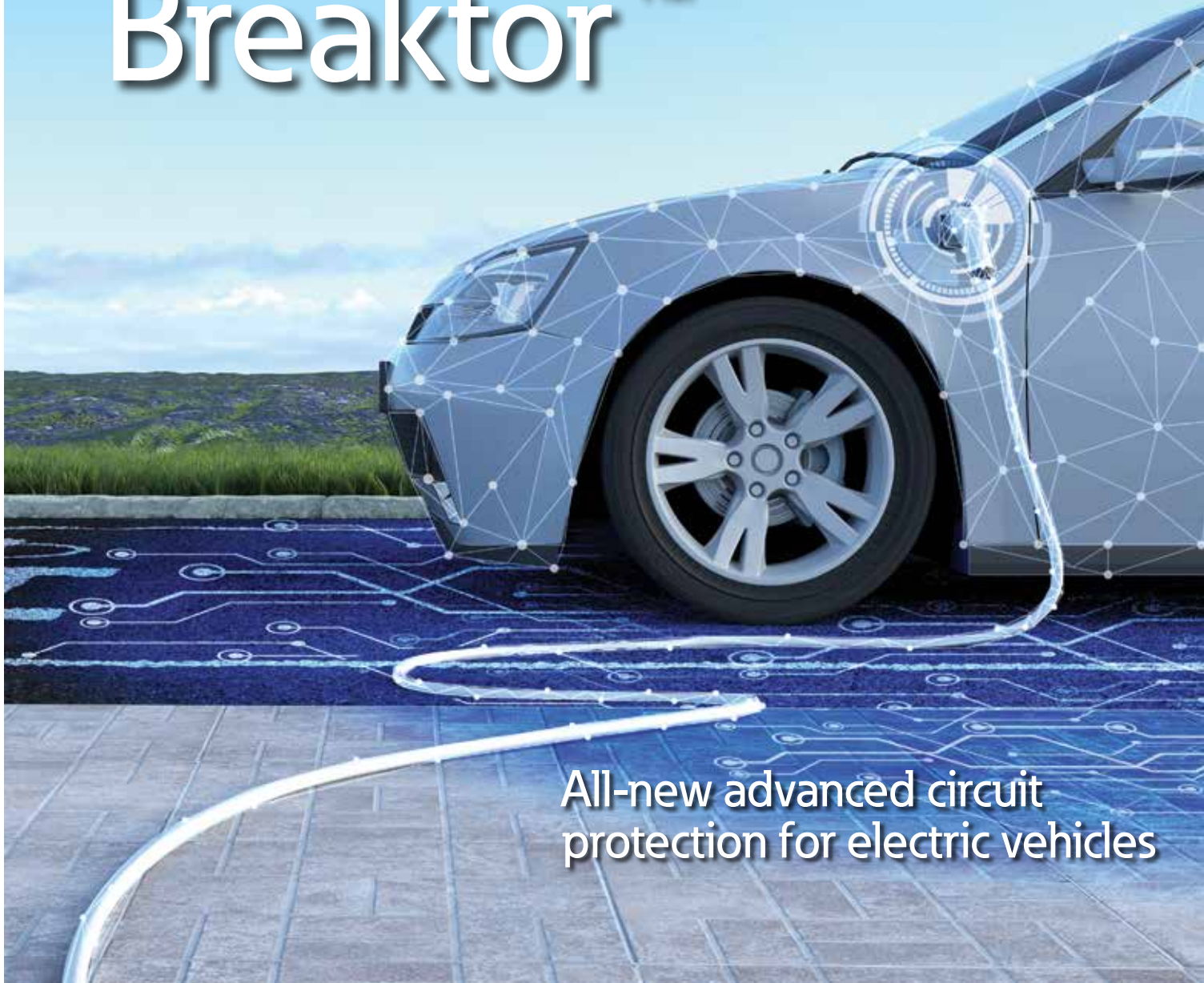


eMobility

Breaktor™



All-new advanced circuit
protection for electric vehicles

EATON

Powering Business Worldwide

Introducing the next generation of EV circuit protection.

As vehicle electrification becomes more prevalent, the demand for increased power levels and charging rates also grows. With these changes and advancements in technology come new vehicle safety implications and challenges.

Electric vehicle systems must safely and reliably protect people and components during all load situations including short circuits, overloads and collision events, as well as quick charging and normal driving scenarios. Eaton's all-new Breaktor™ is the complete solution.

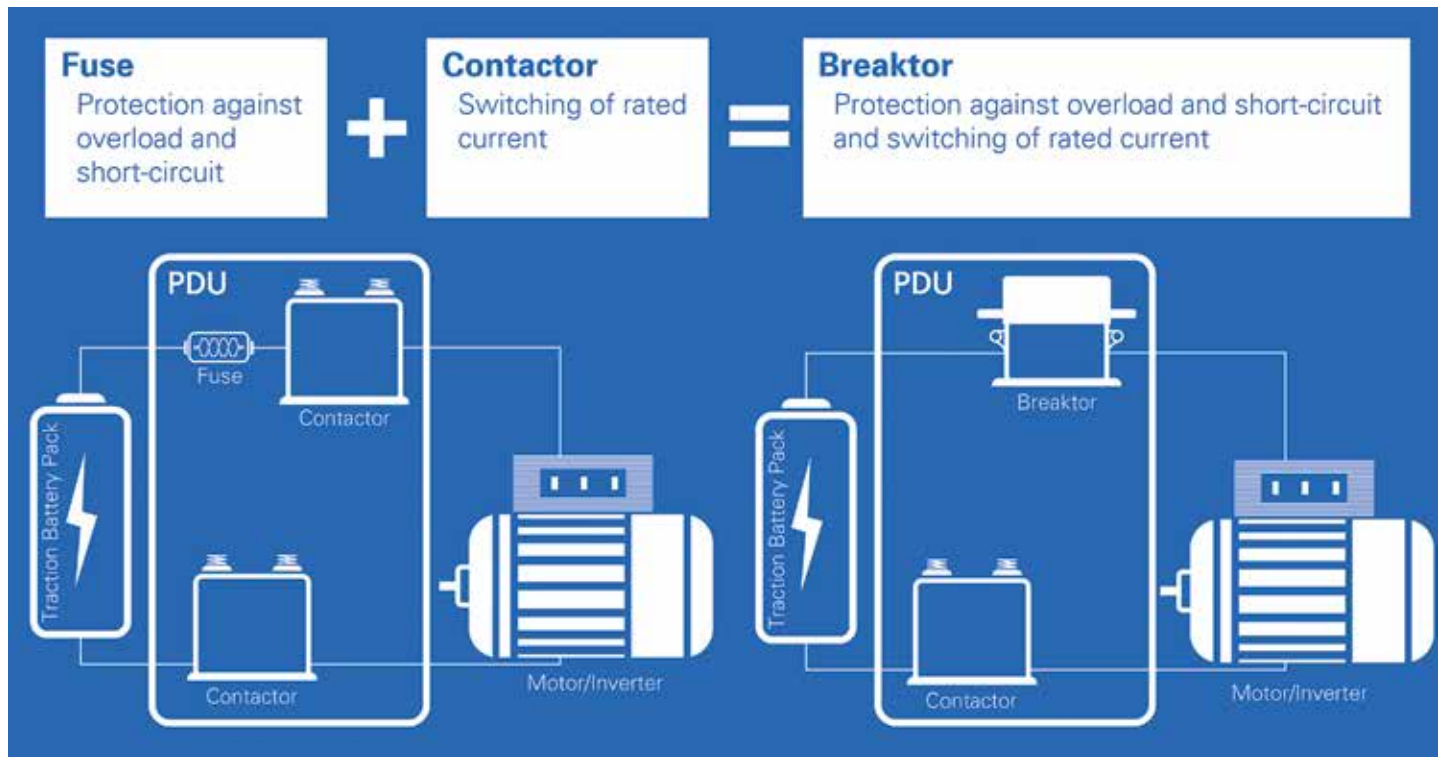


Conventional protection

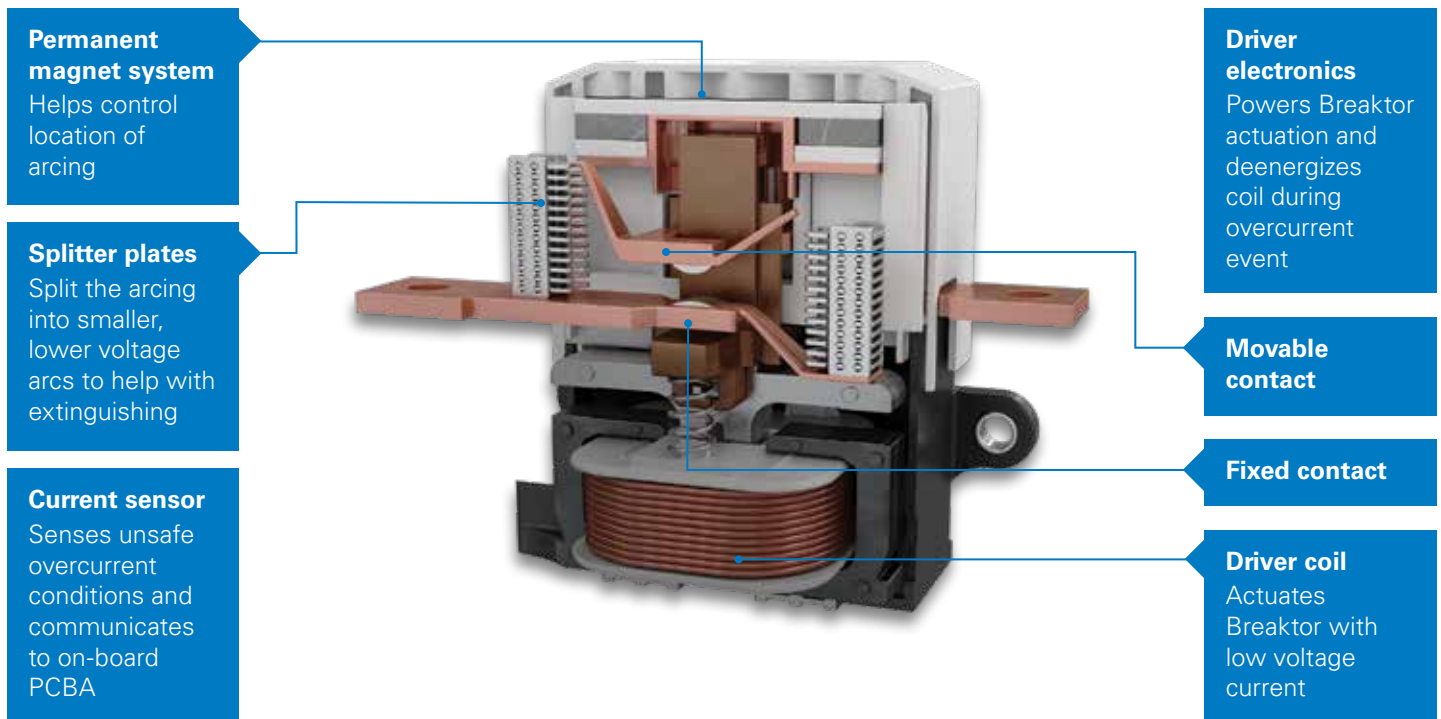
Conventional EV systems rely on fuses and contactors. As continuous current requirements increase, this combination has limitations - primarily due to the fluctuation of current from motor start, acceleration and braking or fast cycles resulting in excessive fuse wear. Conventional protection has contradicting design requirements which create coordination challenges. These coordination challenges can lead to nuisance tripping and significantly reduced reaction time in short circuits or overloads, especially in higher powered BEV applications.

Breaktor complete protection

Eaton's Breaktor has consistent reaction time with no fatigue. It is a new technology that provides all switching and protection function in one unit by combining the contactor structure with DC arc steering. Breaktor also offers load breaking as well as overload and short-circuit breaking ability. It is a self-triggering device, able to sense a current spike and interrupt the circuit on top of external triggering, for improved safety and reliability. Plus, Breaktor is resettable – no device replacements required.



Breaktor key features



Breaktor improves vehicle safety and protects components from any level of overcurrent condition.

- Less than 5-millisecond actuation up to **1,000 volts and 30,000 amps**
- **Resettable** like a circuit breaker, which enables reactivation of the device following a functionality check rather than a time-consuming vehicle service appointment
- **Current limiting** in the event of a short circuit, independent of the current direction
- Available in **multiple configurations** including voltage levels and multi-pole configurations

Why trust Breaktor?

Eaton has produced industrial circuit breakers and relays for over 70 years. Even the highest vehicle system voltage is still considered low or medium voltage in industrial applications. Eaton has a longstanding experience in developing and manufacturing technology for mobile applications.



500V Breaker specifications & capacities

Item	Value	Condition/Comment
General		
rated insulation voltage	Tbd*	max 4000m ASL*
max. operating voltage	500V / 480V	max 2000m ASL / max 4000m ASL
contact configuration	1 NO	
rated current (continuous load, thermal)	350A	<125°C at HV terminals, 120mm ² busbars
max short time current tbd	10min*	
mechanical lifespan operations	>=106 switching operations*	300 ops per hour @no switch-on load*
Main Terminals "HV"		
max. switch on current	approximately 1,7kA±20%*	current sensor threshold
cross area busbar	<=120mm ² *	conductor rail of 20mm width connectable; see drawing*
rated isolation voltage between main terminals and coil	>=1,9kV*	after short circuit trip
Coil Interface "12V switch On/Off" (electronic interface)		
control voltage	12V DC	
pick up voltage	<=8,4V*	over whole temp. range*
switch off voltage	4,5V ... 5,5V	
interface impedance (pick up operation)	1,3Ω*	
max pick up current	7,5A*	after 100ms reducing to holding current *
power consumption (holding power)	2,2W	reduction of holding current implemented
interface impedance (holding operation)	66Ω	@12V
switch on time (12V)	30ms*	
switch off time (12V)	<5ms*	
coil terminals	n/a*	depending on customer requirement*
(autonomous) Overload Protection		
overload current threshold	1,7kA±20%**	
accuracy of overload threshold	20%*	
max overload switch off current	25kA	
# of switch-off cycles	>2 (tbd)*	at max. overload current*
overload switch off time	<5ms*	incl. arcing time*
Emergency Input Switch "Crash" (optional)		
emergency switch off current	0...25kA ¹	1above 2,0kA overload protection as well*
emergency switch off time	<=5ms*	incl. arcing time
emergency shut off signal	12V ; 0,2...1s*	currently active, proposal passive
interface impedance	2,2Ω*	
interface current (threshold)	1,5A*	max. 1s*
switch off interface terminals	n/a*	depending on customer requirement*
Mirror Contact (optional)		
max values	12V, 2mA*	
Environment Constraints		
ambient temperature for short-circuit interruption	-40C...90°C	
ambient temperature for storage	-40°C...95°C*	
max. altitude above sea level	4000m	
mechanical shock resistance, open	25g/11ms*	to be verified
mechanical shock resistance, closed	>60g/11ms*	to be verified
degree of protection	IP00*	

*Breaker™ 500 One Pole Generic, Technical Data, specifications estimation, final value may differ. Other models and configurations available including 900-volt. Consult Eaton for more details. **Value can be custom specified.

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