

Physical Characteristics

Abstract

Overcurrent circuit protectors are available in a variety of different housings and functional arrangements. Whether or not a particular circuit protector is suitable for a particular application is dependent both on the device performance capability and the available physical characteristics for the device.

Typical Circuit Protectors

This whitepaper deals with the physical characteristics of circuit protectors. Different types of circuit protectors have their associated limitations and features. A summary table of physical characteristics is given in Table 1.1.

Fuses

Fuses are now offered in a variety of configurations. Sizes range from small surface mount devices without leads or fuse clips to large cartridges. Other configurations include standard fuse clips, holders, blade types (originally for the automotive industry) and those with wire leads for automatic board insertion equipment. Dual element fuses, indicator and alarm options are available. Fuses cannot be reset and can only be used to clear a fault or overload condition once.

Thermals (a.k.a. CBEs, Circuit Breakers for Equipment)

Thermal circuit breakers are available in small card mountable packaging, a variety of bezel mounts (including snap in) and with different bushing configurations. They are available in automatic reset configurations and in a wide

selection of circuit breaker switches and/or indicator configurations including rockers, push/pull, toggle, illuminated and push-to-reset circuit breakers usual numbers of poles are 1 to 3. Terminals can be wires for card mounting, quick connect blades, screw terminals, Edison base plug type, or fuse clip terminals. Other configurations include "fuse holder" style cartridges. Shunt trip, relay trip, alarm circuits and 3 and 4 terminal devices are available.

Magnetics

Magnetic circuit breakers are available with many options. Time delay options, inrush tolerancing, relay trip, shunt trip, dual coil (voltage and current), auxiliary switch, rocker handles, toggles, illumination and bat handles. Many color combinations are available. Six pole assemblies are available from some manufacturers. Mounting includes small breakers that are card mountable, quick connect blades, screw terminals, buss mounted and bezels that are snap in or screw mounted.

Thermal-magnetics

Reset configurations are mainly push button or toggle. Trip indicators range from lights to handle position to exposed symbols or flags. Mounting is usually with either bezel screws or buss clips.

Solid-state

Although no configuration is typical a range of solid-state protection devices could be from a black box replacement for a thermal or magnetic circuit breaker with terminals, mounting and status indication to a completely integrated set of components on a printed circuit board.

Table 1.1
Typical Values and Ranges for Protection
Devices Rated Below 30 Amperes

Typical Values and Ranges for Protection Devices Rated Below 30 Amperes

Parameters sensed	Fuse current, temp.	Thermal current, temp.	Magnetic current,	Thermal- Mag current, temp.	Solid State current, voltage, temp.
Manufacture's listing of useful ambient temperature range (C°)	—	-40 to 70 -55-121(a)	-40 to 85	-10 to 60	-55 to 85
Ultimate Trip Derating with Temperature	yes	yes no(a)	no	yes	no
Overload Trip Derating with Temperature	yes	yes no(a)	yes	yes	no
Minimum current rating (amperes)	.002	.05	.02	.5	.001
Interrupting capacity, fail safe (amperes)	1,500— 10,000	1,000— 6,000	1,000— 5,000	1,500— 10,000	(b)
Power loss	low	low	low	low	med.
Voltage drop at rated current: @ 2 amperes @ 10 amperes	.16 .12	.75 .03	.50 .13	.60(c) .13(c)	.20(d) .30(d)
Cycle life at rated current	(e)	5,000	10,000	10,000	1,000,000
Switchable	no	yes	yes	yes	yes
Remotely controllable	no	no	no	no	yes
Position sensitive	no	no	yes	no	no
Vibration and shock tolerance	high	high	med.	med.	very high
Cost	low	low	med.	med.	high
Maintenance	high	low	low	low	low

(a) Temperature compensated thermal circuit breaker

(b) solid state circuit protectors are not current withstand devices, they are current limiting

(c) applies to AC only

(d) applies to DC only

(e) not a switchable device

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