Thought leadership
White Paper

How to remotely control and relocate the circuit protection function?

Author name
Alexandre Zint, product manager, Eaton

In today's competitive environment, train operators must use every opportunity to maximise the appeal and competitiveness of rail transportation. One way of achieving this is to reduce onboard equipment dimensions to increase passenger comfort and seating space.

In this paper, Alexandre Zint, product manager at Eaton explains how the correct choice of remote breaker reset devices makes this possible, while also improving equipment reliability and reducing maintenance cost.

Rail operators today find themselves in a highly competitive marketplace where the train is just one of the many transportation methods available. To meet this challenge, the industry is focusing on making the rail system the most appealing transportation choice on offer. Improvements to comfort, speed and affordability are seen as key components within this drive.

An important contribution towards success in this market can be made if some extra room can be freed-up in passenger carriages; this can increase the number of seats, make room for bikes or wheelchairs and improve passenger comfort by allowing them more room. Also, there is pressure to introduce double-deck trains, reduce underframe train gauges and reduce the size of the driver's cab. Accordingly, designers are seeking to delocalise and distribute functions to inaccessible places around the passenger car – in the roof, under the body or in hidden cabinets – to gain this extra space. Eaton's Remote Breaker Reset (RBR) technology provides an opportunity to achieve this, while also guaranteeing circuit breaker reset without disrupting power.

Remote Breaker Reset – principle of operation

As its name suggests, an RBR allows a train driver or other rail operative to remotely reset a circuit breaker after it has been triggered opened. The assembly comprises electronics, connectors, a solenoid and piston as shown in Fig. 1. RBR devices are available in three sizes and ratings; these are designed to be compatible with, and mounted onto different members of the Eaton JS, AR, ADS, GH and GJ Eaton's hydraulic-magnetic Heinemann circuit breakers ' series.

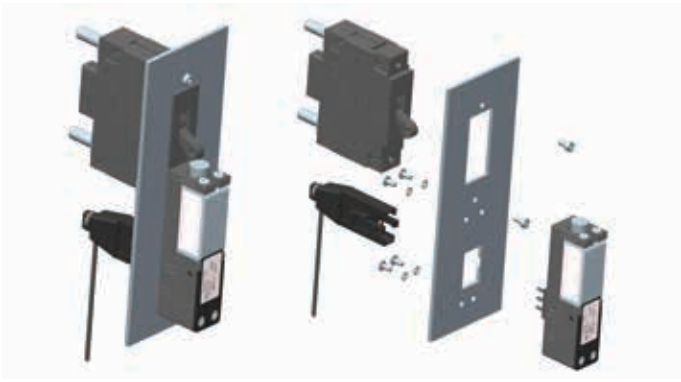

Fig1: Remote Breaker Reset key components

The sequence of events during a reset is shown in Fig. 2. During normal operation, the circuit breaker is closed, allowing current to flow within the protected circuit. The handle is in the up position, and the breaker can remain in this state indefinitely. The RBR solenoid is not energised, and the piston is held in a retracted position by gravity. If a short circuit or extended overload event on the protected circuit occurs, the breaker will trip to cut the current flow, and the handle will drop into down position.

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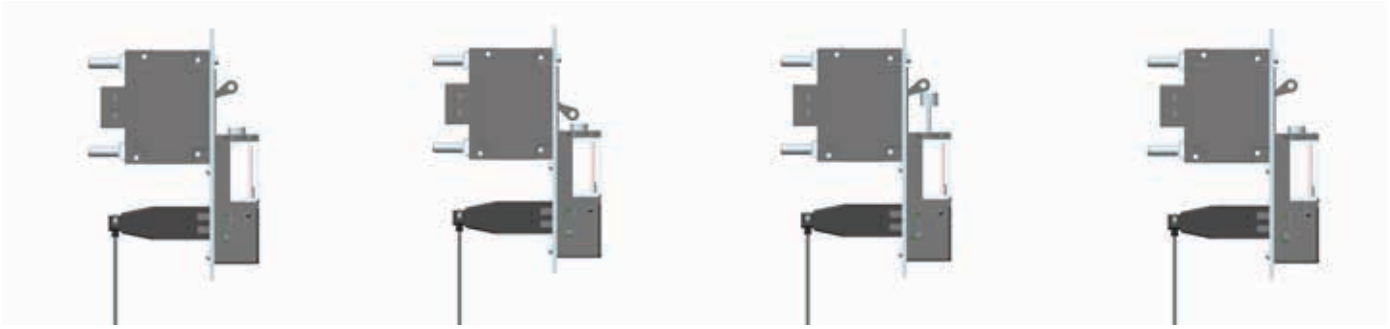

Circuit Breaker closed (protected circuit is powered)

Circuit Breaker opens (current is cut in the protected circuit)

RBR rests signal pulse sent to RBR for reset instruction : RBR actuates the Circuit Breakers handle

RBR back to initial configuration (by gravity)

Fig 2: Remote Breaker Reset operating sequence

The RBR can then be activated by a signal pulse sent from the remote control location. This energises the solenoid, which pulls the piston upwards to strike the circuit breaker handle and reset it, allowing current to flow again in the protected circuit. As the pulse signal returns to zero, the solenoid de-energises and simply returns back to the retracted position by gravity.

Benefits of the remote circuit breaker

Offerings competitive to the RBR depend on a worm gear reset device, which is located in an extra breaker housing and occupies valuable horizontal space. This space can be saved by using an RBR, which locates directly under the breaker handle.

The RBR also resolves timing issues related to the worm gear approach, which takes 5 – 6 seconds to reset the circuit breaker; this can cause arcing during reset under overload or short circuit conditions, damaging contacts and eventually leading to failure. By contrast, the solenoid-based solution resets breakers in milliseconds, preventing arcing damage.

Additionally, the control circuit has been designed to draw low currents – typically around 200 mA – which avoids interfering with any associated computer systems. At the same time, a single RBR is powerful enough to reset up to four circuit breakers in the presence of a short circuit without adversely affecting the breakers' internal components.

The RBR is ideally suited to a wide range of rail as well as other equally demanding remote environments within telecom, industrial and machinery, marine and defence applications. Its availability in three power ratings allows each designer to find the best fit for their application, while all devices are built to operate in extreme, harsh conditions. The devices can be guaranteed to provide electrical protection over time with a high level of reliability throughout conditions of shock, vibration, humidity, salinity and temperature variation. As Fig. 3 shows, there are many options available to the designer in addition to the four voltage ratings (24-48-72 and 110 VDC) and 3 sizes depending on power to develop choices. These allow the RBRs to be integrated into a wide range of control systems.

RBR-AR-4-110-110-C1-V1-T3

Series	Breaker type to reset	# of poles it can reset	Nominal voltage Coil	Nominal voltage Control	Control		Push washer type		Version	Special corrsion Treatment
	ARJS		24	24						
RBR	AR	1 to 4	48	48	C	with control	1	Square push washer (AR)	V1	T3
	GJ		72	72	N	without control	2	Round Push washer (ARJS)		
			110	110						

Fig 3: Remote Breaker Reset options

Conclusions

Eaton's hydraulic-magnetic circuit breakers offer significant advantages in train design because they allow precise circuit protection with improved safety, greatly reducing the incidence of nuisance tripping. They provide this quality of protection while being particularly resilient to the extremes of mechanical, electrical and thermal shock experienced by equipment in rail environments.

The Remote Breaker Reset devices described above offer the same environmental resilience while bringing valuable extra functionality to the circuit breakers. Their compact size and location directly under the breaker handles frees up valuable space which is consumed by the worm gear drives used in competing remote breaker technology.

RBR advantageously allows the relocation of critical functions in non accessible places such as in the roof or under the body of rail carriages, improving seating space and passenger comfort. In addition RBR also allows an immediate reset of a triggered circuit breaker without human intervention on the breaker : a very desirable feature that reduces the total cost of ownership and allows continuity of functions without annoying passengers when the train is rolling.

Another key advantage is the RBR's ability to reset a breaker in milliseconds rather than the 5-6 seconds required by the worm gear reset devices. This prevents arcing, protects the breaker contacts and prolongs the life of the breaker.

Designers wishing to implement remote breaker reset systems within their new or refurbishment rail car projects can benefit from working with a major international partner such as Eaton. Eaton not only designs and manufactures the RBR devices with the advantages described above, but also produces the hydraulic-magnetic circuit breakers that they operate with. They can assist with configuring or even customising integrated solutions optimised for specific applications; support is available both from their applications engineers and local distributors around the world. Local stockholding also assures rapid response to repair requirements, even in remote locations.

If you would like more information about options for remote breaker reset, visit Eaton online at **www.eaton.com/rail**, contact your nearest local distributor or contact us via **alexandrezint@eaton.com**

Eaton
EMEA Headquarters
Route de la Longeraie 7
1110 Morges, Switzerland
Eaton.eu

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