5. Trip Characteristics:** Select breakers with trip curves that match your system's inrush currents and fault tolerance.
- 6. Environmental Factors:** Consider ambient temperature, humidity, and location to select breakers with appropriate environmental ratings.
- 7. Mounting Style:** Verify compatibility of the breaker mounting (DIN rail, panel mount) with your installation setup.
- 8. UL and IEC Standards:** Select breakers that meet relevant standards for safety and performance assurance.

Choosing the right circuit breakers and protectors boosts equipment safety and operational efficiency while cutting downtime and maintenance costs. Always consult manufacturer datasheets and application guides before finalizing designs, and make sure they comply with NEC, CEC, and local electrical codes.



- 9. Auxiliary Features:** Include auxiliary contacts or shunt trips if remote monitoring or control is needed.
- 10. Short-Circuit Protection:** the breaker's interrupting capacity exceeds the maximum available fault current to maintain safe operation.
- 11. Coordination with Other Devices:** Select breakers that coordinate with upstream or downstream protective devices to minimize downtime.
- 12. Mechanical Endurance:** Look for breakers designed for repeated operation if frequent switching or testing is expected.
- 13. Sensitive Protection:** Select electronic circuit protectors with precise settings and fast response times to safeguard sensitive electronics.
- 14. Compatibility with Control Systems:** Verify that breakers integrate with existing control panels or automation systems.
- 15. Cost vs. Performance:** Balance the upfront cost, durability, and features to select a device that delivers long-term value.

SELECTION GUIDE

UL 489 Molded Case Circuit Breakers (MCCB)						
Product Line	Applications and Benefits	Current Range	Voltage Rating	Interrupting Rating	Number of Poles	Starting at Price
GLADIATOR GCB Series	UL 489 molded case circuit breakers with a wide current range offer strong performance at a very competitive price point.	15-1200A	600 VAC / 250 VDC	Up to 65kA at 480 VAC	2- and 3-poles	\$208.00
FUJI ELECTRIC BW Series	Heavy-duty UL 489 molded case circuit breakers engineered for high reliability in demanding installations.	15-800A	600 VAC / 250 VDC	Up to 50kA at 480 VAC	3 poles	\$296.00
AUTOMATIONDIRECT 3P Series	Eaton-manufactured molded case circuit breakers deliver proven branch/feeder protection and are ideal for mains or heavy motor loads.	15-600A	600 VAC / 250 VDC	Up to 35kA at 480 VAC	3 poles	\$428.00

UL 489 Miniature Circuit Breakers (MCB)						
Product Line	Applications and Benefit	Current Range	Voltage Rating	Interrupting Rating	Number of Poles	Starting at Price
EATON FAZ-NA and FAZ-NA-L Series	Trusted, name-brand protection at a competitive price, offering strong value for a premium-grade MCB.	0.5-63A	480/277 VAC / 96 VDC	Up to 14kA at 480/277 VAC	1-, 2-, and 3-poles	\$25.00
GLADIATOR GMCBU Series	Reliable UL 489 protection at a low cost, giving builders a budget-friendly branch-circuit solution.	1-63A	480/277 VAC / 125 VDC	10kA (all models)	1-, 2-, and 3-poles	\$19.00

UL 1077 Miniature Supplementary Protectors						
Product Line	Applications and Benefit	Current Range	Voltage Rating	Interrupting Rating	Number of Poles	Starting at Price
EATON FAZ Series	Dependable component protection with trusted name-brand quality, priced competitively to make premium performance easy to choose.	0.5-63A	480/277 VAC / 96 VDC	Up to 10kA at 480/277 VAC	1-, 2-, and 3-poles	\$20.00
GLADIATOR GMCB Series	Solid supplemental protection at an exceptionally low cost, offering a highly economical choice for isolating faults in control circuits.	1-63A	480/277 VAC / 125 VDC	6kA (all models)	1-, 2-, and 3-poles	\$9.50

Electronic Circuit Protectors						
Product Line	Applications and Benefits	Current Range	Voltage Rating	Type	Number of Channels	Starting at Price
E-T-A REX Series	High-performance electronic protection with fast fault isolation and precise current limiting—ideal for scalable installations needing reliable modular protection.	1-10A	24 VDC	Modular	Supports up to 16 modules (1-2 channels each; 32 channels max); 40A max (main supply module required)	\$44.50
GLADIATOR GECP Series	Cost-effective DC electronic protection with active current limiting and quick fault response—usable standalone or within a modular setup.	1-10A	12/24 VDC	Modular/ Standalone	1-channel modules can operate standalone or be integrated into a modular system (40A max when using distribution modules)	\$29.50
WAGO 787-3861 Series	Reliable DC electronic protection with rapid fault isolation in a compact design—usable standalone or integrated into a modular distribution setup.	0.5-8A	18 to 30 VDC	Modular/ Standalone	1-channel modules can operate standalone or be integrated into a modular system (20A max when using distribution modules)	\$33.50
RECOM RACPRO1 Series	Dependable multi-channel DC protection that simplifies wiring and improves circuit organization with integrated electronic control.	1.75-11.5A	22 to 28 VDC	Standalone	4-channel	\$131.00
WAGO 787-166x Series	Efficient multi-channel DC protection that streamlines circuit distribution with fast fault isolation for clean, organized control layouts.	0.5-10A	24 VDC	Standalone	2-, 4-, and 8-channel models	\$216.00



mCBP-8

PRODUCT LINEUP



MOLDED CASE CIRCUIT BREAKERS (MCCBs)



FUJI ELECTRIC BW SERIES UL 489 MCCBs STARTING AT \$274.00

Fuji Electric BW Series molded case circuit breakers deliver dependable overcurrent protection in a compact, easy-to-install package. Designed for both AC and DC applications, these breakers feature thermal-magnetic trip characteristics, high interrupting capacity, and a robust trip-free mechanism to ensure safety under overload or short-circuit conditions.

- Interrupting rating up to 50kA at 480 VAC
- Meets major international standards (cULus, IEC, CE, etc.)
- Five frame sizes up to 800A
- Field-installable accessories

3P SERIES UL 489 MCCBs STARTING AT \$428.00

The 3P series provides reliable branch and feeder circuit protection for industrial control panels. Designed to meet demanding industry standards, these molded case circuit breakers offer a high interrupting rating and a versatile range of frame sizes, ensuring your circuits are protected.

- Interrupting rating up to 35kA at 480 VAC
- UL 489-compliant for safety and performance
- Four frame sizes, 15 to 600A
- Suitable for branch and feeder circuit protection



GLADIATOR GCB SERIES UL 489 MCCBs STARTING AT \$194.00

Gladiator GCB series molded case circuit breakers deliver robust, UL 489-compliant protection against overloads and short circuits. Engineered for superior performance, this product line offers versatile solutions for low-voltage electrical systems, ensuring maximum safety and reliability.

- Interrupting rating up to 65kA at 480 VAC
- Fixed thermal-magnetic, adjustable thermal-magnetic, and electronic self-powered trip units
- Seven frame sizes, 5 to 1200A
- 2- and 3-pole configurations up to 600 VAC



MINIATURE CIRCUIT BREAKERS (MCBs)

EATON FAZ-NA AND FAZ-NA-L SERIES UL 489 MCBs STARTING AT \$23.00

The Eaton FAZ-NA and FAZ-NA-L series offer reliable, DIN-rail mountable circuit breakers perfect for branch circuit applications. Designed for quick and easy installation, these compact breakers provide UL 489-compliant protection in a small form factor, saving you valuable panel space.

- Interrupting rating up to 14kA at 480Y/277 VAC
- Supports AC and DC applications
- UL 489 listed for reliable protection and industry compliance
- Easily add shunt trips and auxiliary switches
- B, C, and D trip curves to suit a variety of applications
- 1-, 2-, and 3-pole configurations up to 63A



GLADIATOR GMCBU SERIES UL 489 MCBs STARTING AT \$17.00

Gladiator GMCBU series miniature circuit breakers provide reliable, cost-effective protection for both AC and DC branch and feeder circuits. These branch circuit breakers are UL 489 listed, DIN-rail mountable, and designed for easy installation and dependable performance.

- 10kA interrupting rating (all models)
- Supports AC and DC applications
- UL 489-compliant for safe, reliable performance
- Field-installable auxiliary, alarm, shunt trip, and lockout accessories
- B, C, and D trip curves for a wide range of load types
- 1-, 2-, and 3-pole configurations up to 63A



MINIATURE SUPPLEMENTARY PROTECTORS

GLADIATOR GMCB SERIES UL 1077 MINIATURE SUPPLEMENTARY PROTECTORS STARTING AT \$8.50

Gladiator UL 1077 recognized GMCB series miniature supplementary protectors provide overcurrent protection for circuits where branch protection is already provided or not required. They can be installed as components within appliances or electrical equipment and are ideal replacements for fuses used as supplementary protection. Unlike fuses, they are resettable and clearly indicate status through the handle position and flag indicator.

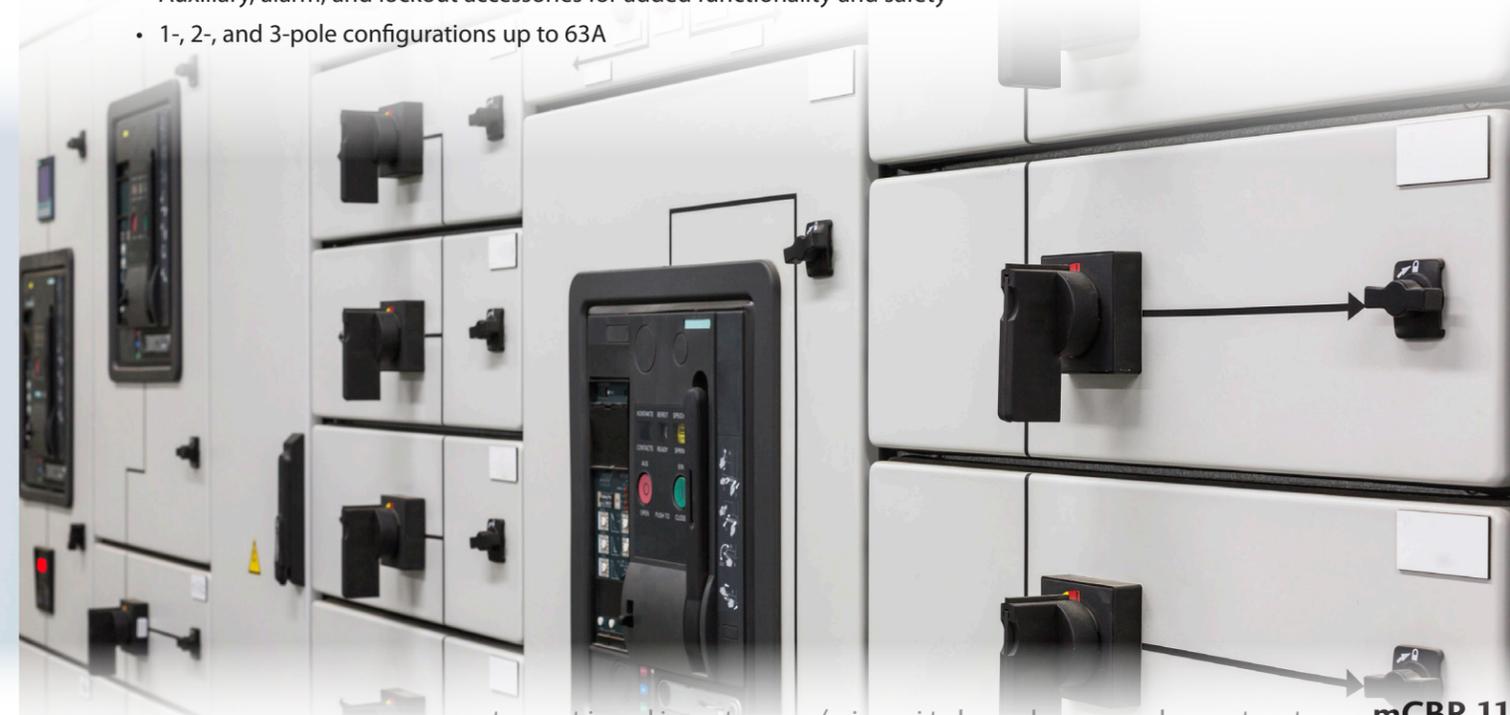
- 6kA interrupting rating (all models)
- Supports AC and DC systems
- 35mm DIN-rail mount with IP20 finger-safe protection rating
- Trip-free mechanism in B, C, and D trip curves
- 1-, 2-, and 3-pole configurations up to 63A



EATON FAZ SERIES UL 1077 MINIATURE SUPPLEMENTARY PROTECTORS STARTING AT \$17.50

Eaton FAZ series supplementary protectors are a smart, reliable choice for applications where branch circuit protection is not required or is already provided. These UL 1077 recognized devices are designed for easy DIN-rail mounting, offering a space-saving solution with a full range of accessories to meet your specific needs.

- Interrupting rating up to 10kA at 480Y/277 VAC
- Simple installation with valuable space savings
- B, C, and D trip curves for a wide range of load types
- Auxiliary, alarm, and lockout accessories for added functionality and safety
- 1-, 2-, and 3-pole configurations up to 63A



ELECTRONIC CIRCUIT PROTECTION DEVICES

WAGO SINGLE-CHANNEL ELECTRONIC CIRCUIT BREAKERS STARTING AT \$33.50



WAGO 787-3861 series electronic circuit breakers feature a compact 6mm form factor to provide safe and reliable protection for 24 VDC control circuits. They offer remote monitoring and control, readily visible LED feedback, and minimize downtime due to overloads and short circuits. Built for challenging environments, they ensure system reliability through robust protection and easily interpreted diagnostics.

- Current ratings from 0.5 to 8 A
- Select models are NEC Class 2 compliant
- Standard models support high-capacitive loads >50,000 μ F and reduce false tripping due to inrush current
- Dual voltage outputs offer flexible connection options while reducing wiring complexity
- Manual operation via a local switch or remote input
- Connect up to 10 units using jumper bars

WAGO MULTI-CHANNEL ELECTRONIC CIRCUIT BREAKERS STARTING AT \$216.00

WAGO's space-saving multi-channel ECBs combine high channel density with dependable overload and short-circuit protection for 24 VDC circuits. They are available in two-, four-, and eight-channel models with adjustable current settings from 0.5 to 10 A.

- Compact 42 or 45mm frame widths (depending on model)
- NEC Class 2 3.8A fixed models
- High switch-on capacity: > 50,000 μ F
- Remote input resets tripped channels or switches on/off any number of channels via pulse sequence
- Optional active current limitation
- Easy-to-use Push-In CAGE CLAMP terminals



RECOM RACPRO1 SERIES ELECTRONIC CIRCUIT PROTECTORS STARTING AT \$131.00



RECOM RACPRO1 series electronic circuit protectors are 4-channel electronic fuse (e-Fuse) load switches with independent overcurrent limit control and real-time output current indication.

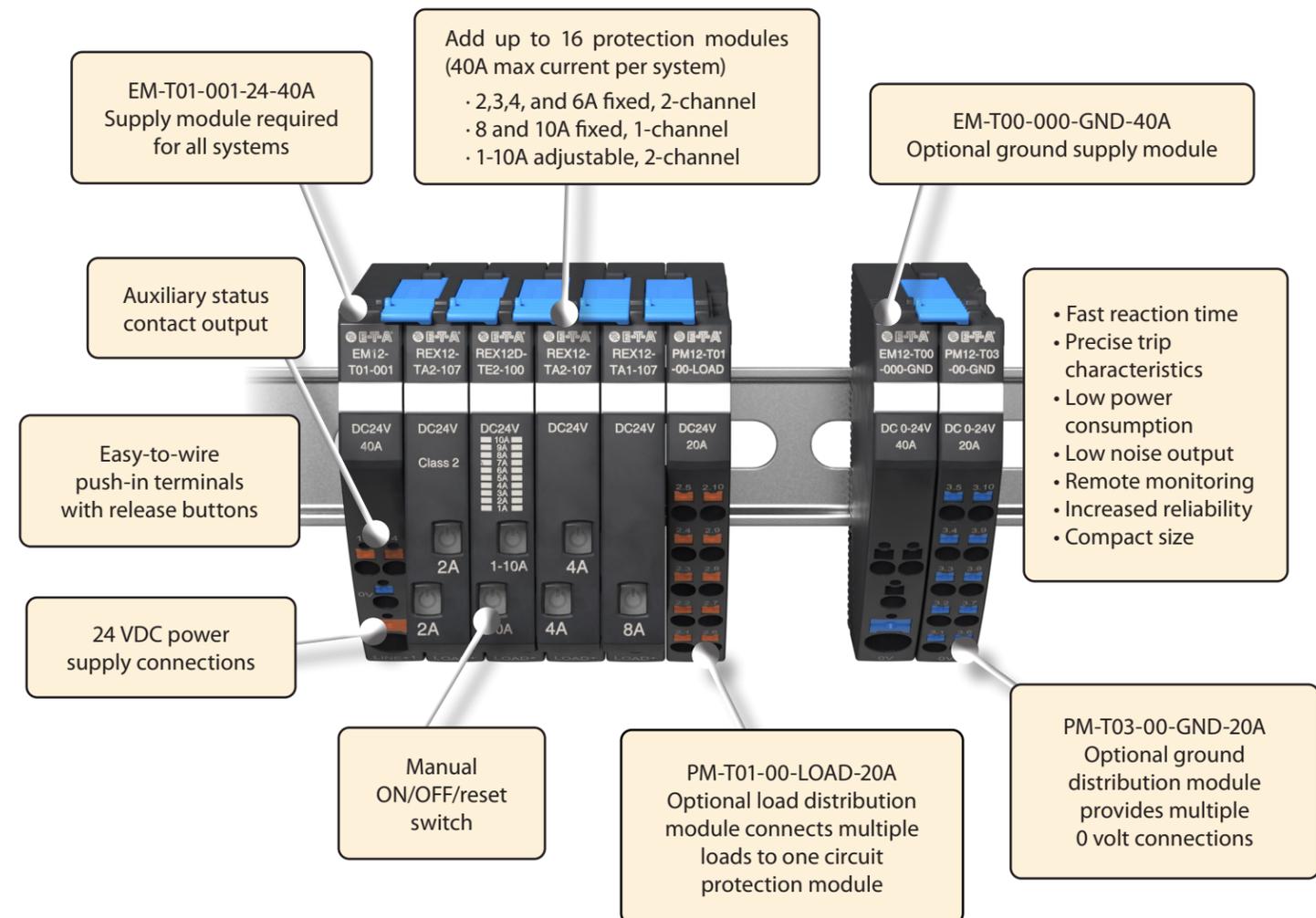
- Push-in connectors for tool-less wiring
- Start-up delay adjustable by switch
- Adjustable power limit and color-coded LED load indication
- Individual ON/OFF and Overcurrent Protection limit for each channel
- Short circuit protection and 150% power boost for 5 seconds
- Easy daisy chaining of multiple modules
- Paired input and output (+, -) connectors included

E-T-A REX MODULAR ELECTRONIC CIRCUIT PROTECTORS STARTING AT \$44.50

E-T-A REX protectors safeguard electrical circuits from overcurrent, short circuits, and other faults. As a modular system, individual protection modules can be combined to meet specific circuit protection requirements, allowing for flexible configurations and easy installation.



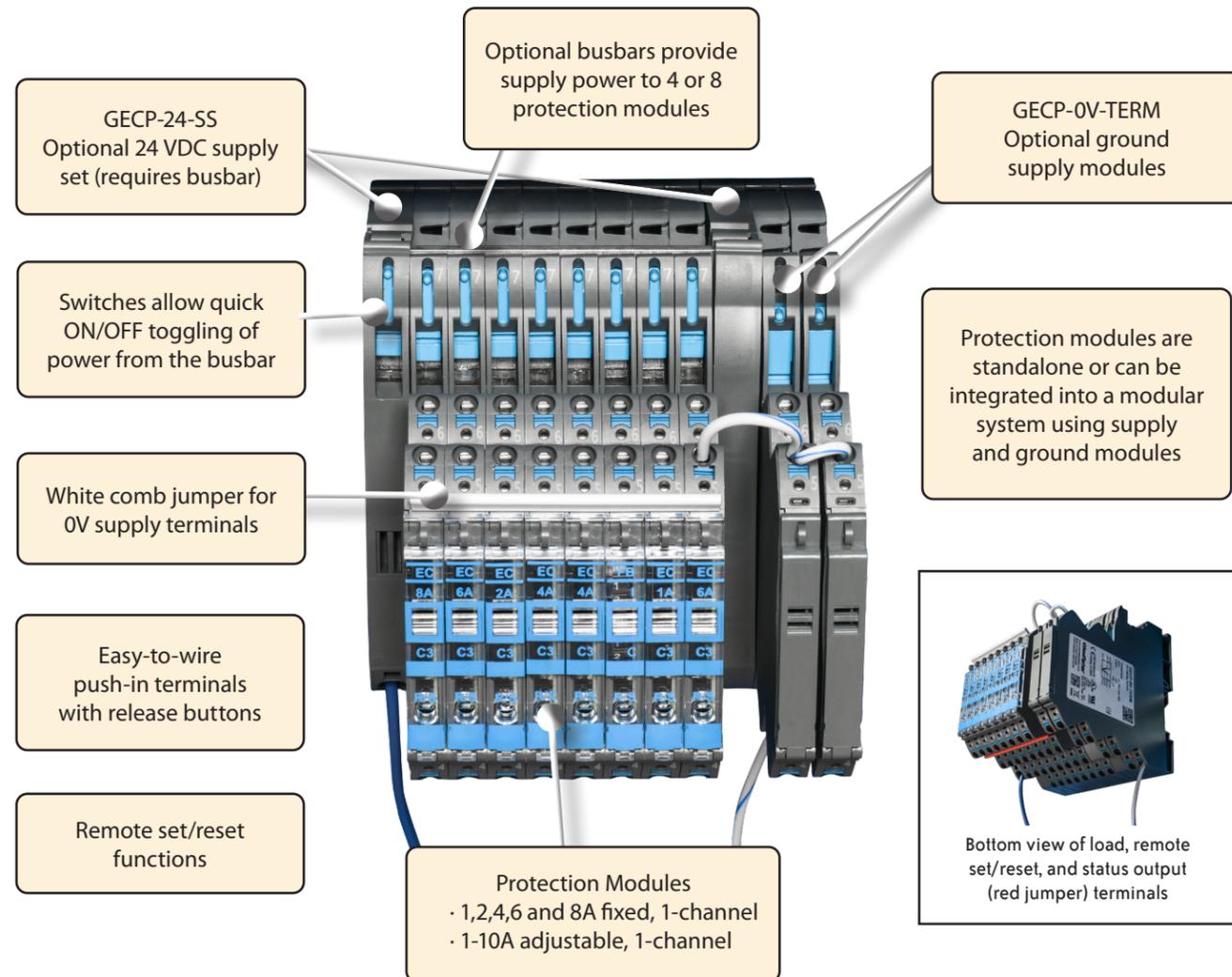
- Use a power supply and multiple protection modules to create a tailored modular system
- Electronic trip curves
- Slim 12.5mm module width
- Integral fail-safe element, adjusted to maximum current rating
- Rated for capacitive loads up to 20,000 μ F



GLADIATOR GECP SERIES ELECTRONIC CIRCUIT PROTECTORS STARTING AT \$29.50

Gladiator GECP series electronic circuit protectors provide reliable load monitoring and protection for 24 VDC control circuits. Their compact design and temperature-independent operation, with no derating required, make them well suited for remote or hard-to-access installations.

- Supports standalone or modular configurations
- Fixed-range up to 8A or adjustable 1-10A with user-selectable trip characteristics
- 10 to 30 VDC operating voltage
- LED high-load warning activates at 90% load
- Remote set/reset for unsafe or hard-to-reach locations
- Connect up to 8 modules using jumper bars



CIRCUIT BREAKER/PROTECTOR ACCESSORIES

SPARE PARTS & ACCESSORIES

Spare parts and accessories for circuit breakers and protectors aid in the installation, operation, and upkeep of these protection devices. Numerous options are available and include:



- **Auxiliary Contacts:** Signal the operational status of the breaker (e.g., ON/OFF, tripped) to external monitoring equipment.
- **Alarm Contacts:** Indicate the breaker has tripped due to a fault condition (e.g., overload, short circuit, or a trip device activation). They are not activated by manual operation.
- **Shunt Trips:** Allow a breaker to be tripped electrically using an external control signal.
- **Undervoltage Trips/Releases:** Protect sensitive downstream equipment by automatically tripping the breaker when the line voltage drops below a safe threshold (typically 70% of the rated voltage). The breaker can only be manually reset when voltage returns to a safe level.
- **Locking Devices & Lockout Attachments:** Padlocking devices that securely lock a breaker in the "OFF" position, ensuring equipment remains safely de-energized during maintenance and repairs.
- **Handles & Shafts:** Mechanisms for externally operating a circuit breaker mounted within an enclosure. Various types are available to fit different frame sizes and enclosure types, including flexible shafts for greater placement flexibility.
- **Terminal Covers & Insulation Barriers:** Safety guards shield operators from touching live terminations and provide additional electrical isolation between breaker phases.
- **Lugs & Multi-Wire Connectors:** Provide different wiring options for connecting to the breaker. Multi-wire connectors allow multiple wires to be connected to a single terminal, which can eliminate the need for separate distribution blocks.
- **Busbar Systems:** Feature various connection options and provide a quick, safe method for distributing power to multiple breakers.
- **DIN Rail Mounting Clips:** Mount compatible circuit breakers to a 35 mm DIN rail.
- **NEMA 12 Safety Door Hardware:** Door interlocking kits prevent access to enclosures and live components while the breaker is energized.

