FAQ

Answers on regulations, application fields and installation methods for RCCBs

Questions and answers

1. Is it necessary to protect RCCBs from overload?

RCCBs are not equipped with integrated overcurrent protection, to avoid overload is primarily fundamental to respect what reported in technical data: “the maximum possible operating current must not exceed the rated current of the fault current protection device”.

Secondly, protection can be obtained either with fuses (one per each phase, with maximum rated current lower than rated current of the RCCB) or with MCBs, coordination tables between these two devices and F200 RCCBs can be found on technical catalogue here .

2. How does the ambient temperature affect RCCBs performances?

Operative temperature range for RCCBs can be found on catalogue here

Working outside the operative temperature range can malfunction of the device.

3. How does altitude affect RCCBs performances?

ABB RCCBs are able to operate at altitude higher then foreseen by the relevant standard IEC/ EN 61008 and IEC/ EN 61009 taking into account the corrective factors. Details as in table:

Elevation	[m]	2000	3000	4000	5000	6000
Rated Current	[A]	1.0xIn	0.96xIn	0.94xIn	0.92xIn	0.90xIn
Rated Voltage	[V]	1.0xUn	0.877xUn	0.774xUn	0.676xUn	0.588xUn

For altitude higher than 3.000 m the isolating characteristic is no longer available.

4. Which are the immunity levels of RCCBs?

Immunity level 2, if I_{dn} < 30 mA

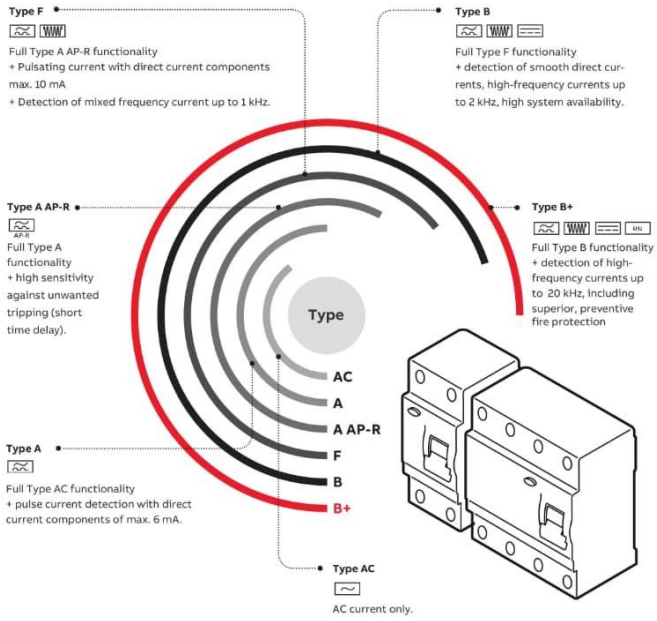
Immunity level 3, if I_{dn} >= 30 mA

5. Which is the difference between type AC, type F, type B RCCBs?

The main difference is the wave form the device can detect.

ABB portfolio includes:

a. Type AC: only alternate current
b. Type A: AC + detection of pulsating currents with DC components
c. Type A-APR: A + high immunity to unwanted tripping
d. Type F: A-APR + detection of high frequencies currents, up to 1 kHz
e. Type B: F + detection of smooth DC currents
f. Type B+: B + detection of high frequencies currents, up to 20 kHz (only in dedi- cated markets).



6. Which is the operating voltage of RCCBs test button?

The operating voltage of test button can be found on technical catalogue here.

7. Is pressing the test button mandatory? How often safety test has to be performed?

Yes, according to the IEC Standards Regulation, RCCBs must be equipped with a test button to be operated regularly in accordance with local regulations and standards.

If no regional test regulations are available, the recommendation is to perform the test every six months. Dedicated declarations to perform the test in a longer time frame can be released upon request.

In the event of a complaint, the customer must demonstrate by means of inspection records that the products have been effectively tested using the test button as specified.

8. Which is the limit value of ABB RCCBs tripping current?

Limit value of tripping current is function of the RCCBs Type and the waveform able to detect:

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 $I_{\Delta n}$

9. Which is the purpose of contact position indicator (CPI)?

Irrespective to the position of the toggle, contact position indicator allows to always know the status of the contacts: red CPI indicates closed contacts; green CPI indicates open contacts.

10. Is it possible to use F200 RCCB for isolation, as disconnector device?

RCCB F200 is a device suitable for isolation according to EN 61008.

Indeed, according to IEC 60364-5-53, all devices used for fault protection shall be suitable for isolation.

According EN 61008 the requirement about the open position is: “The position in which the predetermined clearance between open contacts in the main circuit of the RCCB is secured.”

Thanks to the fact that F200 fully meets EN 61008 requirements, they have been tested to prove the open position, so they fulfil requirements of the clearance distance between contacts when opened.

Please note that RCCBs cannot be considered switch disconnectors as according to EN 60947-3; RCCBs are not tested to stay closed in case of short circuit.

11. Which type of RCCBs are available?

ABB offers a wide range of RCCBs to satisfy the request of different areas of application. In line with the possibility of detecting a wide variety of fault current forms and the relatively demanding device testing, the spectrum of RCCB types today ranges from the protection of pure alternating current consumers to high frequency.

Protection level increases from type A up to type B devices, selective and short-term delay devices are also available.

Special devices such as 110 V operating voltage or 400 Hz frequency are present in ABB portfolio as well.

12. RCCBs with 110 V rated voltage?

This series of devices has the minimum operating voltage of test button of 110V, and it is suitable for 230 V applications. This range is UL approved and compliant to IEC 61008-1, IEC 61008-2-1 standards. Further information can be found here.

13. RCCBs with 400Hz frequency?

By increasing the frequency an increase of the magnetic reluctance of the toroidal transformer is induced. The result is the increasing of the operating residual current up to three times with respect to 50 Hz devices.

The RCCB F 200 400 Hz guarantees protection against indirect contacts and additional protection against direct contacts (with I Δn=30 mA) considering that the operating residual current doesn't increase with the increase of the network frequency.

Possible applications are:

a. 200 Hz: Automotive industry
b. 300 Hz: Woodworking machines
c. 400 Hz: aircraft on-board networks, military installations Additional information can be found here.

14. What is a selective RCCB?

The more important aspects for residual current protection are linked to tripping times. Protection against contact voltages is only effective if the maximum times indicated on the safety curve of the device are not exceeded. If an electrical system has user devices with earth leakage currents which exceed the normal values (e.g.: presence of capacitor input filters inserted between the device phase and earth cables) or if the system consists of many user devices, it is good practice to install various RCCBs, on the main branches, with an upstream main residual current or non-residual current device instead of a single main RCCB.

Different types of selectivity are obtainable:

a. Horizontal selectivity
b. Vertical selectivity
c. Amperometry (partial) selectivity
d. Chronometric (total) selectivity

Generally, to ensure selectivity these two conditions must be guarantee:

e. the tripping time of the upstream device must be higher than the maximum al- lowable tripping time of downstream ones.
f. The rated fault current of the upstream RCCB must be at least 3 times the fault current of downstream ones.

Additional information can be found here.

15. What is a short-term delay RCCB (type APR)?

The ABB range of AP-R anti-disturbance residual current circuit-breakers and blocks was designed to overcome the problem of unwanted tripping due to overvoltage of atmospheric or operation origin.

The electronic circuit in these devices can distinguish between temporary leakage caused by disturbances on the mains and permanent leakage due to actual faults, only breaking the circuit in the latter case.

AP-R residual current circuit-breakers and blocks have a slight delay (approximately 10 ms with respect to standard devices) into the tripping time, but this does not compromise the safety limits set by the Standards in force (release time at 2 $I_{\Delta n}$=150 ms).

Additional information on APR devices can be found here.

16. Is it possible to install Type F RCCBs downstream Type A one?

This configuration doesn't guarantee selectivity.

If selectivity wants to be guaranteed, upstream device must be at least equal (in terms of wave detection) to downstream one.

17. When is tripping desired?

Tripping is desired in every situation that can lead to a potential damage to people (fulguration) or objects (earth fault).

18. When is tripping undesired?

Whenever tripping occurs without any fault current or direct contact between human body and current-carrying parts.

Possible reasons of unwanted tripping are:

a. low discharge currents with different harmonics and a high frequency
b. electric transient conditions and shock-like currents, such as switching on and off capacitive or inductive loads
c. electric transient conditions and shock-like currents in combination with permanent discharge currents, such as the ones caused by electronic devices.
d. overvoltage due to atmospheric events

19. How to avoid undesired tripping?

Recommended solutions, according to IEC 62350, can be related both to the installation and to the device as well:

a. Installation: split the installation into several different circuits, each of them protects by an RCCB.
b. Device: select RCCBs which are more resistant to unwanted tripping (ABB AP-R types)
c. Device: use an auto-reclosing unit to perform the reclosing action (ABB F2C- ARH)

20. How tripping of RCCBs is tested?

RCCBs tripping is tested using these two methods:

a. Resistance to unwanted tripping caused by network disturbances with wave shape 0.5 µs/ 100 kHz, checks whether the device can withstand switching de- vices on and off.
b. Resistance to nuisance tripping due to overvoltage peak (8/ 20 wave), checks whether the device can withstand atmospheric discharges. Since the device can trigger even at low fault currents., the test aims to simulate the indirect influ- ence of lightning.

Results of tests are reported in the following table:

	A or AC	AP-R	B	Selective
Resistance to unwanted tripping caused by network disturbances with wave shape (0.5 µs/100 kHz)	250	250	200	250
Resistance to nuisance tripping due to overvoltages (operational or atmospheric) peak (8/20 wave)	250	3000	3000	5000

21. When is the use of F type suggested?

Type F RCCBs offers the same protection and functionality of A-APR type, in addition they are tested according to IEC/ EN 62423 which means that such devices are able to detect high frequencies currents, up to 1 kHz.

The intervention characteristic has a short-time delayed which prevents unwanted tripping in case pulsed leakage currents of up to ten milliseconds occur at activation of filters. Moreover, type F have a surge current withstand capacity of more than 3kA and can accept superimposed smooth DC residual currents of up to 10mA without affecting their standard functionality

Common applications are household appliances and motors with single phase inverter.

22. Is it possible to use type F RCCBs for selectivity?

Yes, selectivity is ensured thanks to the time delay and the higher sensitivity of the upstream type F RCCB

23. How could a high-frequency fault stream interfere with the proper operation of Type A RCCBs?

Depending on the individual case, Type A RCCBs could present the following disadvantages:

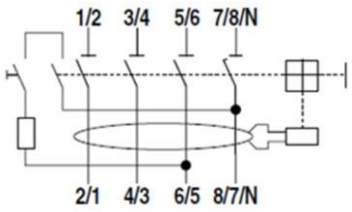
a. Missed tripping in case of a high frequency fault current. Unwanted late trip- ping in case of a too high value of fault current is also apossibility.
b. Tripping outside the specified limits caused by acquired insensitivity.
c. Missed tripping without any interference.

24. What is a universal (Type B) RCCB?

Information about Type B RCCBs can be found here.

25. Which is the correct installation of F200 & FH200 RCCB in a 3-phase circuit without

neutral? The test button circuit, regardless of the rating, is wired inside the device between terminal 5/ 6 and 7/ 8/ N as indicated below, and has been sized for an operating voltage between 110V (170V for the 30mA version according to EN standard) and 254 V (277 V according to UL 1053).

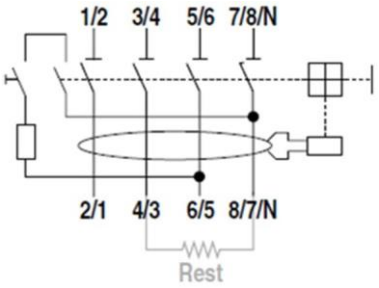


If the concatenate voltage is between 110V (170V for the 30mA version according to EN standard) and 254 V (277 V according to UL 1053) for the correct working of the test button there are two possible solutions:

a. 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).
b. connect the 3 phases normally (supply to terminals 1/ 2 3/ 4 5/ 6 and load to ter- minals 2/ 1 4/ 3 6/ 5) and to bridge terminal 1/ 2 and 7/ 8/ N in order to bring to the terminal 7/ 8/ N the potential of the first phase. In this way the test button is supplied with the phases' concatenate voltage.

26. Which is the correct installation of F200 & FH200 RCCB in a 3-phase circuit without neutral, if the
circuit is supplied with a concatenate voltage > 254 V? Is it possible to use a test resistance different than the indicated one?

If the circuit is supplied with a concatenate voltage > 254 V, it is necessary to normally connect phases (supply to terminals 1/ 2 3/ 4 5/ 6 and load to terminals 2/ 1 4/ 3 6/ 5) and to bridge terminal 4/ 3 and 8/ 7/ N by mean of an electric resistance as indicated in the table above. Resistance must have a power loss higher than 4W.

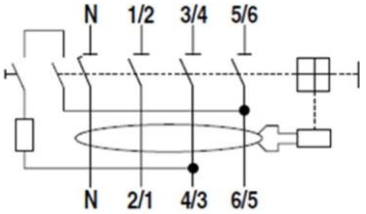


Idn	[A]	0,03	0,1	0,3	0,5
Test	[Ω]	3900	2200	2200	2200

To avoid malfunctions such as avoided tripping it is necessary to install test resistances with the lowest possible variation with respect to those indicated.

27. Which is the correct installation of F200 & FH200 RCCB with neutral on left side in a 3-phase
circuit without neutral?

The test button circuit of these RCCBs is wired inside the device between terminal 3/ 4 and 5/ 6, it has been sized for an operating voltage between 195 V and 440 V - 480 V. In case of a three-phase system without neutral with concatenate voltage between phases of 230 V or 400 V - 277 V or 480 V - it is enough to connect the 3 phases normally (supply to terminals 1/ 2 3/ 4 5/ 6 and load to terminals 2/ 1 4/ 3 6/ 5) without any bridge.



28. Which are MTTF, MTBF, FIT of ABB RCCBs?

Regarding F200 series it is possible to define:

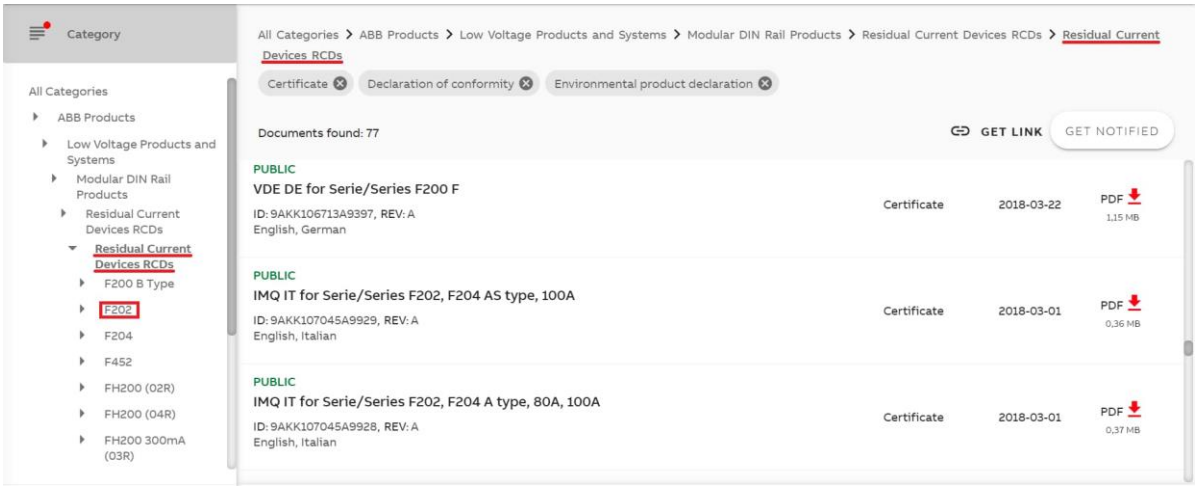
a. Mean time to failure (MTTF) = 1140 years
b. Failure in time (FIT) = 100
c. Mean time between failure (MTBF) = not defined. MTBF is the predicted elapsed time between inherent failures of a system during operation, it's a parameter that refers to repairable items. RCCBs aren't intended to be repaired in case of failure but replaced with a new device.

29. Certificates, declarations, approvals and confirmations

Available documents of RCCBs can be found here.

Available documents of RCD blocks can be found here.

Further filters on product category can be added after reaching linked web pages by acting on the "Category" section.



Any declaration, certificate, approval or confirmation not available in previous links is possibly released only upon request.

30. What is the "Overseas Market" RCCBs range?

The "Overseas Market" range is dedicated to markets which do not need EN standard, but for which IEC standard is accepted. The only difference is in the voltage of test button for execution at 30 mA.

Further information can be found in our Global catalogue here.

31. How does the Auxiliary contact in F-ATI operate?

The auxiliary contact is free from potential so once inserted into a circuit it must be powered with the voltage and current values specified in the technical documentation.

It can then switch due to different reasons and it is not possible to distinguish which one (only possible with the Modbus), so for example when the auxiliary contact switches the multiple causes could be trip switch, resettable differential anomaly, non-resettable differential anomaly, etc.

Thus, the green LED does not represent the contact status but only indicates that F-ATI is active.

32. What are the terminal capacities for RCCBs ranges (F200, DDA200)?

All the information about the terminal capacity for RCCBs can be found in the B section of the RCDs Global Catalogue here.

33. What are the acceptable variations (tolerances) in voltage and frequency for RCCB?

The product is certified according to IEC 61008-1, and the acceptable tolerances are as follows:

- RCCBs functionally dependent on line voltage shall operate correctly at any value of the line voltage between 85% and 110% of their rated voltage.
- The acceptable frequency variation is ±5%.