

Introduction to Different Types of Circuit Protection

There are three general types of circuit protectors: fuses, thermal circuit breakers and magnetic circuit breakers.

Fuses can be an inexpensive, dependable means of protecting equipment and wiring. They also offer relatively high current interrupting capacity for their cost. The disadvantages are that they destroy themselves in the protection process, and they are somewhat imprecise due to the affects of ambient temperature changes and repeated exposure to surges and minor overloads. Also, because the correct fuse may not be readily available, a blown fuse is sometimes replaced with one with a different rating, thus compromising safety.

Thermal circuit breakers utilize a bimetallic strip electrically in series with the circuit. The heat generated by the current during an overload deforms the bimetallic strip and trips the breaker. Thermal breakers have a significant advantage over fuses in that they can be reset after tripping. They can also be used as the main ON/OFF switch for the equipment being protected.

However, thermal breakers have some disadvantages. They are, in effect, “heat sensing” devices, and can be adversely affected by changes in ambient temperature. When operating in a cold environment, they will trip at a higher current level thus compromising safety. When operating in a warm environment, they will “nuisance trip” at a lower current level resulting in unwanted equipment shut downs. Thermal breakers can be derated to allow for minor ambient temperature changes if the amount and duration of these changes are known. But, this is not always feasible. For instance, the use of a thermal breaker in an outside environment such as in

marine use may not be appropriate. Here, wide temperature fluctuations will vary trip point and may create safety concerns.

Thermal breakers have relatively slow trip times as compared to fuses or magnetic circuit breakers. In recent years, larger thermal breakers have incorporated temperature compensating features as well as thermomagnetic mechanisms which address some of these problems. However, adding these features adds to breaker cost and complexity and can eliminate any cost advantage a thermal breaker has over a magnetic breaker.

Magnetic circuit breakers provide highly precise, reliable and cost effective solutions to most design problems. They have the advantages of thermal breakers but none of their disadvantages. The magnetic circuit breaker is considered to be temperature stable and thus is not appreciably affected by changes in ambient temperature. Its hydraulic-magnetic sensing mechanism reacts only to changes of current in the circuit being protected. It has no “warm-up” period to slow down its response to overload. It has no “cool-down” period after overload before it can be reset. The characteristics of a magnetic circuit breaker can be tailored in four separate areas: the desired circuit; the trip point (in amperes); the time delay (in seconds); and the inrush handling capacity of the breaker. These factors can be varied with relatively little impact on the short circuit capability of the breaker.

These options allow excellent flexibility in choosing the proper magnetic circuit breaker for each application. A more detailed explanation of magnetic circuit breakers follows:

About Magnetic Circuit Breakers

All Carlingswitch magnetic circuit breakers are designed to afford manufacturers of electrical and electronic equipment with reliable automatic circuit protection, power switching and circuit control, in a highly precise, versatile, compact, attractive and cost-effective package.

Features

Carlingswitch magnetic circuit breakers are current sensing devices employing a time proven hydraulic magnetic design. Their precision mechanisms are temperature stable and are not adversely affected by temperature changes in their operating environment. As such, derating considerations due to temperature variations are not normally required, and heat-induced nuisance tripping is avoided.

- A trip-free mechanism, a safety feature, makes it impossible to manually hold the contacts closed during overcurrent or fault conditions.
- Worldwide safety agency approvals are available.

- Current ratings to 100 Amps and rated voltages to 600 VAC are available.
- A common trip linkage between all poles, another safety feature, ensures that an overload in one pole will trip all adjacent poles.
- Series trip, mid-trip and switch only (with or without auxiliary switch), remote shutdown, shunt trip, relay trip and dual coil circuit options are offered.
- Industry standard dimensions, mounting and current ratings provide maximum application versatility.
- Handle actuators, solid color rocker actuators, illuminated rocker actuators and the exclusive Visi-Rocker® two-color rocker actuators, allow design flexibility and contemporary panel styling.
- 35mm DIN Rail back panel mounting available for world market applications.