RCCBs - Residual current circuit breakers EFI

Features of residual current circuit breakers EFI

→ Rated conditional short-circuit current : 10 kA

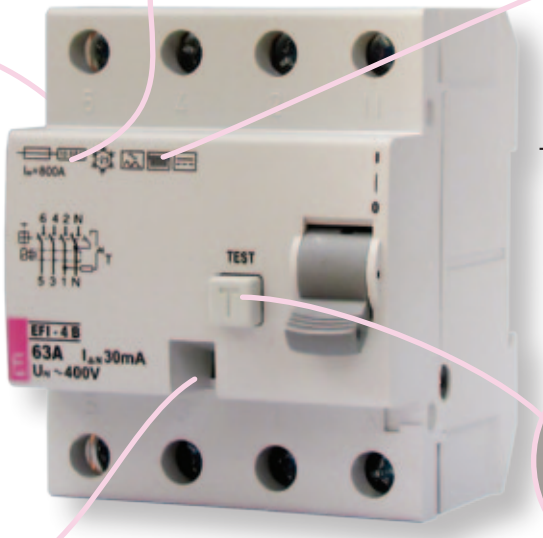
→ AC - pure sinus residual current,

→ A - AC + pulsating direct current

→ B - AC + A + smooth direct current + high frequency (1 kHz)

→ B+ - AC + A + smooth direct current + high frequency (20kHz)

→ Quality seal for tested reliability

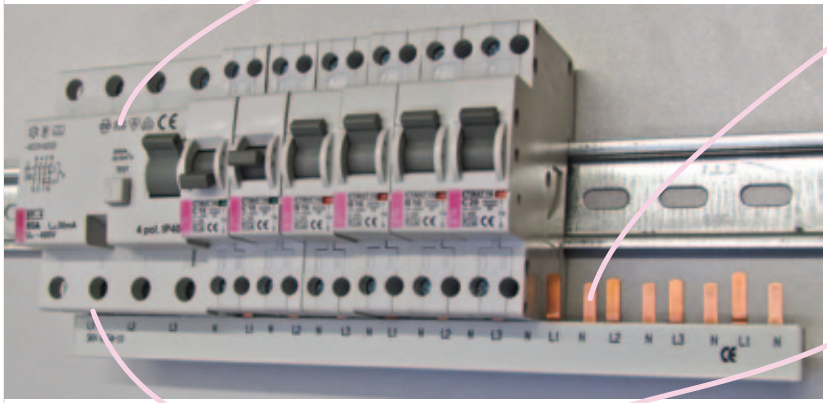


→ Real contact position indication for easier contact status identification

→ Test button enables user to check residual functionality

→ Various quality marks

→ RCCBs can be supplied with single phase and three phase busbars



→ The terminals accept not only wires but also time saving busbars

→ Supply is possible both from top and bottom terminals

Residual current circuit breakers can be used in TN-S, TN-CS, TT and IT network systems, or with other words, in all systems where neutral and protective conductors are separated. Residual current circuit breakers EFI are used for protection against indirect contact (fault protection) and direct contact (additional protection) of parts under voltage. In the case of protection against indirect contact (fault protection) you can use residual current protective devices with a rated residual current of $I_{\Delta n} \leq 300mA$. Residual current protective devices with a rated residual current of $I_{\Delta n} \leq 30mA$ fulfil the conditions for protection against direct contact (additional protection). For protection against fire, according to DIN VDE 0100-482 and IEC 60364-4-482, all cables and conductors in TN and TT systems must be protected by means of residual current protective devices with rated residual current of $I_{\Delta n} \leq 300mA$. In applications where resistive faults can cause a fire (radiant ceiling heating with panel heating elements), the rated residual current must be $I_{\Delta n} = 30mA$.

Types

- AC Type: they are sensitive to alternating (sinusoidal) AC residual currents.
- A Type: they are sensitive to alternating (sinusoidal) AC residual currents and pulsating DC residual currents.
- B Type: they are sensitive to alternating (sinusoidal) AC residual currents, pulsating DC residual currents and smooth DC residual currents. Tripping values are defined up to 1kHz.
- B+ Type: they are sensitive to alternating (sinusoidal) AC residual currents, pulsating DC residual currents and smooth DC residual currents. Tripping values are defined up to 20kHz and they are below 420mA.

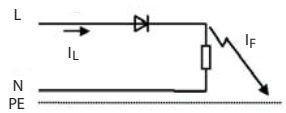
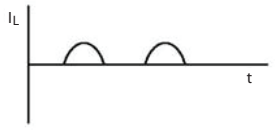
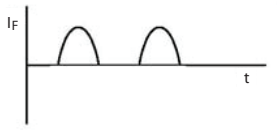
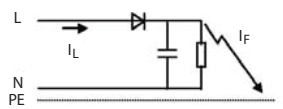
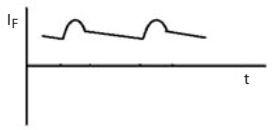
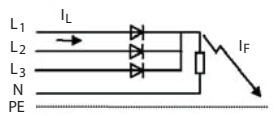
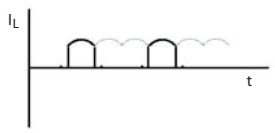
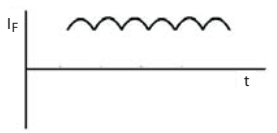
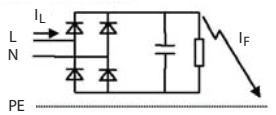
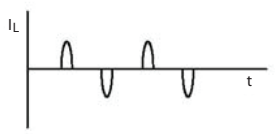
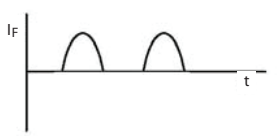
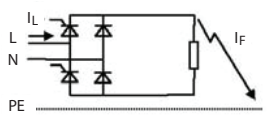
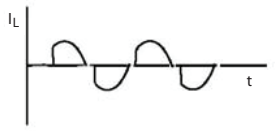
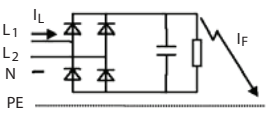
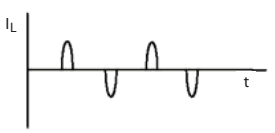
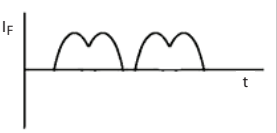
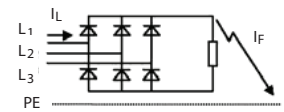
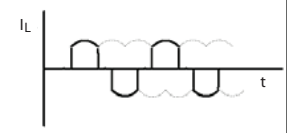
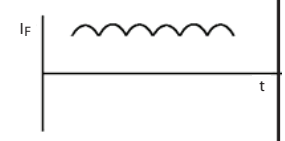
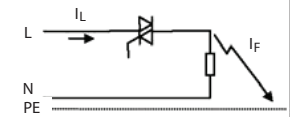
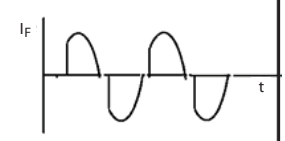
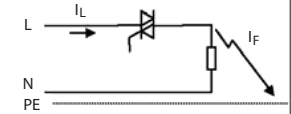
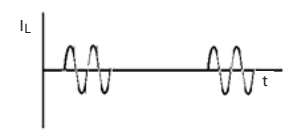
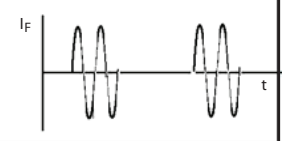
Classification regarding break time

- Instantaneous: max. break time 40ms (Inst.)
- K-Short time delay: time delayed min. 10ms and max. 40ms (K)
- S-Selective: time delayed min. 40ms and max. 150ms (S)

EFI 2 (2M)		Type AC	Type A		
		Inst.	Inst.	K	S
~	For alternating residual current	✓	✓	✓	✓
⎍	For alternating and pulsating direct residual current		✓	✓	✓
10.000	Short-circuit capacity with back-up fuse	✓	✓	✓	✓
-25	Lower temperature limit of application -25°C	✓	✓	✓	✓
VDE	VDE 0664, part 1 (up to 80 A)		✓		✓
K	Short time delayed (10 - 40 ms)			✓	
S	Selective (time delayed 40 -150 ms)				✓

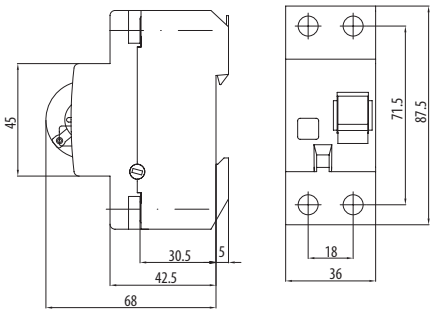
EFI 4 (4M)		Type AC	Type A			Type B			Type B+		
		Inst.	Inst.	K	S	Inst.	K	S	Inst.	K	S
~	For alternating residual current	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
⎍	For alternating and pulsating direct residual current		✓	✓	✓	✓	✓	✓	✓	✓	✓
⎍ ⎓ ⎓	For alternating, pulsating direct and smooth DC residual current (up to 1kHz)					✓	✓	✓	✓	✓	✓
⎍ ⎓ kHz	For alternating, pulsating direct and smooth DC residual current (up to 20kHz)								✓	✓	✓
10.000	Short-circuit capacity with back-up fuse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-25	Lower temperature limit of application -25°C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VDE	VDE 0664, part 1 (up to 80 A)		✓		✓	✓		✓	✓		✓
K	Short time delayed (10 - 40 ms)			✓			✓			✓	
S	Selective (time delayed 40 -150 ms)				✓			✓			✓

Use of AC, A, and B type of RCCB's in case of different fault conditions

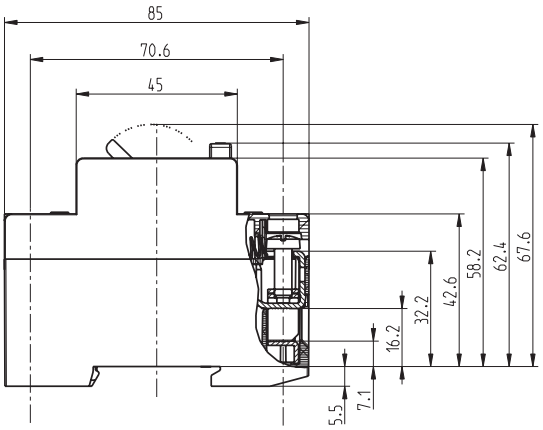
	Connection	Normal mains current	Fault earth current	AC	A	B, B+
1	Single-phase 				■	■
2	Single-phase with smoothing 					■
3	Three-phase star 					■
4	Two-pulse bridge 				■	■
5	Two-pulse bridge, half-controlled 				■	■
6	Two-pulse bridge between phases 				■	■
7	Six-pulse bridge 					■
8	Phase control 			■	■	■
9	Burst control 			■	■	■

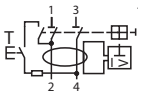
Residual current circuit breaker EFI-2

Technical data			
Type	**Instantenous**	**K type**	**S type**
Electrical			
Rated voltage U_n	230V AC	230V AC	230V AC
Rated current I_n	16, 25, 40, 63, 80, 100A	25, 40, 63A	25, 40, 63A
Rated Insulation voltage U_i	440V	440V	440V
Peak withstand current	-	3kA (8/20ms) surge current proof	5kA (8/20ms) surge current proof
Electrical isolation	> 4mm contact space	> 4mm contact space	> 4mm contact space
Rated residual operating current $I_{\Delta n}$	0,03; 0,1 & 0,3A	0,03; 0,1 & 0,3A	0,1 & 0,3A
Rated conditional short-circuit current I_{cn}	10kA	10kA	10kA
Rated making and breaking capacity I_m	800A	800A	800A
Maximum back-up fuse	100A gG	100A gG	100A gG
Isolation class	B	B	B
Standard	IEC/EN 61008	IEC/EN 61008, OVE E 8601	IEC/EN 61008
Mechanical endurance (op. c.)	> 4000	> 4000	> 4000
Electrical endurance (op. c.)	> 2000	> 2000	> 2000
Mechanical			
Frame size	45mm	45mm	45mm
Device height	68mm (DIN rail acc to EN60715)	68mm (DIN rail acc to EN60715)	68mm (DIN rail acc to EN60715)
Device width	36mm (2 x Module units 18mm)	36mm (2 x Module units 18mm)	36mm (2 x Module units 18mm)
Degree of protection	IP20	IP20	IP20
Upper and lower terminals	open mounted/lift terminals	open mounted/lift terminals	open mounted/lift terminals
Terminal capacity	1-25mm^2	1-25mm^2	1-25mm^2
Terminal screw	M5 (Pozidrive PZ2)	M5 (Pozidrive PZ2)	M5 (Pozidrive PZ2)
Terminal torque	2-2,5Nm	2-2,5Nm	2-2,5Nm
Busbar thickness	0,8 - 2 mm	0,8 - 2 mm	0,8 - 2 mm
Operating temeprature	-25°C ... +55°C	-25°C ... +55°C	-25°C ... +55°C
Storage and transport temperature	-40°C ... +70°C	-40°C ... +70°C	-40°C ... +70°C
Resistance to climatic conditions	IEC/EN 61008	IEC/EN 61008	IEC/EN 61008
Contact position indicator	mechanical red/green	mechanical red/green	mechanical red/green
Supply possibility	Top or bottom	Top or bottom	Top or bottom

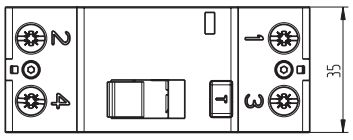


EFI-2 16-80 A





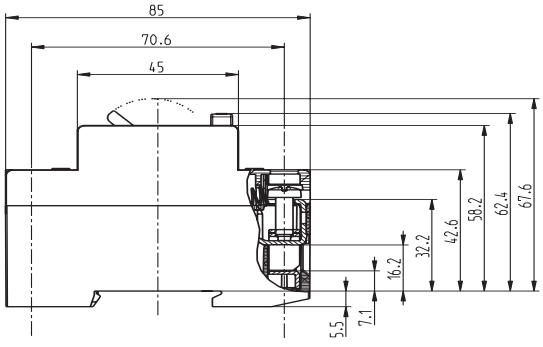
EFI-2 100 A

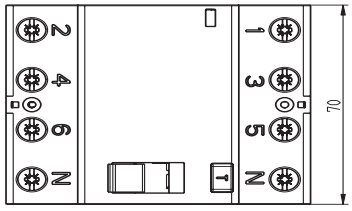


EFI-2 100 A

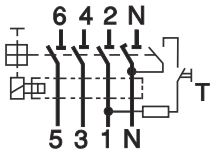
Residual current circuit breaker EFI-4

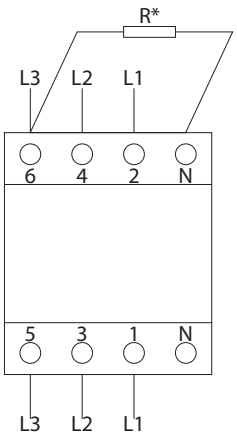
Technical data			
Type	**Instantenous**	**K type**	**S type**
Electrical			
Rated voltage U_n	230V AC	230V AC	230V AC
Rated current I_n	16, 25, 40, 63, 80, 100A	25, 40, 63A	25, 40, 63A
Rated Insulation voltage U_i	440V	440V	440V
Peak withstand current	-	3kA (8/20ms) surge current proof	5kA (8/20ms) surge current proof
Electrical isolation	> 4mm contact space	> 4mm contact space	> 4mm contact space
Rated residual operating current $I_{\Delta n}$	0,03; 0,1 & 0,3A	0,03; 0,1 & 0,3A	0,1 & 0,3A
Rated conditional short-circuit current I_{cn}	10kA	10kA	10kA
Rated making and breaking capacity I_m	800A	800A	800A
Maximum back-up fuse	100A gG	100A gG	100A gG
Isolation class	B	B	B
Standard	IEC/EN 61008	IEC/EN 61008, OVE E 8601	IEC/EN 61008
Mechanical endurance (op. c.)	> 4000	> 4000	> 4000
Electrical endurance (op. c.)	> 2000	> 2000	> 2000
Mechanical			
Frame size	45mm	45mm	45mm
Device height	68mm (DIN rail acc to EN60715)	68mm (DIN rail acc to EN60715)	68mm (DIN rail acc to EN60715)
Device width	72mm (4 x Module units 18mm)	72mm (4 x Module units 18mm)	72mm (4 x Module units 18mm)
Degree of protection	IP20	IP20	IP20
Upper and lower terminals	open mounted/lift terminals	open mounted/lift terminals	open mounted/lift terminals
Terminal capacity	1-25mm^2	1-25mm^2	1-25mm^2
Terminal screw	M5 (Pozidrive PZ2)	M5 (Pozidrive PZ2)	M5 (Pozidrive PZ2)
Terminal torque	2-2,5Nm	2-2,5Nm	2-2,5Nm
Busbar thickness	0,8 - 2 mm	0,8 - 2 mm	0,8 - 2 mm
Operating temeprature	-25°C ... +55°C	-25°C ... +55°C	-25°C ... +55°C
Storage and transport temperature	-40°C ... +70°C	-40°C ... +70°C	-40°C ... +70°C
Resistance to climatic conditions	IEC/EN 61008	IEC/EN 61008	IEC/EN 61008
Contact position indicator	mechanical red/green	mechanical red/green	mechanical red/green
Supply possibility	Top or bottom	Top or bottom	Top or bottom

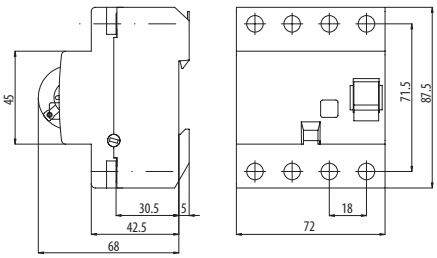




EFI-4 100 A







EFI-4 16-80 A

RCD EFI-4 Type in 3-phase system without neutral conductor:

30mA: R=4k7/1W (500V)
100mA: R=1k/1W (500V)
300mA: R=1k6/1W (500V)
500mA: R=1k6/1W (500)

* Resistor (R) has to be connected between N and L3 as to ensure proper functionality of the test button.

NEW EFI B and B+ type

Features and advantages of UNIVERSAL CURRENT SENSITIVE RCCBs B type and B+ type

APPLICATION
- Fault protection (protection against indirect contact of live parts)
- Additional protection (protection in case of direct contact of live parts, IΔn≤30mA)
- Fire Protection (for locations exposed to fire hazard)

Residual current sensitivity – UNIVERSAL

AC pure sinus residual current, 50/60Hz
A sinus and pulsating direct current, 50/60Hz
B AC + A + smooth direct current + high frequency (1kHz)
B+ AC + A + smooth direct current + high frequency (20kHz)

Basic types

according to rated values:

4p B In = 25A, 40A, 63A, IΔn=30mA, 100mA, 300mA
4p B+ In = 25A, 40A, 63A, IΔn=30mA, 100mA, 300mA

according to breaking times:

4p B, B+ instantaneous, short time delayed, selective

according to the number of poles:

4p, 2p

Standards

IEC/EN 61008-1	basic standard for RCCB's AC and A type
IEC/EN 62423	additional requirements for type B
VDE 0664-400 B+	VDE standard for B+ requirements (20kHz)

Mode of operation

Pure a.c. and pulsating d.c. type residual current sensitivity, A voltage independent

Smooth d.c. current sensitivity:	B, B+ voltage dependent
Minimum operating voltage:	50V

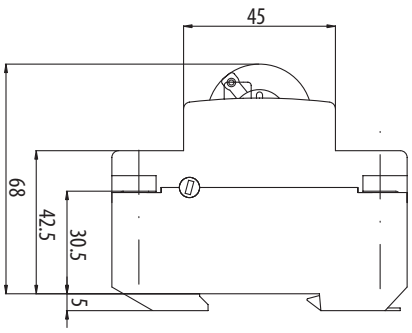
Typical applications

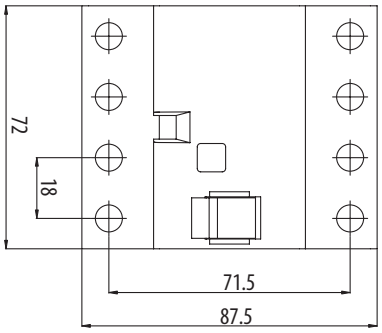
Which are vulnerable to smooth d.c. residual currents:
- Frequency converters,
- Photovoltaic systems, a.c side,
- Charging stations for electric vehicles,
- Variable speed machine tools,
- UPS, computer data centres
- Elevator controls,
- Cranes of all kinds
- Electronic equipment on construction sites,
- Test set-ups in laboratories,
- Installation in general where we can expect d.c. smooth direct residual currents, etc.

B and B+ type residual current circuit breaker EFI-4

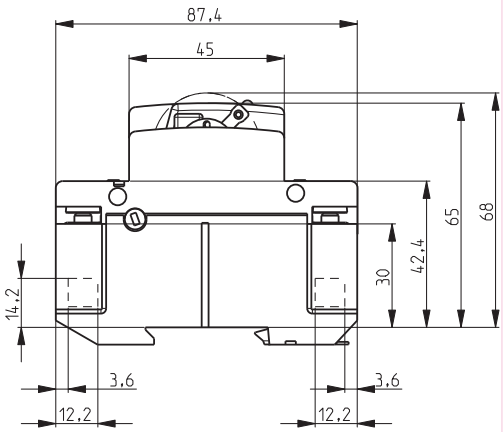
Technical data		
Type		**B & B+**
Electrical		
Design according to		IEC/EN 61008, IEC/EN 62423
		B+ -> VDE 0664-400
Current test marks as printed onto the device		
Rated voltage U_n		230/400 V AC, 50 Hz
Mode of operation		"A type functionality: voltage independent B and B+ type functionality: voltage dependent"
Operation voltage electronic		50 – 253V AC
Voltage range test circuit		196 – 253V AC
Rated residual operating current $I_{\Delta n}$	Instantaneous	30, 100, 300 mA
	K - short time delayed	30, 100, 300 mA
	S - selective	100, 300 mA
Sensitivity		Alternating, pulsed and smooth direct currents
Rated insulation voltage U_i		440 V
Rated impulse withstand voltage U_{imp}		4 kV (1.2/50µs)
Rated conditional short-circuit current I_{cn}		10 kA
Rated making and breaking capacity I_m		800 A
Peak withstand current		3 kA (8/20 µs) surge current proof
Electrical isolation		> 4 mm contact space
Maximum back-up fuse I_n = 25-63A		Short circuit and overload protection 100 A gG/gL
Endurance (operating cycles)	electrical components	≥ 2000
	mechanical components	≥ 4000
Mechanical		
Frame size		45 mm
Device height		68 mm (DIN rail acc to EN60715)
Device width		72 mm (4xModule Units 18mm)
Degree of protection		IP20
Upper and lower terminals		open mounted/lift terminals
Terminal protection finger and hand touch safe		IEC/EN 61008
Terminal capacity		1 - 25 mm^2
Terminal screw		M5 (Pozidrive PZ2)
Terminal torque		2 - 2.5 Nm
Busbar thickness		0.8 - 2 mm
Operating temperature		-25°C ... +55°C
Storage- and transport temperature		-40°C ... +70°C
Resistance to climatic conditions		IEC/EN 61008
Contact position indicator		mechanical red / green
Supply possibility		top or bottom

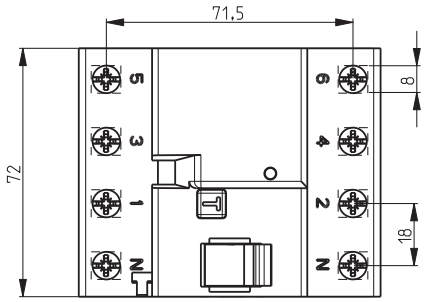
Instantenous



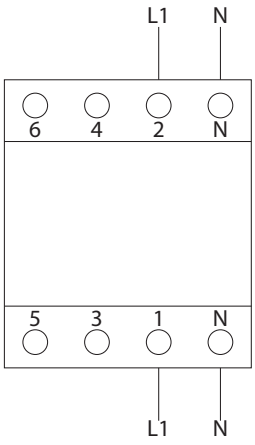


K-Short time delay, S-Selective

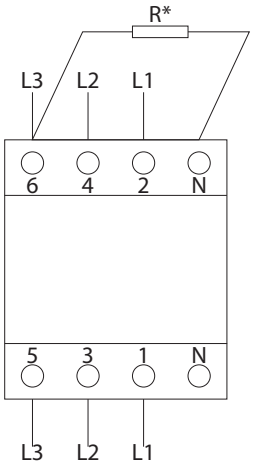




* Resistor (R) has to be connected between N and L3 as to ensure proper functionality of the test button.



RCD ETI Type B in 1-phase system U_n=230V

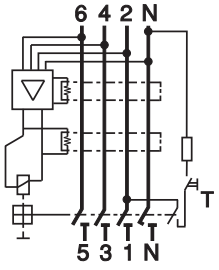


RCD ETI Type B in 3-phase system without neutral conductor - U_n=400V

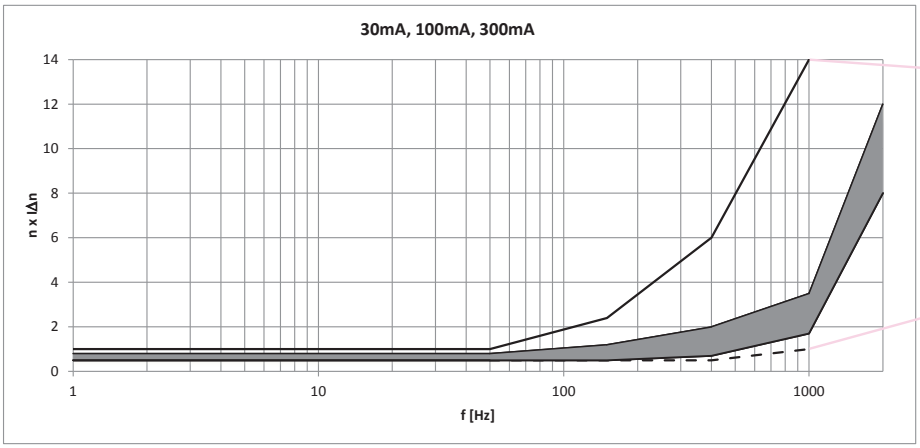
30mA: R=2k7/1W (500V)

100mA: R=7k5/1W (500V)

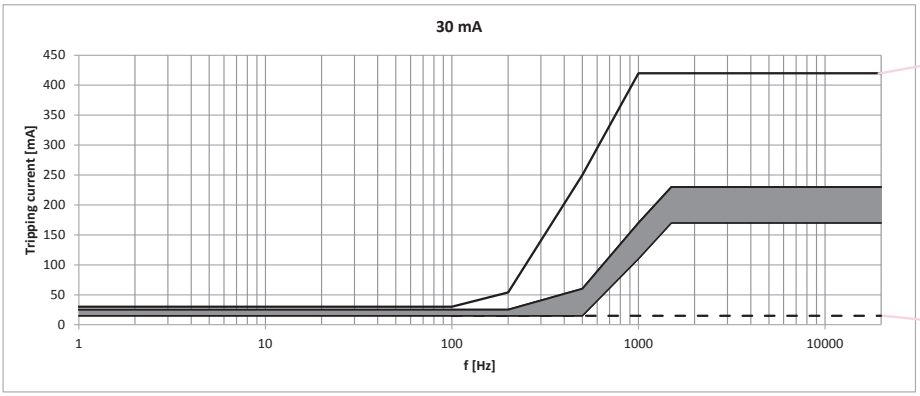
300mA: R=2k7/1W (500V)

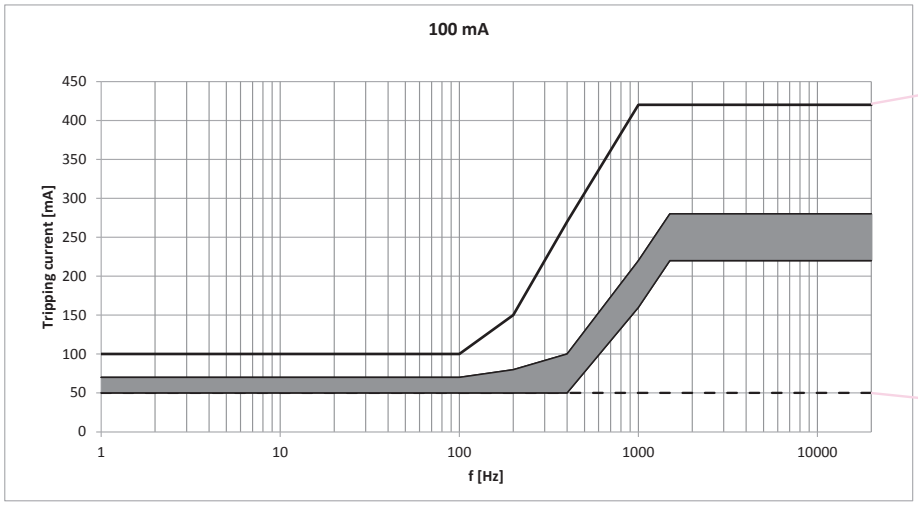


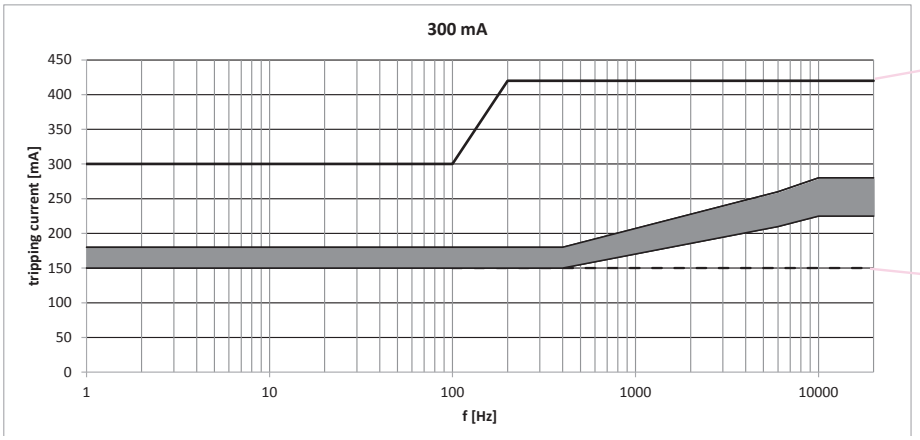
EFI B type



EFI B+ type

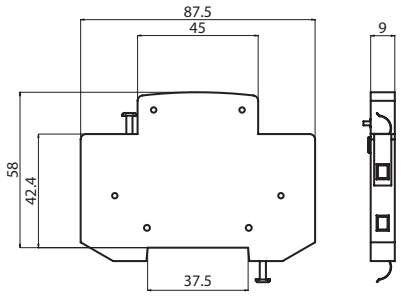






Auxiliary switch PS EFI

Technical data	
Rated current I_n	6 A (230 V AC), AC 12,
	1 A (110 V DC), DC 12
Conditional short-circuit current	1 kA with fuse-link 20 A
Standards	EN 62019



The PS EFI is fixed to EFI series switches. The width of the device is 9 mm, other dimensions are in compliance with EFI switches. The auxiliary switch PS EFI is used for the remote signalling of the state of contact's condition (closed/open) of EFI switches. During fitting, the EFI must be switched off. PS EFI and DA EFI can not be mounted both together, because both can only be mounted on the right side of EFI.

Shunt trip release DA EFI

Technical data	
Rated voltage	230V AC
Rated frequency	50/60Hz
Max inrush current	0,8A
Build-in width	9mm