Immunity to nuisance tripping: advantages of Type B RCCBs

RCDs Type B are advance-designed products that, on one hand, are able to protect from different kinds of faults, regardless of their waveform; on the other hand, they are immune to unwanted trippings.

In order to be such an effective device in terms of protection, every Type B RCD must withstand successfully all the tests provided by the Standards. In the testplan are foreseen several tripping waveforms that are considered to represent the best approximation to a real fault condition in case of non linear circuits.

Tripping waveforms for Type B RCDs

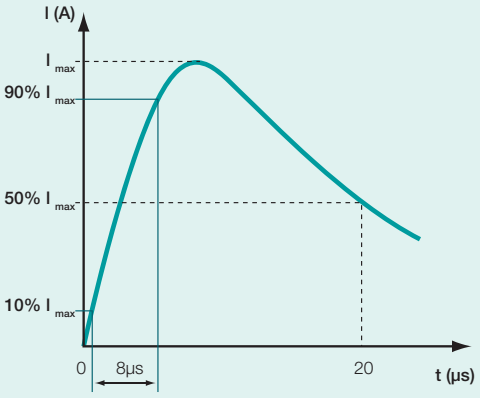
	Residual current form	Limit value of tripping current
Alternating		0,5...1,0 $I_{\Delta n}$
Unidirectional pulsating		0,35...1,4 $I_{\Delta n}$
Unidirectional pulsating with phase angle mode		Cut-off angle 90° from 0,25 to 1,4 $I_{\Delta n}$
		Cut-off angle 135° from 0,11 to 1,4 $I_{\Delta n}$
Alternating sinusoidal residual current plus pulsating dc current, suddenly applied or smoothly increasing		Max. 1,4 $I_{\Delta n}$ + 0,4 $I_{\Delta n}$ d.c.
Unidirectional pulsating superimposed on direct		Max. 1,4 $I_{\Delta n}$ + 0,4 $I_{\Delta n}$ d.c.
Multi-frequency		From 0,5 to 1,4 $I_{\Delta n}$
Two-phase rectified		From 0,5 to 2,0 $I_{\Delta n}$
Three-phase rectified		
Direct without ripple		
Alternating up to 1 kHz		Current frequency 150 Hz from 0,5 to 2,4 $I_{\Delta n}$
		Current frequency 400 Hz from 0,5 to 6 $I_{\Delta n}$
		Current frequency 1000 Hz from 0,5 to 14 $I_{\Delta n}$

To prove their immunity to unwanted tripping, Type B residual current devices must successfully pass further severe tests such as:

– 8/20 µs impulse up to 3000 A (s. fig. 1);
– 10 ms impulse up to10 $I_{\Delta n}$ (s. fig. 2).

These tests emulate the conditions that an RCD must withstand in case of overvoltages or leakages due to EMC filters or electronic loads. Type B and devices can be considered suitable for all difficult applications, not only in terms of protection, but of operational continuity as well.

1



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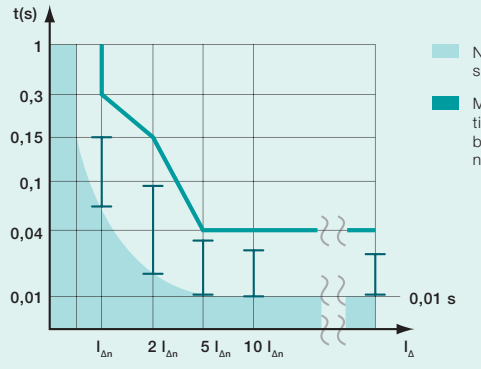
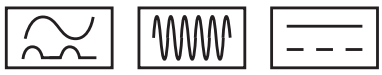


1 Impulse 8/20 µs | 2 Insensitivity to short-term residual currents

Details that make the difference

Type B residual current devices are marked according to EN 62423. The marking reminds the different current types that Type B residual current devices are sensitive to



Easy to connect and compatible with busbars thanks to the System pro *M* compact clamps

Sole two-pole device in only two modules on the market

VDE approved

Green LED to monitor operation of the residual current circuit breaker

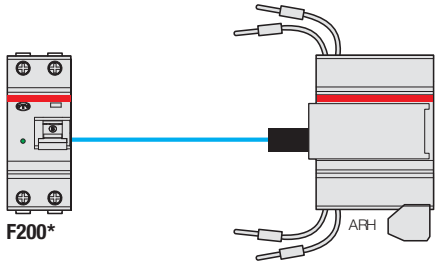
Indication of the position of the contacts

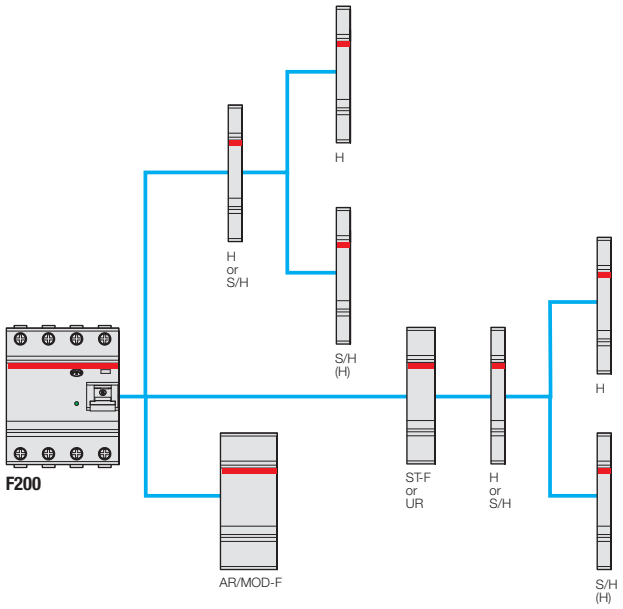
Advantages

- Compatible with all System pro *M* compact accessories of F200 series
- Higher operational continuity thanks to auto-reclosing units and motor operating devices
- Operating temperature from -25 to +60 °C with high immunity for extremely harsh weather conditions
- F200 B can be installed either in two-phase and three-phase networks
- A lot of space saving thanks to the two poles device in just two modules
- Coordination and back-up with all ABB devices.

Auxiliary elements and accessories for MCBs and RCDs
Selection tables

New F200 B Type from 16 to 63 A



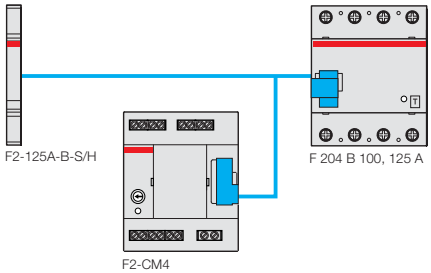


ARH	Home automatic resetting unit	F2C-ARH

* F202 30 mA or 100 mA (depending on ARH model), max 63 A

H	Auxiliary contact	S2C-H6_...R
S/H	Signal/Auxiliary contact	S2C-S/H6R
S/H (H)	Signal/Auxiliary contact used as auxiliary contact	S2C-S/H6R
UR	Undervoltage release	S2C-UA
AR	Auto reclosing unit	F2C-ARI
MOD-F	Motor operating device	F2C-CM
ST-F	Shunt trip for F200 RCCB	F2C-A

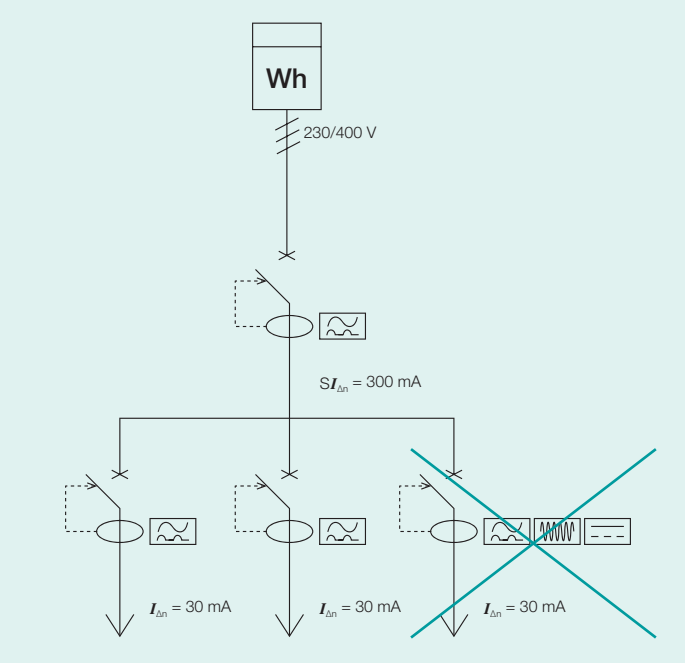
F200 B high ratings



F2-125A-B-S/H	Signal/Auxiliary contact
F2-CM4-MOD	

Questions & answers
Answers on regulations, application fields and installation methods for Type B RCCBs

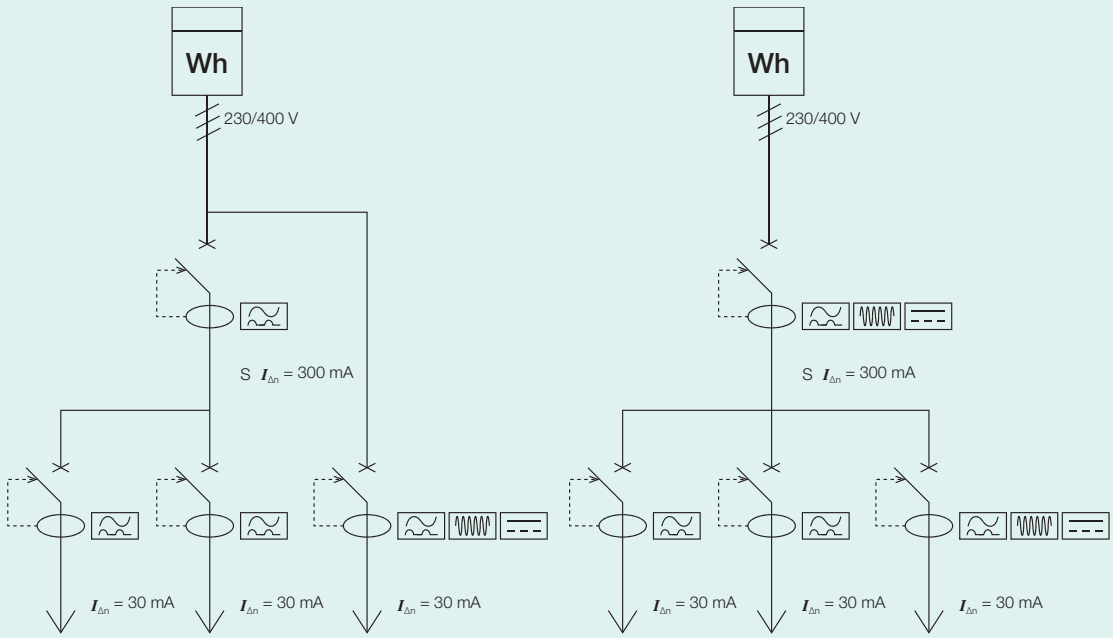
What's the correct installation?
Since Type B RCCBs are used in the presence of loads that can also generate direct fault currents, when designing the electrical system any other RCCB installed upstream of a Type B RCCB, and which is traversed by the same fault current, must also be a Type B RCCB (s. Fig. 3). Any direct current leakage could impair the proper operation of the upstream Type AC, A or F RCCBs which are not suitable in the case of direct residual currents. In fact, even if Type B RCCBs protect against direct fault currents, the tripping value (for example 60 mA for a circuit breaker with $I_{\Delta n}$ = 30 mA) is high enough to compromise the regular operation of other non-Type B RCCBs. It is therefore necessary to derive the power supply of Type B RCCBs upstream of any non-Type B RCCBs; or, if an upstream RCCB is required, one must use a Type B for this one as well.



Example of a wrong installation of a Type B RCD

3 Example of an appropriate installation of a Type B RCD

3



How do you coordinate with the grounding system to provide protection against indirect contact at high frequencies?

To provide protection against indirect contact in TT systems, the circuit breaker must be coordinated with the resistance of the grounding system with the customary ratio:

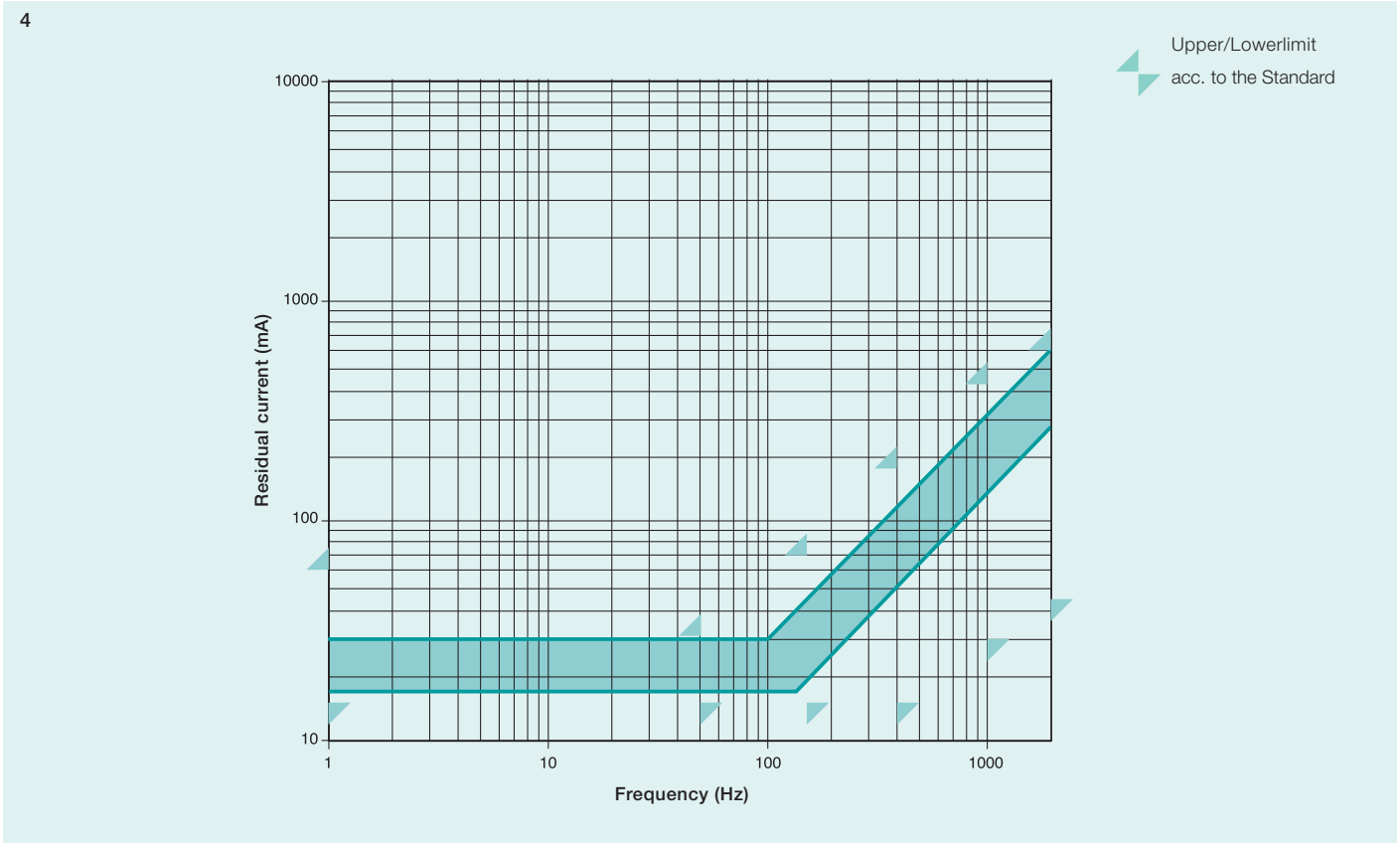
$R_E \cdot I_{\Delta n} \leq 50\ V$

With this coordination ratio the protection against indirect contact is automatically checked in the case of direct current faults, since the permissible limit contact voltage in direct current is 120 V, which corresponds to 50 V in alternating current.

In the case of high-frequency faults, however, a permissible limit contact voltage has not yet been established at the regulatory level. Although the risks for the human body decrease as the frequency increases, until the standards have set these values, the Standard IEC EN 62423 recommends as a precautionary measure to maintain unchanged the value of 50 V also at higher frequencies. To do this, it is necessary to take into account the actual tripping value of a possible fault frequency. For example, in the case of a Type B circuit breaker whose tripping characteristic is that shown in Figure 4, at 1,000 Hz tripping is guaranteed with a residual current of 300 mA (lower than the regulatory limit of 420 mA). Therefore, if the power consuming equipment can generate a fault current of 1,000 Hz, the ground resistance must meet the ratio

$R_E \cdot \mathbf{0{,}3\ A} \leq 50\ V$
i.e. $R_E \leq \mathbf{166\ \Omega}$

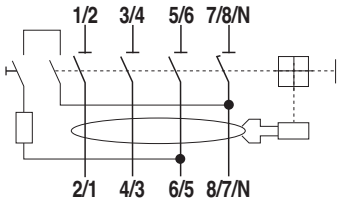
4 Frequency tripping curve for a given RCD



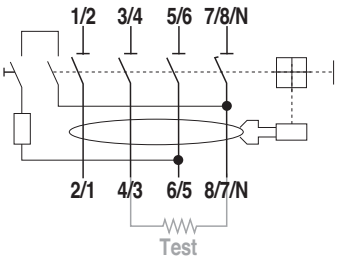
Questions & answers
Answers on regulations, application fields and installation methods for Type B RCCBs

How's insultation test performed?
It is possible to perform the insulation test without disconnecting the neutral; however, in order to prevent the electronic board from failures, it is necessary to set the toggle in OFF position and then unplug the terminal 2-4-6-8.
This test procedure is valid whenever the device is supplied from upstream. When the device is fed from the bottom terminals, it is enough to set the toggle in OFF position.

Is it possible to use an RCCB in a three-phase network with no neutral?
Yes, but you have to make sure that the test button works properly. In fact, the test button circuit of an RCCBs 4P F200 is wired between terminal 5/6 and 7/8/N as indicated in the diagram below and is designed for operation between 110 and 254 V



In case of installation in a 3 phase circuit without neutral, there are two possible installations:
1. Concatenate voltage between 110 and 254 V connect the 3 phases to the terminals 3/4 5/6 7/8/N and the terminals 4/3 6/5 8/7/N (supply and load side respectively) or connect the 3 phases normally (supply to terminals 1/2 3/4 5/6 and load to terminals 2/1 4/3 6/5), bridging terminal 1/2 and 7/8/N
2. Concatenate voltage higher than 254 V



$I_{\Delta n}$ [A]	Test [Ω]
0,03	3300
0,1	1000
0,3	330
0,5	200

a. connect normally the phases (supply to terminals 1/2 3/4 5/6 and load to terminals 2/1 4/3 6/5)
b. bridge terminal 4/3 and 8/7/N with an electric resistance according to the table.

Test resistance must have a power loss higher than 4 W.