TECHNICAL BRIEF

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PHOENIX CONTACT
INSPIRING INNOVATIONS



Fundamentals of overcurrent protection

Matt Hemphill
Product Marketing Manager – TRABTECH
Phoenix Contact USA

Selective device protection with the widest range of tripping mechanisms provides maximum safety for every load. This means that only the areas that are actually affected by an overload or short circuit current are shut down. Different demands exist, depending on the area of application and task.

Protecting the device

Overcurrent protection for devices is used in situations where loads must be protected to a high degree of precision or where the overall system must remain running when a single end device or circuit experiences a failure. A fast and secure shutdown is essential; it is therefore particularly important to select the appropriate characteristic curve and the correct nominal current.

Options, technologies, and versions

Why overcurrent protection?

Overload and short-circuit currents are usually unexpected. They cause malfunctions and interrupt the operation of a system. Undesirable production downtimes and repair costs are often the result. You can minimize damage by protecting entire circuits and individual devices or device groups separately. This provides the overall system and end devices with optimum protection against damage or destruction. System parts not in the affected circuit continue to operate without interruption, assuming the overall process allows it.

Overload currents:

Overload currents occur when end devices unexpectedly require a higher current than the intended rated current. Such situations can arise, for example, when a drive is blocked. Temporary starting currents for machines are also overload currents. Although in principle, their occurrence can be determined by calculation, they can vary depending upon the machine load when starting. Take these conditions into account when selecting suitable overcurrent protection for such circuits and loads. Safe shutdown should occur within a range of a few seconds up to a few minutes.

Short-circuit currents:

Short circuits can arise between damaged operating voltage-carrying conductors or internally to a damaged end device. Typical protective devices for interrupting short-circuit currents include fuses, circuit breakers, and device protectors with various tripping mechanisms. These short-circuit currents should be safely interrupted within milliseconds.

Various technologies offering different forms of protection

Phoenix Contact provides thermal, thermal-magnetic, hydraulic-magnetic, and solid-state (a.k.a. electronic) overcurrent protection. The thermal devices protect via a bimetallic strip that trips when heated. However, this takes between 300 milliseconds and several minutes. In the event of overloads, this period of time is more than sufficient. In addition to thermal protection, a thermal-magnetic device provides protection in the event of a short circuit per the “magnetic” function of the device. If the current suddenly increases, shutdown occurs within a few milliseconds.

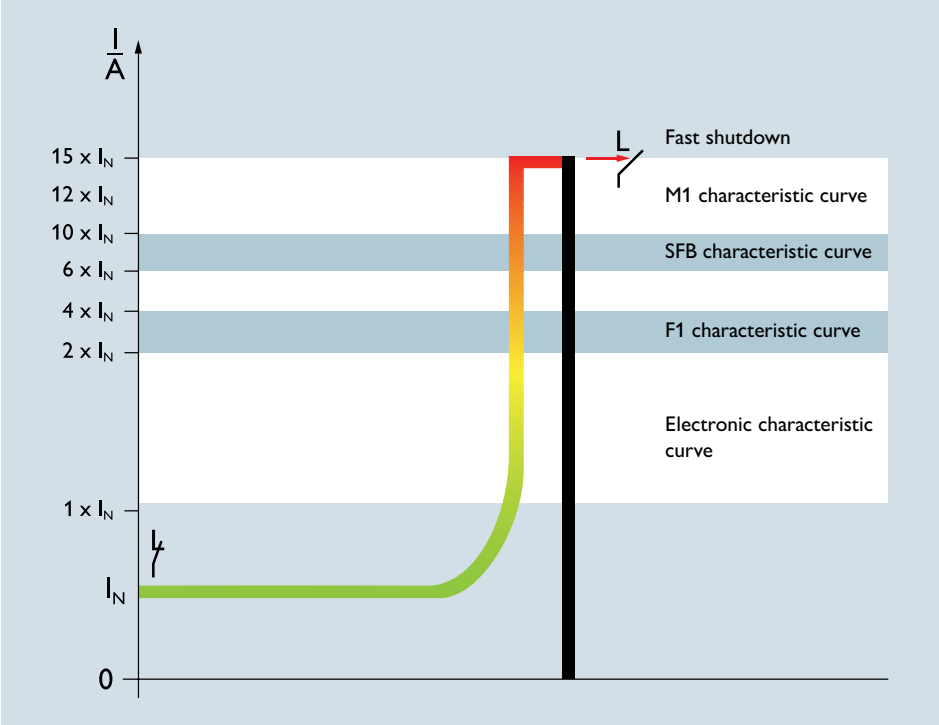
Hydraulic-magnetic devices perform in a similar way to thermal-magnetic devices. However, it relies on magnetic flux created by the flow of current through the device to determine when to trip in an overload situation. The magnetic part operates in a similar way as the thermal-magnetic device.

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Electronic devices reliably protect against both overloads and short-circuit currents, and they offer many advantages. Current and voltage are measured and monitored continuously. Errors are detected far more precisely and quickly. Currents are intelligently assessed and interrupted depending on various parameters. An electronic device will trip at a significantly lower current than an electromechanical device if appropriate. This allows the power supply output to be utilized far more efficiently, so reserve capacity can be significantly reduced.



Tripping behavior of various device circuit breakers

Selecting the right protection

The requirements for optimum protection vary depending on the area of application and task. Overcurrent device protectors feature a wide range of tripping technologies: electronic, thermal, thermal-magnetic, and hydraulic-magnetic. You will find the right solution for every demand in the Phoenix Contact product range.

The differences are in the tripping technology and the shutdown behavior. Characteristic curves clearly illustrate the various shutdown characteristic. Overcurrent protection is selected based on the nominal voltage, nominal current, and, if required, the starting current of an end device. The expected error situation – short circuit or overload – then determines the appropriate shutdown behavior.

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