

To Fuse or Not to Fuse



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Fuses are commonly used to help protect an electronic circuit from damage caused by excessive current. However, in many applications resettable devices such as polymeric positive temperature coefficient (PPTC) devices, ceramic PTC devices, bimetal breakers, and thermostats are the preferred solution.

Despite the inherent advantages of resettable devices, there are circumstances where a fuse may be the preferred form of circuit protection. Under conditions where restoration of normal operation poses a potential safety hazard and/or where service on the equipment should be performed after a fault condition has occurred, a fuse or circuit breaker is appropriate.

For example, in a device with no inputs or outputs, where high fault current could be caused by a shorted capacitor, fuse protection might be preferred. Fuse protection would also be appropriate for a garbage disposal motor, since the blades could cause serious harm if the motor were to suddenly resume operation.

On the other hand, the resettable PPTC device is a logical solution for helping to protect loudspeaker coils that might be damaged by excessive power during sustained high-volumes. In this case, although a fuse could be used to protect the speaker, a blown fuse could be a source of frustration for the user and might result in a warranty return. PPTC devices are often used here because, if the voltage can be varied during operation, automatic reset can be designed into the application. In this case, PPTC devices provide “soft switching” into a high-resistance tripped state and automatically reset to a low-resistance state when the source voltage is reduced.

While a generic term for PPTC devices — “resettable fuses” — is sometimes used,

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technically they are **not** fuses, but non-linear thermistors. It is important that the circuit designer recognize critical differences between the two devices.

1. Fuses are circuit interruption devices, whereas PPTC devices are current limiting devices. Once a fuse activates, there is no longer voltage present in the circuit. PPTC devices require a low leakage current in order to remain in the tripped condition.
2. Fuses must be physically replaced following an overcurrent event. PPTC devices automatically reset when the power is cycled and the fault is cleared, allowing the restoration of “normal” circuit operation.

When deciding whether to specify a fuse or a PPTC device, certain application considerations should be addressed, such as:

1. Is the protection intended to guard against misconnection, or against internal faults?
2. Will the reset function be “voluntary” or “involuntary”?
3. Will involuntary restoration pose a safety hazard?
4. Will failure to alert the user to a fault condition (e.g.LED indicator) result in equipment damage?

For more information, please visit [Fundamentals of Resettable Functionality in PPTC Devices \[1\]](#) or [around the circuit \[2\]](#).

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<http://www.chem.info/blogs/2012/08/fuse-or-not-fuse>

Links:

[1] http://www.circuitprotection.com/catalog/fundamentals/PPTC_tech_brief.pdf

[2] <http://blog.circuitprotection.com/>