



CIRCUIT BREAKERS FOR VEHICLES

Product overview

AUTOMOTIVE CIRCUIT BREAKERS

1160, 1610, 1620, 1170

For universal use

Automotive circuit breakers

The extremely compact **1610** and **1620** thermal automotive circuit breakers and the powerful **1170** model are mainly used in professional environments. They are perfectly suitable for all applications where continuous reliability and availability are essential.

1616, **1626** and **1176** are identical in form and fit, but offer a faster trip curve. The terminal design corresponds to standard automotive blade fuses of 2.8 mm or 5.2 mm.

If a protective element is placed in a location that is hard to access, blade fuses are inconvenient to use. For such

an application, we recommend our **1610-92**, **1620-1**, **1160** and **1620-2** autoreset types. The SAE type 1 circuit breakers keep on resetting in cycles of a few seconds until the failure has been remedied, i.e. until the overload has been removed. The **1160** and **1620-2** SAE type 2 circuit breakers offer a modified autoreset function keeping the contacts open until the voltage at the circuit protector was switched off for a certain time.

Especially designed for utility vehicles such as trucks, buses, agricultural and construction machinery, the **1170/1176** offer comprehensive protection through snap-action mechanism, trip-free

mechanism and a high rupture capacity of 400 A. The tease-free mechanism ensures switch-on operation without harmful arcs. The trip-free mechanism ensures reliable disconnection even with the reset button blocked. Its retaining clips provide a tight fit in the terminal block even in the event of shock and vibration. This circuit breaker is also suitable for use in 48 V on-board electrical systems.

Technical data

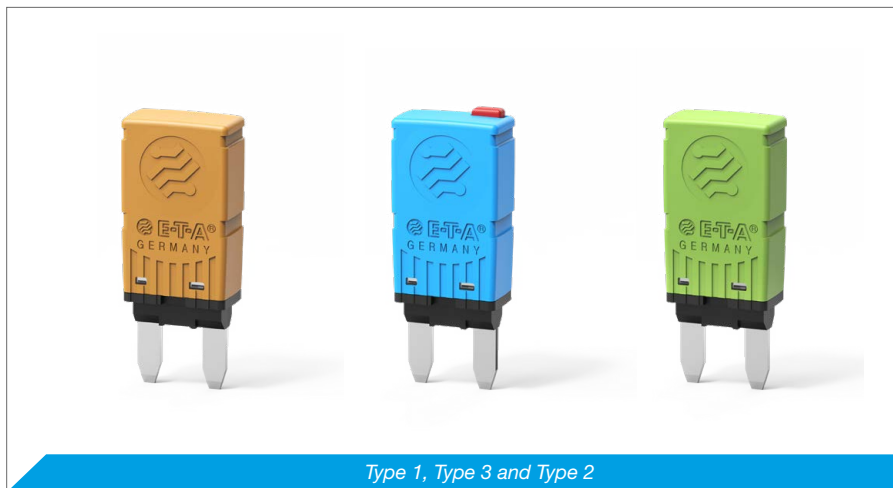
- 12 V/24 V/48 V on-board electrical systems
- Colour coding of enclosure according to current ratings



Reliable protection in all vehicle applications:
E-T-A automotive circuit breakers

Application in the industries

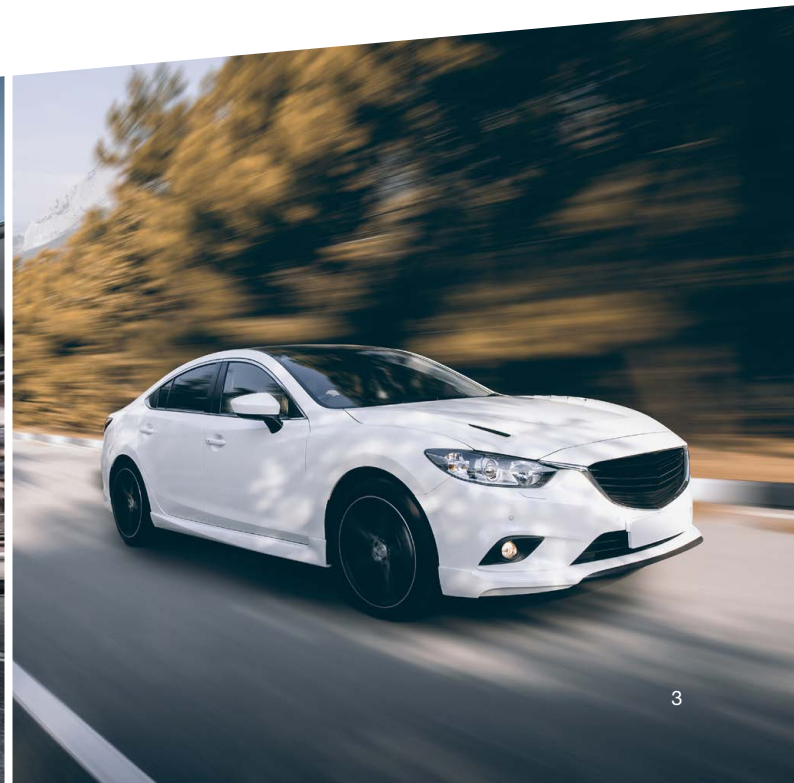
- Passenger cars
- Trucks and buses
- Construction machinery
- Agricultural vehicles and forestry equipment
- Specialty vehicles



Type 1, Type 3 and Type 2




Your benefits

- **Increased availability** because no replacement fuses are required
- **Universal use**, independent of socket or terminal block system
- **Time saving** through reduced downtimes thanks to autoreset after a failure



PRODUCT OVERVIEW

Automotive circuit breakers

Type	1160	1610-92	1610-21	
				

Working principle to SAE

SAE type	2	1	3	
Autoreset	•	•		
Modified reset	•			
Manual reset			•	
Manual release				

Special features

Trip free mechanism				
Snap-action mechanism			•	
Version with fast trip curve (70 % curve)		1616-92	1616-21	
Special features	Special sockets from the OEMs			

Technical data

Voltage rating	DC 12 V	DC 12 V	DC 12 V, DC 24 V	DC 12 V, DC 24 V
Operating voltage	9 ... 16 V	9 ... 16 V	9 ... 32 V	9 ... 32 V
Current ratings	12, 15, 20, 30 A	5, 7.5, 10, 15, 20, 25, 30 A	5, 7.5, 10, 15, 20, 25, 30 A	5, 7.5, 10, 15, 20, 25, 30 A
Holding current	<0.6 A			
Switching cycles	≥ 300 (2xI _N)	≥ 300 (2xI _N)	≥ 300 (2xI _N)	≥ 300 (2xI _N)
Interrupting capacity	200 A (3x)	150 A (3x)	150 A (3x)	150 A (3x)
Max. short circuit current	2,000 A	2,000 A	2,000 A	2,000 A
Voltage drop	<150 mV	<150 mV	<150 mV	<150 mV
Degree of protection (cap)	IP54	IP54	IP30	IP30
Temperature range	-30 ... +60 °C	-40 ... +85 °C	-40 ... +85 °C	-40 ... +85 °C

Terminal design

2.8 mm (ISO 8820-3 type F)				
6.3 mm (DIN 72581 part 3)	•	•	•	•
Socket design compatible with	ATO™ design	ATO™ fuse holder	ATO™ fuse holder	ATO™ fuse holder



3H	1	2	3	3H
	•	•		
		•		
•			•	•
•				•

				•
•			•	•
1616-H2	1626-1	1626-2	1626-3	1176
	Space-saving design	Space-saving design	Space-saving design	Very high endurance through double contact system Retaining clips for a tight fit (shock, vibration)

DC 12 V, DC 24 V	DC 12 V	DC 12 V	DC 12 V, DC 24 V	DC 12 V, DC 24 V and 48 V
9 ... 32 V	9 ... 14.5 V	9 ... 14.5 V	9 ... 29 V (32 V)	9 ... 60V
10, 15, 20, 25, 30 A	5, 7.5, 10, 15, 20, 25, 30 A	5, 7.5, 10, 15, 20, 25, 30 A	5, 7.5, 10, 15, 20, 25, 30 A	3, 4, 5, 6, 7.5, 8, 10, 15, 20, 25 A
		<0.3 A		
≥ 300 (2xI _N)	≥ 300 (2xI _N)	≥ 300 (2xI _N)	≥ 300 (2xI _N)	≥ 1,000 (2xI _N)
150 A (3x)	150 A (3x)	150 A (3x)	150 A (3x)	400 A (3x)
2,000 A	2,000 A	2,000 A	2,000 A	2,000 A
<150 mV	<150 mV	<150 mV	<150 mV	<150 mV <300 mV (I _N ≤ 5 A)
IP30	IP50	IP50	IP40	IP40
-40 ... +85 °C	-40 ... +85 °C	-40 ... +85 °C	-40 ... +85 °C	-40 ... +85 °C

	•	•	•	
•				•
ATO™ fuse holder	Mini fuse™ blade-type fuses	Mini fuse™ blade-type fuses	Mini fuse™ blade-type fuses	ATO™ fuse holder

E-T-A HIGH PERFORMANCE PRODUCT RANGE

Top performers in a robust design

No other industry sets higher standards with regard to safety than the aerospace industry. But also on the ground, the requirements concerning components to be built into rail vehicles, construction machinery and agricultural vehicles are extremely demanding. Vehicle uptime is the top priority, therefore, reliability is paramount. Our high performance circuit breakers exactly meet these requirements.



Application in the industries

- Aerospace
- Construction machinery and agricultural vehicles
- Rail vehicles

ROBUST DESIGN, HIGH RUPTURE CAPACITY:

E-T-A high performance circuit breakers

Simulator switch



9510 Type



482 Type



483 Type



4120 Type



4140 Type



412 Type



413 Type



4130 Type

Thermal high performance circuit breakers

Superior quality and robust design allow use under harshest environmental conditions. Even at very high temperatures and extreme vibrations or shock, E-T-A's circuit breakers trip reliably, minimising the risk of devastating cable fires. Renowned aircraft manufacturers qualified these products, which meet the requirements of all relevant aerospace standards. The high performance portfolio covers current ratings from 0.1 A to 100 A at DC 28 V or at up to AC 200 V (400 Hz). This includes single pole and double pole thermal or thermal-magnetic circuit breakers with an extremely high interrupting capacity. Auxiliary contacts are optionally available.

Trip characteristics range from fast to delayed. V0 enclosures provide uncompromising safety in the air and on the ground. The unique design of E-T-A's circuit breakers with temperature compensation allows installation of these products in all areas of an aircraft or vehicle, because the trip time remains constant even at extreme temperatures.

The additional function of a so-called snap-action mechanism (abrupt contact closing to avoid contact welding) ensures a high endurance of these circuit breakers and makes them maintenance-free. The trip-free mechanism provides additional safety. A white indicator ring on the push buttons clearly shows the tripped condition of the breaker.

Some of our high performance circuit breakers are also available with blade terminals, so they can be plugged onto printed circuit boards, making them easy to equip or replace.

Optional auxiliary contacts provide a clear indication of the faulty path in the event of a failure as well as a matching group signalling, significantly increasing transparency.

The **9510 simulator switch** for use in flight simulators completes this E-T-A portfolio. This switch with an extremely low "trip current" copies the operating mode of a circuit breaker in a power-saving and reliable way.

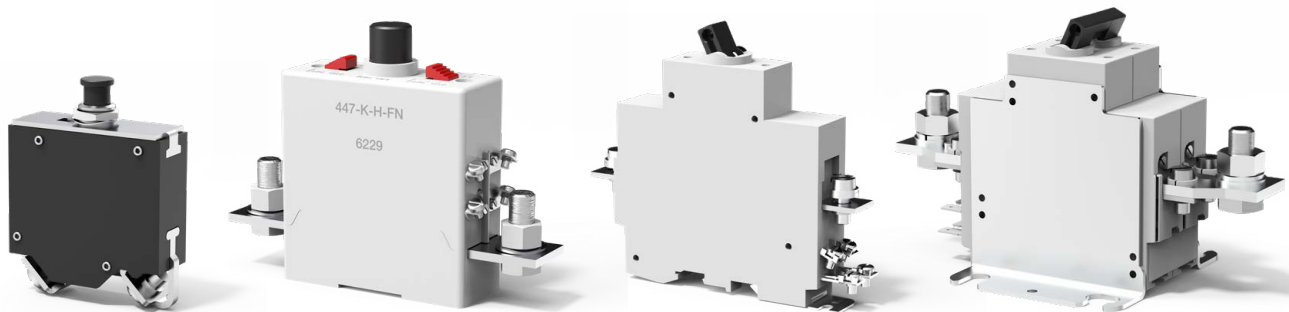
Interchangeable button covers allow professional training under real conditions without additional effort and without high current flow.

Your benefits

- **Enhanced safety** through trip-free mechanism, explosion proof design to VG 95210 and V0 enclosure
- **High reliability**, due to temperature compensation which ensures constant trip time even at extreme temperatures.
- **Resilience and increased machine uptime**, because high shock and vibration resistance prevents nuisance tripping
- **Maintenance-free**, because snap-action mechanism minimises contact wear and significantly increases the circuit breaker's endurance



Thermal-magnetic high performance circuit breakers



452 Type





446 Type



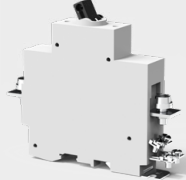


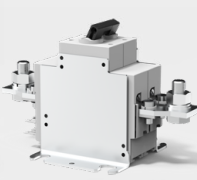
410 Type

437 Type

PRODUCT OVERVIEW

High performance circuit breakers

Type	4130	412/413	482	4140/5140
				
Description	Thermal circuit breaker	Thermal circuit breaker	Thermal circuit breaker	Thermal circuit breaker 4140: single pole 5140: three-pole
Voltage				
Voltage rating	AC 240 V, DC 50 V	DC 28 V AC 115 V (400 Hz) Upon request	AC 115 V (300–800 Hz), DC 28 V	AC 115 V (300–800 Hz), 3 AC 200 V (300–800 Hz), DC 28 V
Current rating				
Current rating range	20 ... 80 A	412: 6 ... 35 A 413: 30 ... 90 A	0.1 ... 50 A	20 ... 50 A
Auxiliary contact	–	–	0.5 A, DC 28 V	0.5 A, DC 28 V
Rupture capacity	800 A	6,000 A	6,000 A	4140: 4,000 A 5140: 2,000 A
General data				
Endurance	See data sheet max. 500 of cycles	412: 4,000 cycles at 2 x I _N 413: 2,000 cycles at 1 x I _N	10,000 cycles mechanical 5,000 cycles at 1 x I _N	5,000 cycles mechanical 2,500 cycles at 1 x I _N
Ambient temperature	-30 ... 60 °C	-55 ... 75 °C	-55 ... 75 °C	-55 ... 125 °C
Approvals	IEC/EN60934, UL 1077, C22.2	UL1077, C22.2, TL 5925	UL 1077, C22, VG 95345	Airbus EN 3662-005 Airbus EN 3662-005
Functions				
Snap-action mechanism	•	•	•	
Trip free mechanism	•	•	•	•
Explosion-proof to VG95210			•	
Temperature compensated				•
Two-chamber system				
Optional auxiliary contacts			•	•
Remote control				
Remote trip				
Various trip characteristics available		•		
Terminal design and accessories		•	•	•

4120	483/583	410/520/530	452	446/447/449	437
					
Thermal circuit breaker	Thermal circuit breaker 483: single pole, 583: three-pole	Thermal-magnetic circuit breaker 410: single pole 520: double pole 530: three-pole	Thermal-magnetic circuit breaker	Thermal-magnetic circuit breaker 446: fast trip curve 447: medium delay curve 449: delayed trip curve	Thermal-magnetic battery isolation switch
AC 115 V (300–800 Hz), DC 28 V	AC 115 V (300–800 Hz), 3 AC 200 V (300–800 Hz), DC 28 V	AC 240 V, 3 AC 500 V, DC 110 V	DC 28 V	DC 28 V	DC 144 V
1 ... 25 A	1 ... 35 A	7 ... 125 A	50 ... 100 A	446: 30 ... 400 A 447: 100 ... 400 A 449: 125 ... 500 A	40 ... 240 A
0.5 A, DC 28 V	0.5 A, DC 28 V	6 A, AC 240 V 1 A, DC 110 V	–	10 A	6 A at DC 28 V 0.2 A at DC 180 V
6,000 A	6,000 A	10,000 A	6,000 A	10,000 A	10,000 A (DC 28 V)
20,000 cycles mechanical 5,000 cycles at 1 x I _N	20,000 cycles mechanical 10,000 cycles at 1 x I _N	20,000 cycles mechanical 10,000 cycles at 1 x I _N	2,500 cycles at 1 x I _N	2,000 cycles mechanical 1,000 cycles at 1 x I _N	3,000 cycles at 240 A, 180 V DC 10,000 cycles at 240 A, 28 V DC
-55 ... 125 °C	-55 ... 125 °C (≤ 15 A) -55 ... 90 °C (> 15 A)	-40 ... 60 °C	-55 ... 75 °C	-55 ... 75 °C	-40 ... 60 °C
UL1077, VG 95345 et al., MS 3320 Airbus EN 2995-004/-005	VG 95345 et al., LN29887, AS14154, Airbus EN 2995-004/-005	UL 1077, C22.2	UL 1077, C22.2, VG 95345 et al., TL 5925-001	UL 1077, C22.2, VG 95345 et al.	–
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HYDRAULIC-MAGNETIC CIRCUIT BREAKERS

8335, 8340-F, 8340-G, 8340-T, 8345
Temperature, shock and vibration resistant



The **8335, 8340-G, 8340-T** and **8345** hydraulic-magnetic circuit breakers are particularly suitable for rail applications and other vehicle applications with high temperature and vibration values, because they feature a very robust trip mechanism and high resistance to vibrations.

The hydraulic-magnetic working principle is based on an iron core within an air-core coil, which is placed moveable in a tube filled with hydraulic oil. Only if the overcurrent is applied long enough and the core has been drawn entirely into the centre of the coil, the magnetic field will trip the mechanism. The oil used will always behave identically in a temperature range of -40 °C to $+85\text{ °C}$. Hence the characteristic curve remains nearly unchanged, i.e. temperature

compensated. By varying the oil viscosity, the trip curve of the circuit breaker can exactly be adjusted. In this product group E-T-A offers products with push-pull actuation and actuator toggle.

Application in the industries

- Construction machinery and agricultural vehicles
- Rail vehicles
- Specialty vehicles

Technical data

- 1 ... 125 A
- 1 ... 3 poles in a single device
- Remote control optional for ON and OFF operation
- Remote trip module optional
- Optional auxiliary contacts
- A wealth of design and mounting options

Your benefits

- **Maximum safety** through temperature-independent overcurrent and short circuit protection
- **High reliability** of the entire system through very high shock and vibration resistance
- **Effective use** of the space in the control cabinet as the devices can be mounted side-by-side without mutually influencing the trip curve.



TEMPERATURE-INDEPENDENT OVERCURRENT PROTECTION

Hydraulic-magnetic circuit breakers



PRODUCT OVERVIEW

Hydraulic-magnetic circuit breakers

Type	8335	8340-F
		

Mounting

Flange mounting	•	•
Threadneck		
Rail mounting		
Toggle actuation	•	•
Rocker actuation	•	

Technical data

Current rating range (DC 80 V)	1 ... 50 A	0.02 ... 50 A
Rupture capacity UL1077 (80 V DC 50 A)	1,500 A	3,500 A
Rupture capacity UL1077 (240 V AC 30 A)	1,500 A	3,500 A
Versions for 80 V DC (current ratings see data sheet)	•	•
Versions for 110 V DC (current ratings see data sheet)		
Versions for 250 V AC (current ratings see data sheet)	•	•
Max. no. of current paths per device	3	4

Add-on modules

Auxiliary contacts	•	•
Remote actuation		
Remote trip		
Water splash covers		
Actuator guard		

Approval logo

VDE EN60934	•	•
UL 1077	•	•
UL 1500 (based on UL 1077)	•	
UL 489A	•	
UL 489		
CCC	•	•

8340-G	8340-T	8345
		
•		•
•	•	•
0.02 ... 50 A	0.02 ... 50 A	1 ... 125 A
3,500 A	3,500 A	10,000 A
3,500 A	3,500 A	5,000 A
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4	4	4
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3131, 3120-N ROCKER-ACTUATED CIRCUIT BREAKERS

Circuit breaker/switch combination

The 3131 and 3120-N rocker circuit breakers are an attractive combination of ON/OFF switch and integral overcurrent protection. The appealingly designed 3131 rocker with soft-touch surface offers a smooth, but well-defined switching behaviour. The 3120-N additionally impresses with its worldwide unique accordion-style seal, excluding failures and resulting complaints due to dirt or humidity penetration. A wealth of circuit breaker versions and options offers maximum flexibility and allows tailor-made solutions - even for the most demanding applications.

The integral overcurrent protection obviates the need of fuse holders or additional space-consuming circuit breakers. This enhances the design and reduces wiring and mounting

complexity. The optional push-in terminals of the 3120-N allow fast and easy installation, while operation of the rocker switches is intuitive. If the circuit breaker trips, the rocker snaps back into the OFF position. Generous rocker surfaces for both rocker switches allow comfortable and safe operation even when wearing work gloves. This makes the 3131 and 3120-N the first choice products for construction machinery and agricultural vehicles, but also for specialty vehicles, trucks and buses.

Various symbols, rocker colours and illumination versions offer a wealth of design options. In addition, the 3131 as three-position switch (without overcurrent protection) is also available in the same design - for a seamless panel appearance.

Application in the industries

- Construction machinery
- Agricultural and forestry equipment
- Specialty vehicles

3131 technical data:

- DC 28 V
- 0.1 ... 20 A
- Single pole
- VDE, UL

3120-N technical data:

- DC 50 V
- 0.1 ... 20 A
(up to 30 A upon request, 1-pole only)
- 1 - or 2-pole
- VDE, CSA, UL, CQC, KTL





3131 Type

3120-N Type

Your benefits

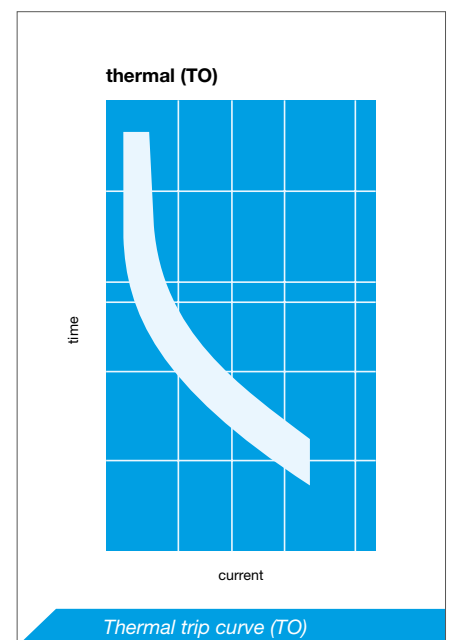
- **Reduced of system costs** through switch and circuit breaker combination
- **Additional safety** through integral overload protection
- **Increased availability** through reset function after a failure, fuse replacement is omitted
- **Additional ruggedness** for the entire system through a weather-proof version with integral water splash protection, featuring protection degree IP66



TECHNICAL INFORMATION

Thermal overcurrent circuit breaker (TO)

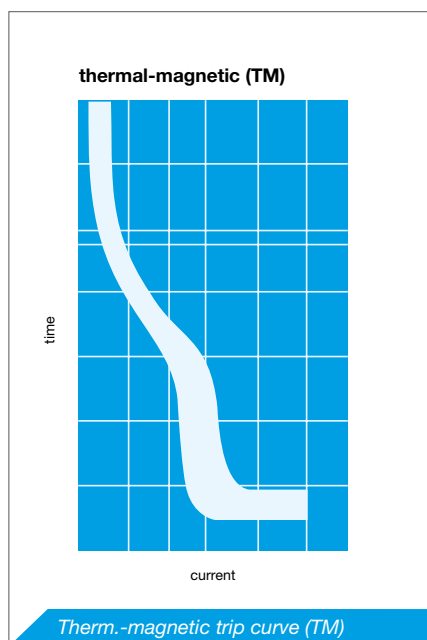
The trip time of thermal circuit breakers depends on the value and duration of the overload current. The higher the overcurrent, the faster the bimetal will reach its defined tripping temperature. In the event of a low overload it will take longer until the required disconnection of potentials takes place. Thermal circuit breakers are recommended for all applications where an overload is expected. They are the ideal solution for protecting loads, such as motors, transformers, magnetic valves, on-board electrical systems and low voltage lines.



Basics and application examples

Thermal-magnetic circuit breakers (TM)

The protective function of thermal-magnetic circuit breakers is achieved by combining temperature and magnetic force. The thermal element of the circuit breakers provides protection in the event of an overload with a delayed trip characteristic. The magnetic part responds without delay to high overload and short circuit currents and disconnects the faulty circuit within a few milliseconds. These circuit breakers are well suited for telecommunications, process control and similar applications requiring precision performance.



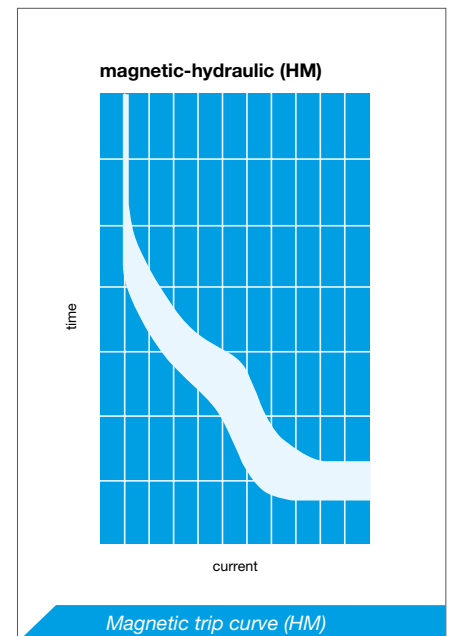
TECHNICAL INFORMATION

Basics and application examples

Hydraulic-magnetic circuit breakers (HM)

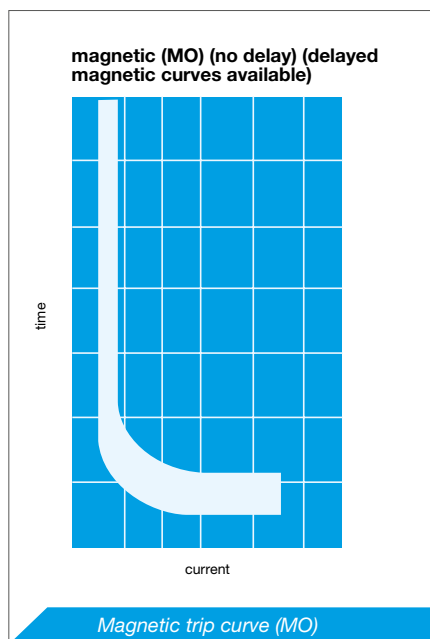
A well-proven design of solenoid coil with optional hydraulic delay provides tripping that is highly tolerant to changes in ambient temperature.

A wide range of performance characteristics is available in single, double and three pole configurations. The magnetic part responds without delay to high overload and short circuit currents and disconnects the faulty circuit within a few milliseconds.



Magnetic circuit breakers (MO)

Magnetic circuit breakers have an extremely fast trip characteristic. In the event of a short circuit the faulty circuit will be interrupted nearly without delay. The magnetic system of the breaker is the sole tripping element. As tripping depends on the time curve of the magnetic force and thus also on the magnetic field, the trip limit is influenced by the shape of the current characteristic (AC/DC). Magnetic circuit breakers are highly resistant to temperature fluctuations. This operating principle is ideally suited to protect any application with a higher short circuit risk.



Automotive circuit breaker operating modes (to SAE J 553)

Type I (autoreset):

Reset is effected automatically (autoreset). The circuit breaker opens the contact due to overcurrent. After the trip element has cooled down, it will reset automatically.

Type II (modified autoreset):

The circuit breaker trips in the event of a failure, but remains in the open condition as long as the load voltage is still applied. Only after removal of the voltage, the circuit breaker will start the reset process.

Type III (manual reset):

In the event of an overload these breakers open the circuit permanently. As the breaker has to be closed manually afterwards, it is ensured that the user notices the failure.

Type III H (manual reset with manual release facility):

As an extended version of type III, there is a version with manual release button, which offers the possibility to switch off mechanically, e.g. if maintenance or service is required.

Snap-action mechanism

The snap-action mechanism used in many E-T-A products ensures that the contact closing speed is independent of the operation speed of the actuator (e.g. push button, rocker, toggle). The moving contact is retained until the actuator reaches a certain force value in the closing direction of the contacts. Once this value is exceeded, the mechanical retention is released, allowing the contacts to snap closed (tease-free mechanism). The closing speed only depends on the applied force value. Snap action mechanisms eliminate contact welding upon ON-switching onto occurring short circuits and minimise the risk of contact wear over a circuit breaker's typical life.

Trip-free mechanism

Reliable switching behaviour of E-T-A circuit breakers is ensured by the trip-free mechanism (positively trip-free). The circuit breaker trips reliably in the event of an overcurrent, even when the actuator (push button, toggle or rocker) is blocked.

Auxiliary contacts

Some of E-T-A's circuit breakers are equipped with auxiliary contacts. These electrically separate low current contacts are used for alarm and control switching circuits.

Typical internal resistance values

The internal resistance values are typical for new devices. They may change through storage, life-span or overcurrent. Deviating internal resistance values do not affect the protective function of the circuit breaker.

Accessories for circuit breakers, circuit protectors and system solutions

E-T-A offers a comprehensive range of accessories completing our product portfolio. It includes add-on modules for zero-voltage release or auxiliary contact functions as well as water splash covers, terminal blocks, sockets, busbars, retaining clips, jumpers and many more. For detailed information please see the individual technical data sheets of our products (www.e-t-a.de), section "Accessories". For further details on our products please visit www.e-t-a.de.

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