# Miniature Circuit-Breakers

## Introduction

### Benefits

- High rated breaking capacity up to 10 000 A acc. to IEC/EN 60898
- Excellent current limiting and selectivity characteristics
- Tripping characteristics A, B. C and D
- Terminals offer protection against contact with fingers or the back of the hand acc. to the German accident prevention regulations VBG 4/BGV A3
- Combined terminals enable a simultaneous connection of busbars and feeder cables
- Uniform additional components which can be mounted individually, quickly and on-site thanks to their snap-on technique
- The handle locking device effectively prevents any unauthorized operation of the handle
- Particularly suitable for installation in flat distribution boards for building installations

### Application

*N-system* miniature circuit-breakers primarily serve to protect cables and lines against overload and short circuit. Thus, they also serve to protect electrical equipment against excessive overheating acc. to DIN VDE 0100-430 (see also IEC 60364-4).

Under certain conditions, miniature circuit-breakers also offer protection against dangerous leakage currents caused by excessive touch voltage due to insulation faults acc. to DIN VDE 0100-410.

Thanks to their fixed rated current settings, the miniature circuit-breakers may also be used for limited motor protection applications.

A range of different tripping characteristics are available for the applications described here. The IEC/EN 60898 standards form the basis for the miniature circuit-breakers' design and approval.
When used for industrial applications and for system and plant engineering applications, the *N-system* miniature circuit-breakers can be supplemented by individually mountable add-on components such as auxiliary circuit switches, fault signal contacts, shunt trips and individually mountable accessories, such as busbar systems and mounting parts.

### Design

*N-system* miniature circuit-breakers are equipped with a delayed overload/time-dependent thermal release (thermal bimetal) for low overcurrents and with an instantaneous electromagnetic release for higher overload and short-circuit currents.

The special contact materials used guarantee a long service life and offer a high degree of protection against contact welding.

### Function

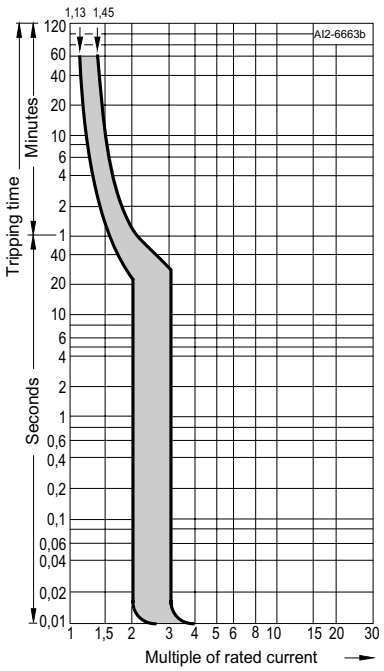
Thanks to the extremely fast contact separation in cases of failures and the rapid quenching of the arc consequently generated in the arcing chamber, the *N-system* miniature circuit-breakers ensure safe and current-limiting disconnection.

The permissible limit $I^2t$ values of the energy limitation class 3 specified in IEC/EN 60898 are generally undercut by 50 %. This guarantees an excellent selectivity towards upstream overcurrent protection devices.

### Characteristic curves

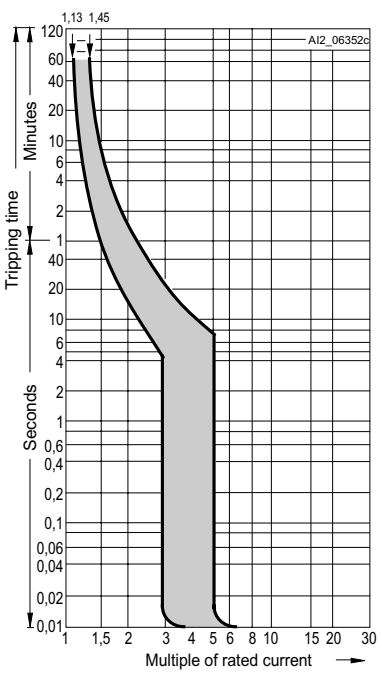
***Tripping characteristic acc. to IEC/EN 60898***

Tripping characteristic A




- For limited semiconductor protection
- Protection of measuring circuits with transformers
- Protection of circuits with long cable lengths which will require tripping within 0.4 s acc. to DIN VDE 0100-410

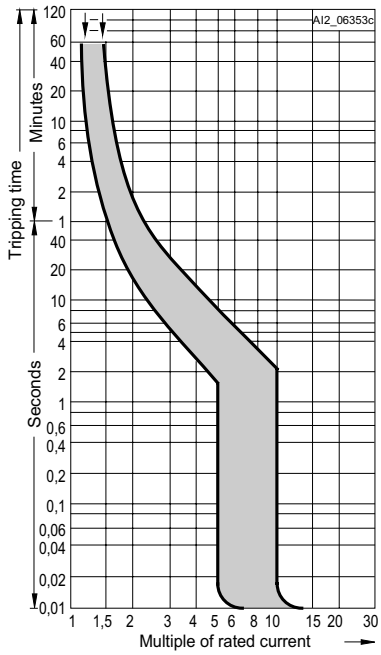
Tripping characteristic B




- Line protection mainly in socket outlet circuits; no proof required regarding personnel safety

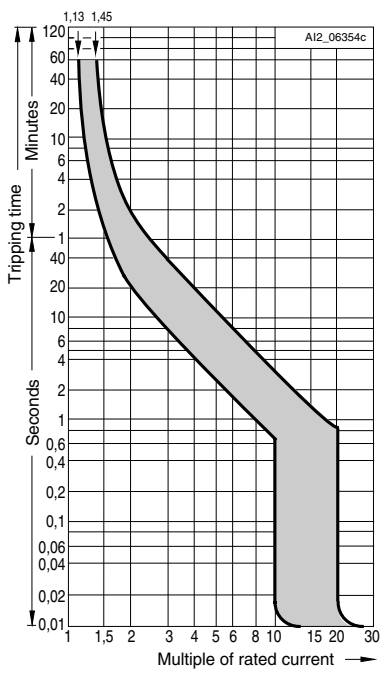
## Characteristic curves

Tripping characteristic C




- General line protection, especially advantageous with higher starting currents (lamps, motors, etc.,).

Tripping characteristic D




- The tripping range has been matched to applications involving equipment generating significant pulses (transformers, solenoid valves)

## Introduction

In the case of different ambient temperatures, the current values of the delayed tripping operation change by approx. 5% per 10 K temperature difference > for temperatures lower and < for temperatures higher than 30 °C.
For direct voltages, the maximum current values of the instantaneous tripping operation increase by a factor of 1.2.

If more than one electrical circuit is loaded in a series of circuit-breakers the resulting increase in ambient temperature affects the characteristic curve.

In this case an additional correction factor, specific to the rated current of the circuit-breaker, must be taken into account.

| **Number** | 1 | 2 ... 3 | 4 ... 6 | > 7 |
|---|---|---|---|---|
| **Correction factor K** | 1.00 | 0.90 | 0.88 | 0.85 |