Residual current circuit-breakers
DFS 2/4 B

Doepke

# Safely equipped for any residual current

DFS 2/4 B – reliable protective separation for smooth DC residual currents and AC residual currents up to 150 kHz
– maximum surge current strength for maximum system availability
– flexible system retrofitting thanks to varying dimensions
– two-terminal residual current circuit-breakers in compact housing of just two module widths


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# Complex installations call for special protection

*Electronic consumers and frequency converters with operating frequencies into the kilohertz range are now standard in electro-technical installations. The residual currents that can occur in these installations may vary: in addition to conventional AC residual currents, smooth DC residual currents and AC residual currents with frequencies not equal to 50 kHz are becoming increasingly common. In this case, type A residual current circuit-breakers are no longer sufficient because they cannot detect these dangerous residual currents precisely. The VDE regulations and the safety rules of the professional association stipulate the use of type B residual current devices here.*

Doepke developed the AC-DC sensitive DFS 2 B and DFS 4 B devices for the reliable, standard-compliant protection of installations – and of course the people who operate them. They have offered reliable protection against residual currents of all types for years.

## High expertise for AC-DC sensitive solutions

Consider photovoltaic systems, charging columns for electric vehicles or single-phase frequency converters, where smooth DC residual currents may occur: each of these installations and applications requires a different type of protection. That's why with the AC-DC sensitive residual current circuit-breakers from Doepke you can choose between different versions to cover all of your protection requirements. Even the installation dimensions are flexible: the DFS is available in just four module widths and now even comes in a compact housing that requires a mere two module widths. This makes retrofitting really easy, even when space is at a premium. Plus it goes without saying that all Doepke residual current circuit-breakers meet the DIN VDE 61008 device standard requirements. DIN VDE 0100 Part 530 serves as a useful guide when choosing a circuit-breaker and Doepke's team of experts are very happy to help you determine which circuit-breaker is the best choice for your needs.

With the AC-DC sensitive DFS 2 B or DFS 4 B from Doepke, you can be certain that your system is equipped for the future when it comes to residual current protection. While your project's immediate needs are more than covered, the high-quality AC-DC sensitive circuit-breaker delivers optimal protection for your electrical installation for years, no matter what equipment or devices are used in future.

# The perfect tripping response thanks to various characteristic curves

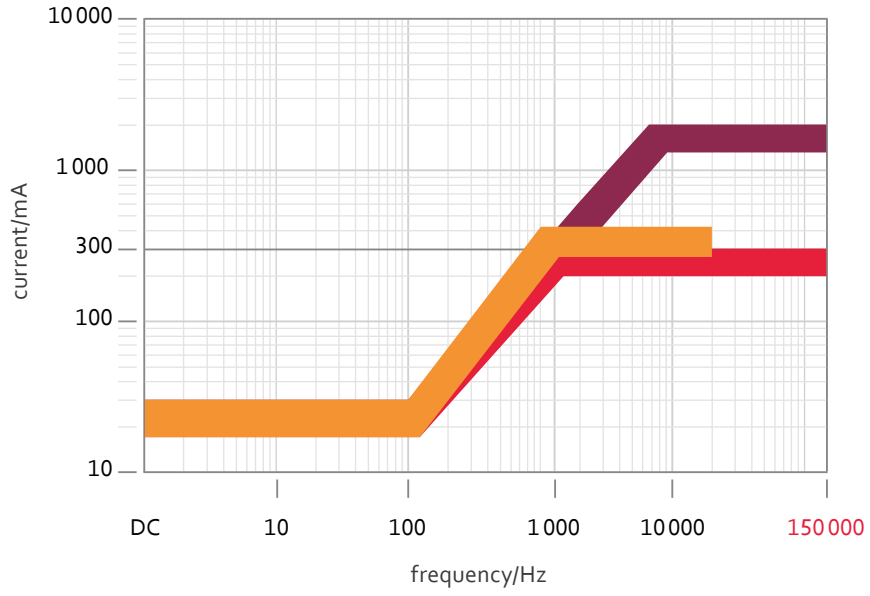
**The best fire protection with the DFS 2/4 B NK or B+**

Need AC-DC sensitive residual current circuit-breakers that also meet requirements for preventative fire protection? Look no further than the devices in the DFS 2/4 type B+ or NK series. With type B+ devices the characteristic curve for the tripping frequency response runs below a tripping threshold of 420 mA at frequencies up to 20 kHz. The even more sensitive devices with the NK tripping characteristic offer a lower tripping threshold – with their conventional top limit of 300 mA they can even work at up to 150 kHz.

**High system availability with the DFS 2/4 B SK**

The tripping frequency response for the DFS 2 B and DFS 4 B type SK circuit-breakers has a tripping threshold up to 2 A at high frequencies. If system-specific, high-frequency leakage currents are expected, the SK characteristic curve ensures the highest possible system availability. Devices with this curve provide fire protection at frequencies up to 1 kHz. Residual current circuit-breakers with this characteristic curve therefore combine safety and cost-efficiency while protecting installations where system availability is the top priority.

**Choosing the right breaker**




tripping frequency response DFS 4 B SK; $I_{\Delta n}$ = 30 mA
tripping frequency response DFS 4 B+; $I_{\Delta n}$ = 30 mA
tripping frequency response DFS 4 B NK; $I_{\Delta n}$ = 30 mA

# Choosing the right residual current circuit-breaker

**Basic circuit for electronic operating equipment in accordance with HD 60364-5-53:**
- three-phase full bridge circuit
- three-phase star circuit
- full bridge circuit between external conductors
- single-phase detection with smoothing

**Systems with frequency converters:**
- pumping, air conditioning and ventilation systems
- escalators and elevator systems
- medical devices
- solar power plants
- welding plants
- UPS systems

YES

Will the RCCB be used in a charging device for electric vehicles?

NO

YES

Does the vehicle manufacturer stipulate an AC/DC-sensitive RCCB?

YES

NO

NO

use of single-phase frequency inverters

examples:
- washing machines
- vibrators
- hammer drills
- heat pumps

NO

YES

A

**DFS 2/4 A**

use conventional RCCBs (Type A).

F

**DFS 2/4 F**

use mixed frequency sensitive RCCBs (Type F).

A EV

**DFS 4 A EV**

with active additional device for tripping at residual DC currents greater than 6 mA.

B SK

**DFS 4 B SK**

with a tripping threshold of 2 A at frequencies above 2 kHz, this RCCB protects against high leakage currents.

Note:
The rated residual current is not subject to this illustration – it has to be chosen according to the protection purpose.

Will the RCCB be used for a plant where fire is a potential hazard?

examples:
– agricultural facilities
– biogas plants
– paint shops
– joineries
– refuelling systems
– warehouses

YES

Is a fire protection threshold of 420 mA too high or are frequencies greater than 20 kHz?

NO

YES

NO

Will the RCCB be used in a circuit with unknown upstream protective measures?

NO

YES

Will the RCCB be used in a circuit with unknown upstream protective measures?

NO

YES

B SK MI

DFS 4 B SK MI

with a reduced tripping threshold of ≤ 6 mA in order to ensure the correct tripping of upstream protective devices.

B+

DFS 4 B+

meets required fire protection levels of 420 mA at frequencies of only 20 kHz or lower.

Result: limited system protection

B+ MI

DFS 4 B+ MI

with a reduced tripping threshold of ≤ 6 mA in order to ensure the correct tripping of upstream protective devices.

B NK

DFS 4 B NK

meets conventional required fire protection levels of 300 mA at frequencies up to 100 kHz.

Result: optimal system protection

# More designs for special requirements

**The selective series for even more control**

Doepke has thought of every application in the development of its residual current circuit-breakers. Device versions with the "S" designation provide the option of selectively protecting installations with main and sub-distribution boards. A targeted layout of instantaneous conventional or AC-DC sensitive circuit-breakers can be arranged, allowing your customers to benefit from tiered system protection where only the faulty part of the installation is switched off.

**The heavy duty version for tough environments**

With Doepke's AC-DC sensitive residual current circuit-breakers you have the right tools, even in extreme situations. Our HD (heavy duty) version is designed for use in tough ambient conditions. HD versions are especially protected against corrosion and are always the right choice in applications involving dust, humidity, corrosive gases or high temperatures up to 60 degrees.

We are partner

# Doepke

**Doepke** Schaltgeräte GmbH
Stellmacherstraße 11
26506 Norden | Germany

@ —— info@doepke.de
T —— +49 (0) 49 311 806-0
F —— +49 (0) 49 311 806-101

**www** —— doepke.de

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