Electronic circuit breakers protect 24 V dc circuits in industrial control panels

For industrial control panels, electronic breakers offer advantages compared to mechanical breakers. Standard fuses or breakers have some issues that occur when a fault or short comes up within one of the spread circuits fed by the same power supply.

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For industrial control panels, electronic breakers offer distinct advantages over mechanical breakers.

An industrial control panel consists of an array of circuits. There are feeder, branch, control, or class II circuits that are needed to establish the specified function(s). All except Class II circuits need to be protected by a fuse or circuit breaker. For feeder and branch circuits the use of fuses or molded circuit breakers is common, as it also is for 24 V dc control circuits. In view of the progress of electronic development of PLCs, sensors, and the like, the electronic components become more sensitive to voltage dips and interruptions.

The standard way of fusing 24 V dc circuits is with the use of standard circuit breakers. If more than one circuit is needed, the output of the used power supply is to be split into the needed numbers of circuits by using fuses or breakers. It is a basic requirement that fuses or breakers used in control circuits have to comply with the applicable standard for supplementary overcurrent protectors. These well-known standards like UL 1077 or UL 248-14 are not applicable for electronic breakers. UL established a new standard UL 2367 – Solid State Overcurrent Protectors. This type of protectors is intended for the load side of an isolating transformer, power supply, or battery to provide supplementary protection.

Standard fuses or breakers have some issues that occur when a fault or short comes up within one of the spread circuits fed by the same power supply: a voltage drop on all connected loads with an amplitude based on the shorted path's impedance. A mechanically operated breaker or melting fuse will need some time to operate before shutting down the affected circuit. During this period the voltage can drop until 0 V dc for more than 10 ms and may lead PLCs into an unsafe or uncertain condition. When using an electronic fuse (solid state overcurrent protector), overcurrents are detected much more accurately and shut down much faster than by a fuse or breaker. This reduces the risk of misoperations to near zero.

Active current limiting

To avoid these problems, advanced circuit breakers can provide a solution. Variants provide different features. One design follows a thermomagnetic curve and behaves like a standard molded circuit breaker, but faster and more accurately based on electronic detection. High inrush currents (>50.000 µF) can be handled without problems.

Another series of breakers have an active current limiting implemented, which avoids any drop on the output circuits other than those affected. Based on that 100% individual channel design and sequential switch-on functionality, high inrush currents are manageable without any problems or shut downs. An advanced design can avoid shutdown of outputs during one single-channel failure (other than the affected channel), such as with some with electronic breakers available.

Electronic measurement of each channel's current allows designers to reduce the installed power of the power supply used; there is no need for backup power for letting circuit breakers trip in case of a short. Benefits like two-wire communication, remote reset, or signaling contacts are available.

Some reduced space designs are especially advantageous for 4- or 8-channel units. For mechanical breakers, eight breakers can require approximately 5.7 in.; some electronic breakers needs as little as 1.7 in. Only two more wires are needed for remote operation.

NEC Class II electronic breakers can be used to establish a NEC Class II circuit being supplied by the same power supply as with other circuits. **ce**

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