

Installation and operating instructions for residual current operated circuit-breakers with integral over-current release and arc fault protection equipment (series DAFDD 1)



This installation and operating instructions are aimed at qualified electrical specialists. The installation of devices of this type is not appropriate for electrical laypersons due to the considerable potential dangers. The installation and operating instructions must be kept so that they can be referred to at a later stage. The operator of the electrical installation must be informed about the use and function of this protective device.

Intended use

DAFDD 1 series switching devices are residual current operated circuit-breakers with integral over-current release (RCBO, also known as a FI/LS combination) and arc fault protection equipment (AFD, also known as fire protection switches colloquially). The DAFDD1 meet requirements both for fault current and overcurrent protection and for arc fault detection and switch-off. Used in electrical installations, their automatic switch-off protects, for example, against electric shock (as per VDE 0100 Part 410) and against thermal effects (as per VDE 0100 Part 420). The RCBO and AFD functions aside, the DAFDD1 also monitors internal voltage to protect connected consumers against continuous over-voltage. The DAFDD switches off if the voltage exceeds 270 V AC.

Application

The DAFDD 1 are designed solely for use in single-phase alternating current systems with a rated voltage of 230 V and a rated frequency of 50 Hz. They are not intended for use in DC networks.

Application instructions and warnings

- Devices with visible damage must not be installed or used.
- Without any additional protective housing, protective switching devices should only be stored and operated in a dry, low-dust environment. An aggressive atmosphere must also be avoided.
- Protection against direct contact according to protection class 2 must be ensured with the assistance of the associated distribution board or device covers.
- The user must be made aware of repeat testing using the test button T.
- Trips due to leakage currents caused by surge voltage cannot be completely ruled out. In cases where an interruption of the power supply may lead to potential dangers for humans and animals or serious damage to property, residual current protection with increased surge current strength and upstream surge arresters should be implemented. In specific cases, the switching status should be monitored by means of an auxiliary contact on the residual current and an appropriate signalling device.
- When working on electrical installations, this fuse must always be activated and the safety rules must be observed. Should there unexpectedly be any contact with live parts, a doctor must be called immediately.

Mounting and connection

Assembly

DAFDD 1 devices are designed as modular DIN rail components for integration in distribution boards or unit housings for installation on mounting rail TS 35. The guide phase and neutral conductor must be connected from underneath the switch (make sure the power flow direction is as per the label on the device). The neutral conductor can be connected on the left or the right. The installation has two-terminal monitoring.

Insulation test and commissioning

The consumer system's insulation is tested according to national guidelines. This may only be done when the device is disconnected. Conducting the test when the device is connected may result in incorrect values being measured or in the AFD unit being damaged. Testing of all safety measures during commissioning must be carried out according to the information in the valid national installation regulations.

Switching on the device

The LED briefly lights up red, yellow, then green when the device is switched on. During normal operation (all AFD unit functions available), the LED will light up green without interruption. If the LED displays a (yellow) blink code after the device is switched on, please refer to table 'Explanation of AFD unit error codes'.

Functional inspections

Testing the residual current circuit-breaker

A functional inspection of the residual current circuit-breaker itself is possible with connected mains voltage by pressing the test button T. As in commercial use (DGUV regulation 3), it should be carried out at least every six months in the case of stationary systems and should be repeated every working day in the case of non-stationary systems. The test button is pressed to conduct internal testing on the residual current device. Pressing this button regularly may extend the reliability of the device in the long term, as it means that the mechanical components are moved and the electronic components are tested. Pressing the test button and switching the device back on following a successful test can be done by an ordinary person and does not require expert electrotechnical knowledge.



The switch is defective if it does not trip when the test button is pressed, or if there is a delay before this happens. In the event of a fault, adequate protection may no longer be guaranteed!

AFD unit testing

The AFD unit constantly tests the incoming high-frequency signals and the results from the controller for plausibility. If anything is conspicuous during this self-testing, the switch will trip. The internal fault will be displayed as a blink code via the LED after the device is switched back, then switches from red to yellow permanently. This restart feature makes 24-hour operation possible, until the switch trips again. Restarting can take place any number of times; the flashing and tripping are reminders that the AFD unit stopped working.



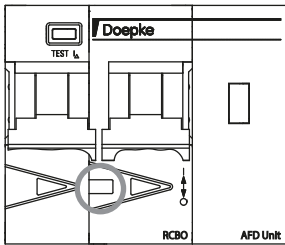
Arc fault monitoring is not guaranteed during 24-hour operation! All RCBO functions will be available, independently of the AFD unit.

DAFDD 1 displays

The different tripping causes are displayed separately.

Tripping due to RCBO

Residual current

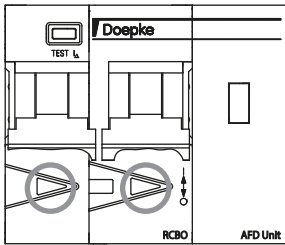


The rectangular display located centrally below the toggle switches from white to blue.

White: OK (with supply connection and disconnection)

Blue: tripped

Line protection

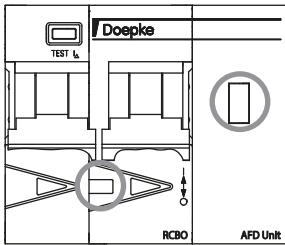


Position indicating devices are required to identify trips caused by line protection. The triangle displays below the toggle switch between green and red, as described below. The display for residual current remains white.

Green: device switched off or tripped

Red: device switched on

Tripping due to AFD unit



The rectangular display located centrally below the toggle switches from white to blue. The LED displays a (yellow) blink code after the device is switched back on. The unit repeats this three times, then switches permanently to green (normal operation) or switches yellow-red (the AFD unit has stopped working during 24h operation). Refer to the table 'Explanation of AFD unit error codes' for more about the error that is displayed here.

Switching back on after tripping

The triangle operation indicators beneath the toggles indicate the status of the main switching contacts. If the sequential circuit is open (e.g. after tripping or switching off), these will be green, and red if the main switching contacts are closed. The residual current display will be blue after the switch has tripped as a result of the test button being pressed or due to a system-specific residual current. The DAFDD 1 toggle will be in the lower toggle position, 'o'. The toggle must be moved up to position 'I' in order to switch back on. If the toggle does not remain switched on independently, the switch/installation will need to be tested by an electrically skilled person.

Explanation of the AFD unit error codes after device is switched on

Display blinks...	Colour	Meaning
continuously glowing	green	normal operation
1x	yellow	serial error
2x	yellow	dimmer error
3x	yellow	parallel error
4x	yellow	over-voltage > 270 V
5x	yellow	temperature > 115 °C
6x continuously	yellow yellow/red	internal error

A sticker containing explanations of the codes (e.g. for the distribution box) is included in the scope of delivery.

Error code displayed repeatedly on the AFD unit

The blink code may be displayed repeatedly after tripping caused by the AFD unit. In this situation, turn off the switch (toggle underneath) then turn it on again by pressing the test button.

Dimmer error

If tripping is caused by a consumer that is using a leading and trailing edge during operation (e.g. a dimmer), 'dimmer fault' will be displayed as the cause of the fault. This will make troubleshooting easier in the system. In this case, the DAFDD and dimmer are not compatible with all of the dimmer area. This is not a critical error; it may be necessary to replace the dimmer however.

Preventive maintenance and repair

No preventive maintenance of the device is required on top of regularly pressing the test button (see 'Functional inspections'). The DAFDD 1 does not contain any components which can be repaired or replaced. Defective devices must be replaced immediately.

Warranty

All professionally installed, unaltered devices are covered by warranty for the duration of the statutory warranty period from the day of purchase by the end user. The warranty is not applicable to damage incurred during transport or caused by short-circuit, overloading or improper use. In the event of defects in workmanship or material being discovered within the warranty period, the company will provide repair or replacement free of charge. The warranty will be rendered null and void if the device is opened without authorisation.

Technical data

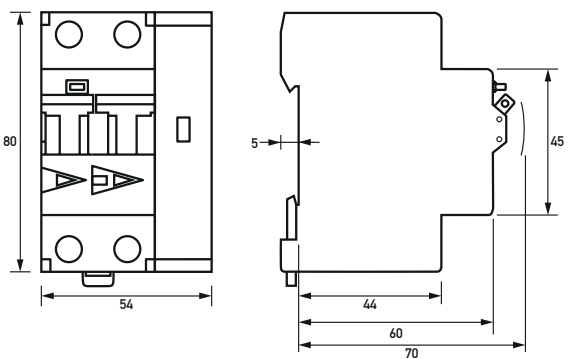
DAFDD 1				
Type of residual current	AC	A	A KV	F
Rated residual current IΔn	0.01 A or 0.03 A			
Short-time delayed	no	no	yes	yes
Number of poles	2			
Neutral-pole position	variable; left or right			
Tripping characteristic (MCB)	B, C			
Rated current (AC)	10 A, 13 A, 16 A, 20 A, 25 A, 32 A, 40 A			
Rated voltage (AC)	240 V (170 V–264 V)			
Rated frequency	50 Hz			
Rated short-circuit current	10 kA			
Max. rated switching capacity	10 A, 13 A, 16 A, 20 A, 25 A = 10 kA 32 A, 40 A = 6 kA			
Surge current strength	0.25 kA	0.3 kA		
Rated insulation voltage	250 V			
Min. operating voltage range of test circuit	196 V			
Max. operating voltage range of test circuit	253 V			
Rated impulse withstand voltage	4 kV			
Overvoltage category	III			
Short-circuit back-up fuse (SCPD)	100 A			
Back-up fuse type	gG			
Protective cover available	yes			
Protective cover	DGUV regulation 2 (BGV A3), ÖVE-EN 6			
Clamping area	1 mm²–25 mm²			
Mechanical endurance	min. 20,000 switching cycles			
Electrical endurance	min. 4000 switching cycles			
Storage temperature	-35 °C–60 °C			
Ambient temperature	-25 °C–40 °C			
Resistance to climatic changes	according to IEC/EN 61009			
Housing type	distribution board housing			
Mounting type	mounting rail			
Housing material	thermoplastic			
Protection class	IP20 (installed: IP40)			
Dimensions (w × h × d)	54 mm × 80 mm × 76 mm			
Installation depth	70 mm			
Module widths	3			
Design regulations/standards	EN 62606, EN 61009			
Certifications	VDE			
Power limitation category	3			
Pollution degree in accordance with EN 60664	2			

Explanation of type codes

Example: DAFDD 1 B10/0.03/2/A KV

- DAFDD 1 = series 1 AFD
- B10 = line protection characteristic
- 0.03 = rated residual current
- 2 = two-terminal
- A KV = type A residual current circuit-breaker (RCCB), KV form factor

Dimensions



Additional information

Terms	
RCBO	Residual current operated Circuit-Breaker with Overcurrent protection
AFDD	Arc Fault Detection Device
AFD unit	Arc Fault Detection-Unit

Function

The RCBO part of the DAFDD 1 contains a residual current circuit-breaker with line protection for protecting persons, farm animals and material items in the event of earth leakage currents as per VDE 0100 Part 410 and for protecting systems in the event of a short-circuit and overload as per the requirements of VDE 0100 Part 430. Overload tripping occurs at currents in the overload range through a short-time delayed, heat-sensitive bimetal trip and at short-circuit currents through an electro-magnetic instantaneous trip. The DAFDD 1 is a two-terminal device. Whereas the RCBO functions are not voltage-dependent, the AFD unit requires a power supply to detect arc faults. This power is supplied internally via the monitored load circuit; as such, a separate power supply is not necessary. Arc faults are detected in the high frequency range; a microcontroller provides evaluation.

Device form factor

RCBO residual current circuit-breaker

Type AC
Circuit-breakers with residual current characteristic AC only detect AC residual currents. They cannot detect pulsating DC residual currents so are not permitted for use as residual current operated protective devices in Germany. They are therefore only available as export models.

Type A

Switches with residual current characteristic A allow the detection of sinusoidal AC currents and pulsating DC residual currents.

Type A KV

Switches with residual current characteristic A allow the detection of sinusoidal AC currents and pulsating DC residual currents. Because they have a response delay of 10 ms, KV design devices only respond to residual currents that last longer than a half-period of the power frequency. In contrast to instantaneous breakers, they are significantly less sensitive to brief impulse-like residual currents and facilitate problem-free operation, even when lightning or switching overvoltage in the system causes capacitive surge residual currents or insulation flashovers with a secondary current up to the zero point of the mains voltage. The tripping times set out in national and international design regulations for instantaneous RCBOs are also observed by the KV design devices. Therefore, in principle, these may be used instead of a standard breaker.

Type F

Type F residual current circuit-breakers meet all requirements for type A circuit-breakers. They also detect residual currents with mixed frequencies deviating from 50 Hz which can occur, for example, when single-phase frequency converters are used. With an integrated response delay of 10 ms, they only respond to residual currents that last longer than a half-period of the power frequency. As such, they guarantee increased system availability, like switch type A KV. The tripping times set out in national and international design regulations for instantaneous RCBOs are observed. Therefore, in principle, these may be used instead of a standard breaker.

RCBO – line protection

B characteristic

Line protection with characteristic B ensures standard protection for lighting and socket circuits. As their short-circuit trip is three to five times the rated current, they should not be used to fuse-protect load circuits with high inrush currents.

C characteristic

Miniature circuit-breakers with characteristic C are primarily suitable for power circuits with high inrush or peak currents, as their short-circuit trip value is five to ten times the rated current.