



## RCD Type F

Residual current protection for single phase inverters applications

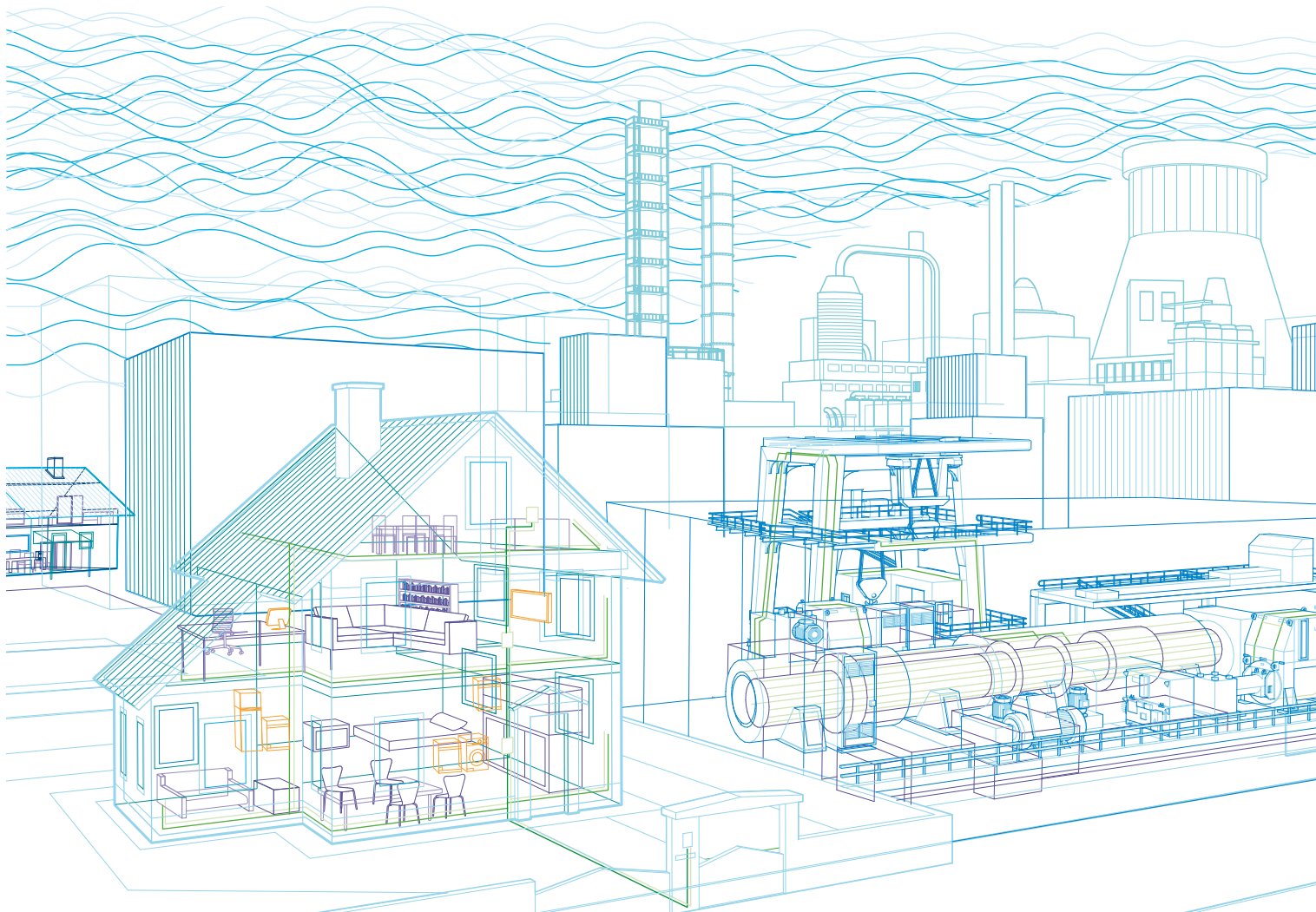
# Type F: a new RCD type to ensure complete safety

ABB introduces the Type F Residual Current Devices, dedicated to the protection of lines supplying single phase inverters.

Nowadays electric appliances including single phase inverters are widely used in household and commercial/industrial applications to reach higher level of efficiency reducing the energy consumption of the electric motors. Single phase inverters regulate the speed of motors by supplying a variable frequency, from 10 to 1000 Hz.

Classical types of RCDs, intended to protect people and equipment at rated frequency of 50/60Hz, are not specifically tested in presence of residual currents with a relevant contribution from high frequencies AC components. The new Type F RCD (where "F" stands for Frequency), introduced in the Product Standard IEC/EN 62423, requires specific high frequency tests to be accomplished.

ABB new Type F RCDs clearly respond now to the customers need of a reliable and accurate protection of lines supplying single phase inverters with a proven solution.





**F202 Type F**, RCCB in two poles with rated current 25-40-63A and sensitivity 30mA for the protection of single phase circuits.



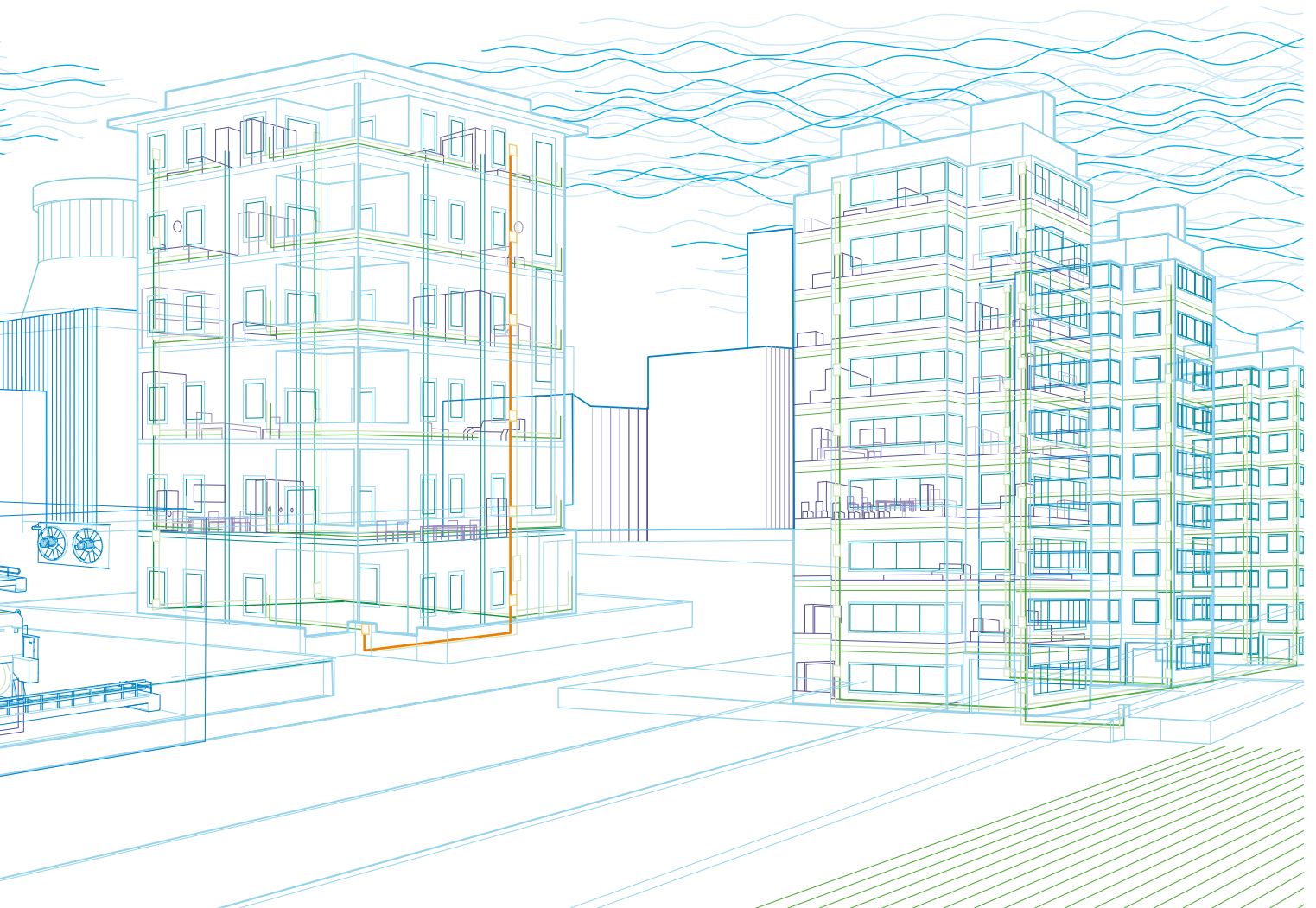
**F204 Type F**, RCCB in four poles with rated current 25-40-63A and sensitivity 30mA for the protection of more than one single phase circuit with a single device.



**DS201 Type F**, compact RCBO 1P+N with rated current 6...40A, B/C curves and breaking capacity 10kA in only two modules.



**DDA 202 Type F**, RCD blocks (to be mounted with S202 MCBs) in two poles with rated current 40 and 63A and sensitivity 30mA for quick and flexible solutions.

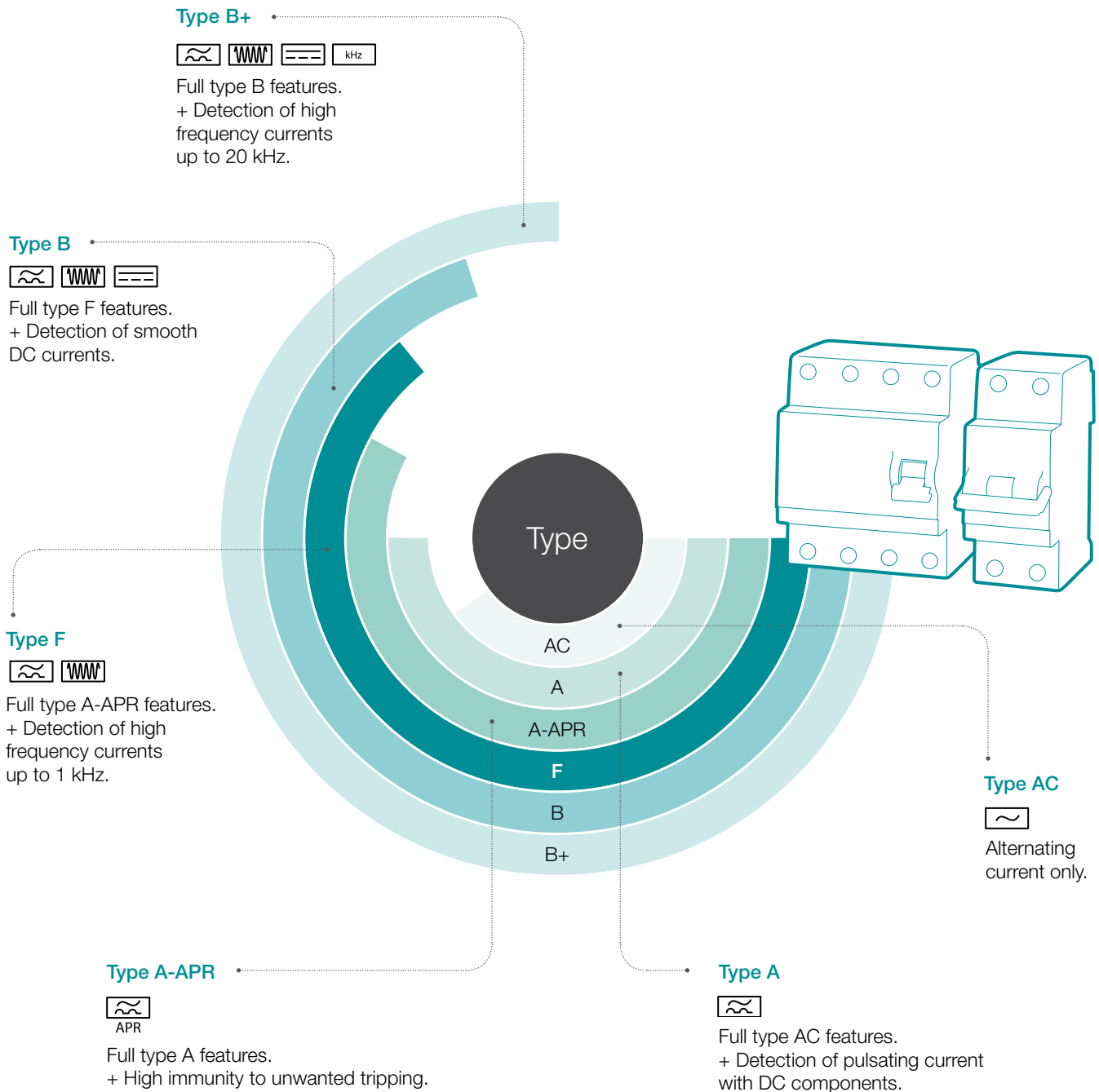


# Residual Current Devices

## A world of solutions

The variety of residual current devices has continuously increased in last decades following the technology evolution and the massive introduction of electronics in all fields of applications.

According to the capability to detect different waveforms of residual current and the relative sophisticated type testing, today the spectrum of RCDs types covers from pure AC loads up to high frequency and DC related applications with an increasing level of protection passing from AC types up to F and B types.

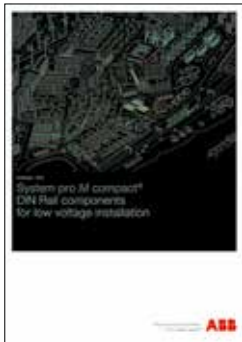


# Type Selection Guide

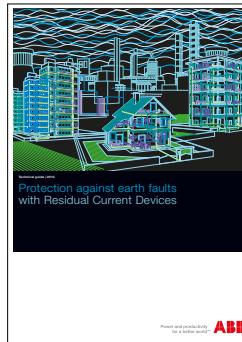
## Quick selection of RCD type

Typical applications	Typical loads	RCD selection
General applications (household, commercial, industrial)	Oven, lights	Type AC
	Dimmer, primary switch mode power supply, multi-speed motors, fan, oven, air conditioning supplied at 50/60Hz with part of the sinus wave	Type A
	Extended lighting circuits, computers supply and other lines subject to unwanted tripping	Type A-APR
	Household appliances and motors with single phase inverters	Type F
Industrial applications	Motors driven by three-phase inverters	Type B
	Motors driven by three-phase inverters with very high frequency	Type B+

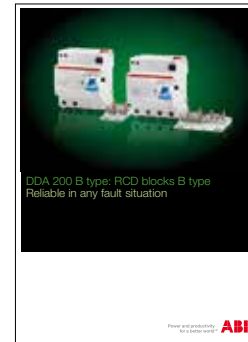
## For more information



General catalogue  
System pro M compact®  
2CSC400002D0211



Technical guide  
Protection against earth faults  
with Residual Current Devices  
2CSC420004B0201



Brochure  
DDA 200 B type: RCD blocks B type  
2CSC427002B0201



# Type F - Protection of lines including loads with single phase inverters

Nowadays single phase inverters are present in many household and industrial loads, such as washing machines, hoovers, dishwashers, ventilation, pumps etc.... Inverter technology is a “plus” in domestic equipment, since it helps to reach better performance reducing power consumption and improving energy efficiency.

## Working principle

A single phase frequency converter, also named inverter, is a commonly used electric drive which regulates the speed of an electric motor, operating on supply voltage and frequency.

During normal operation, the current generated by a single phase inverter in the downstream section is the result of the overlapping of mixed frequency components which varies from 10Hz (motor frequency), to 50Hz (rated frequency) and 1000Hz (switching frequency).

RCDs type F have been specifically designed for single phase inverters applications in order to meet the requirement to assure adequate protection level in case of an earth fault with such harmonic content, offering at the same time an increased resistance to nuisance tripping.

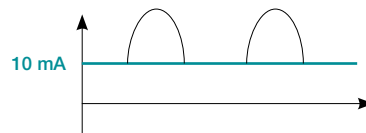
On the other side only RCD type B remain the only devices which are suitable to detect smooth DC components in the residual current caused by insulation faults in the DC section of a three phase frequency converter.

## Type F features at a glance:

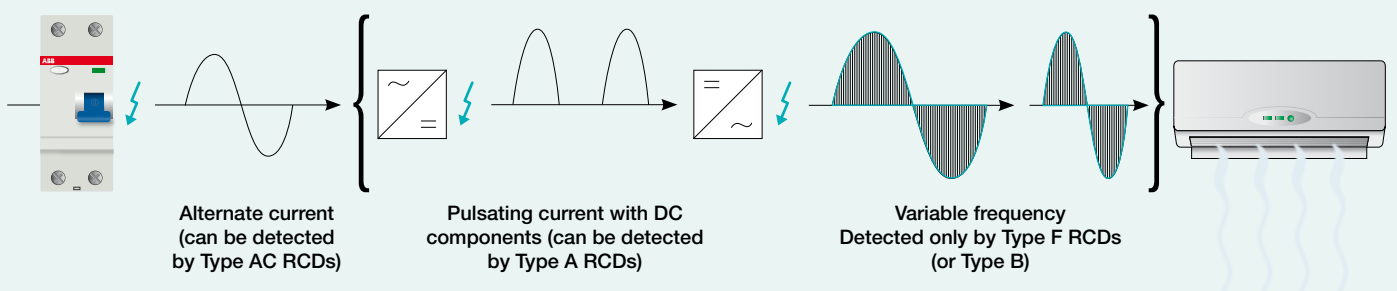
Type F RCDs offer the same range of protection and functionality as an RCD Type A APR; this means that they detect sinusoidal AC currents as well as pulsating DC currents. In addition to this, they are also tested according to IEC/EN 62423 which foresees the application of a simulated multi-frequency residual current with appropriate coefficient associated to the each level of frequency up to 1kHz.

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.

The RCDs 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.



Typical residual current waves that can occur in a circuit that supplies a single phase inverter:





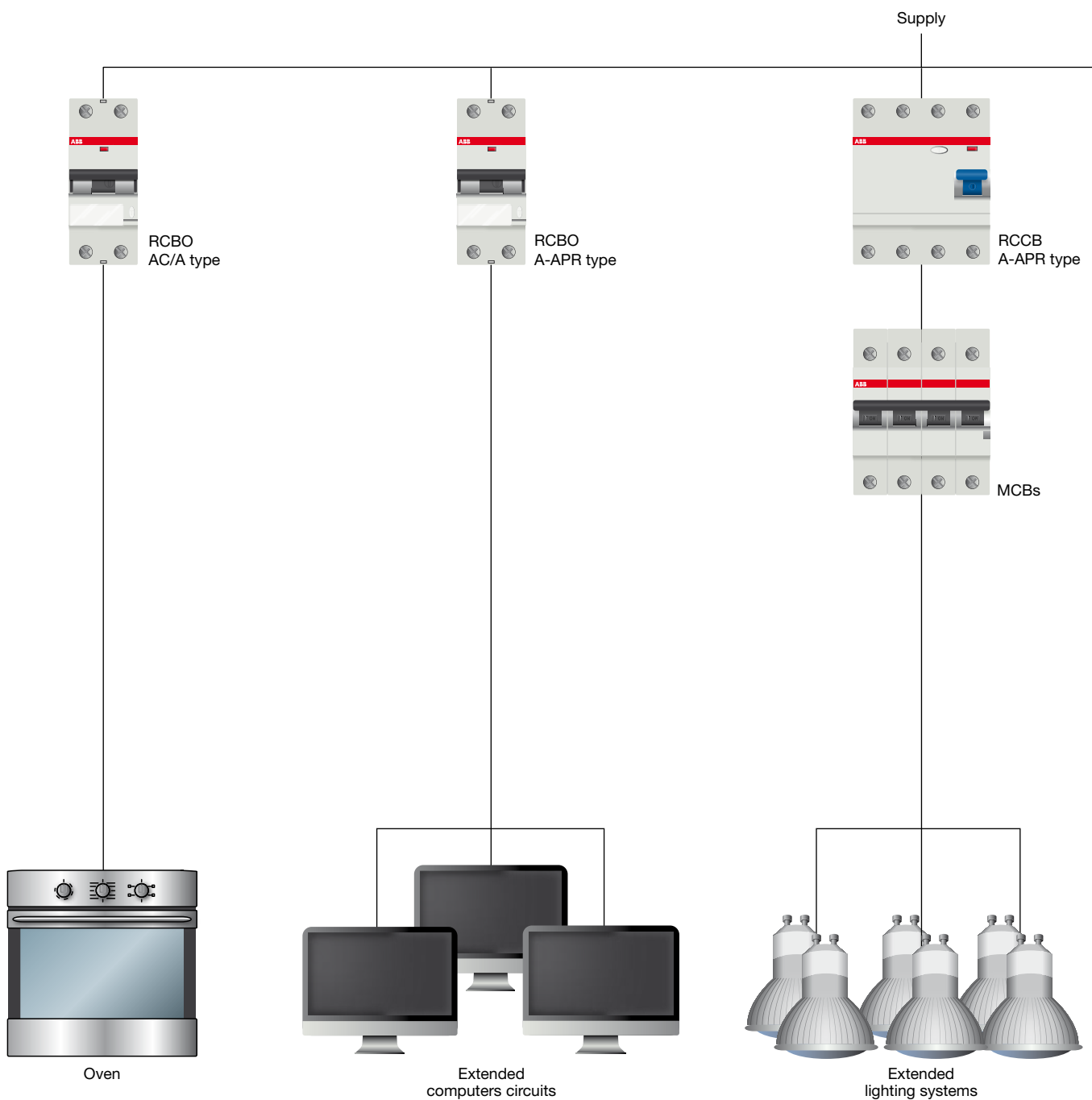


# Maximum protection, in all cases

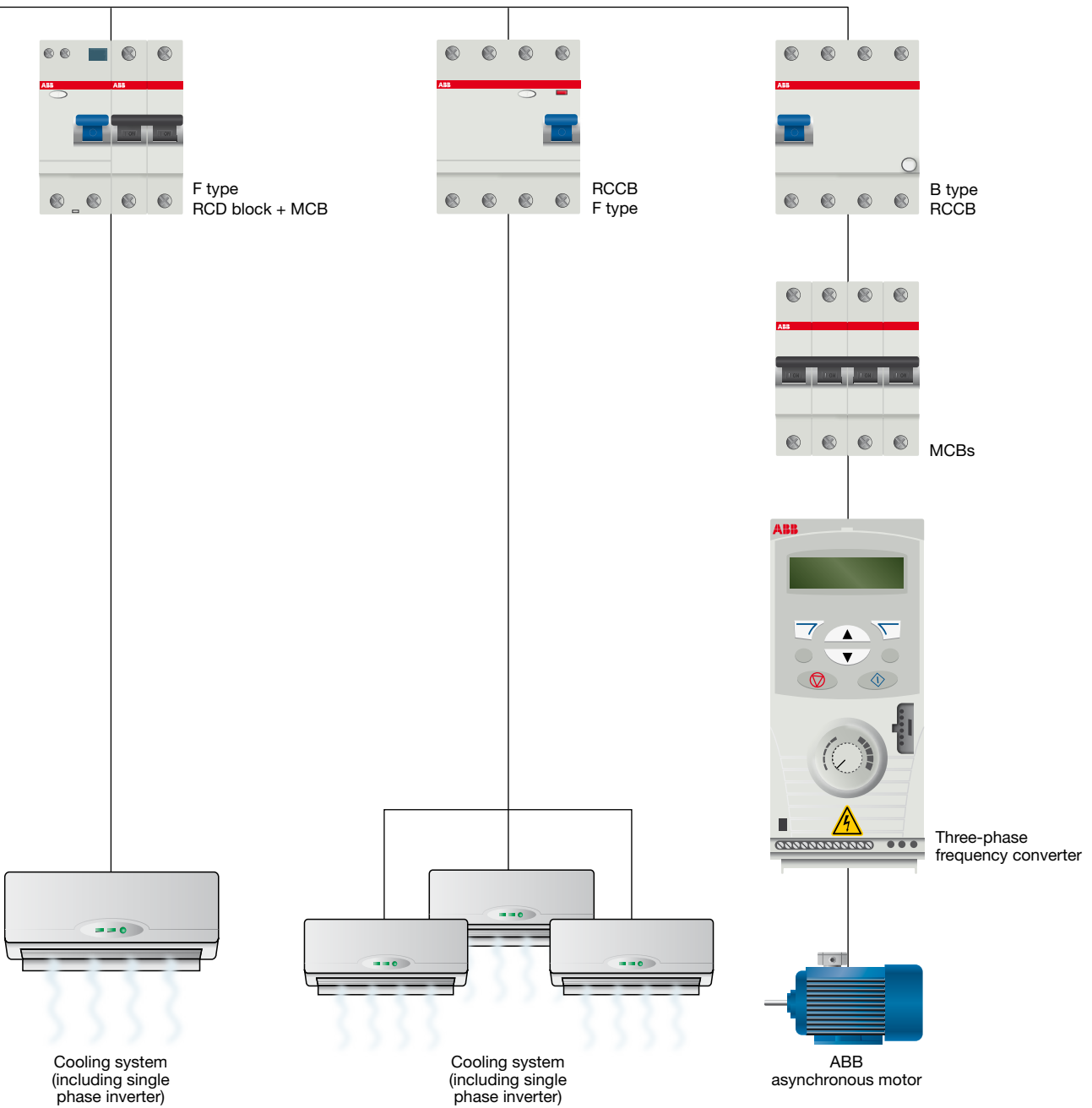
## Example of correct design of RCD protection in an industrial application

According to the type of loads to be protected, the level of safety and the continuity of service, all different RCDs types could be needed. Pure resistive loads can be protected by means of RCBOs Type AC or A. In case of critical circuits due to a high level of peak leakage current like computers networks or ballasts, RCCBs Type A APR offer the adequate solution.

Cooling systems powered by a single phase inverter requires a RCD designed to work with current containing higher harmonics like a RCD-block Type F combined with a correspondent MCB. Finally a RCCB Type B is installed to protect a line supplying a three-phase frequency converter driving a motor load.

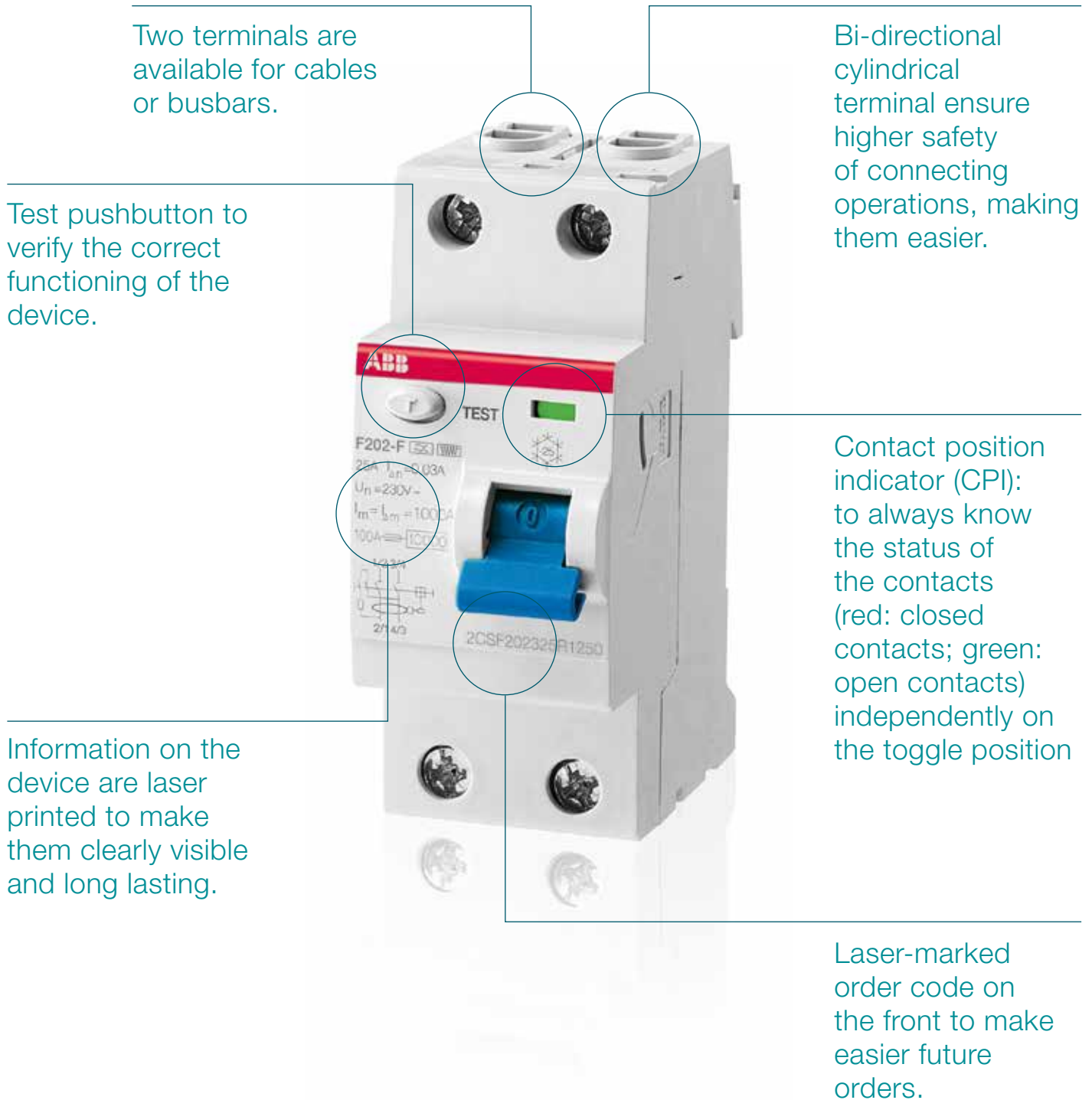






# RCCB F200 type F. The details make the difference

## A range designed to ensure efficiency and protection

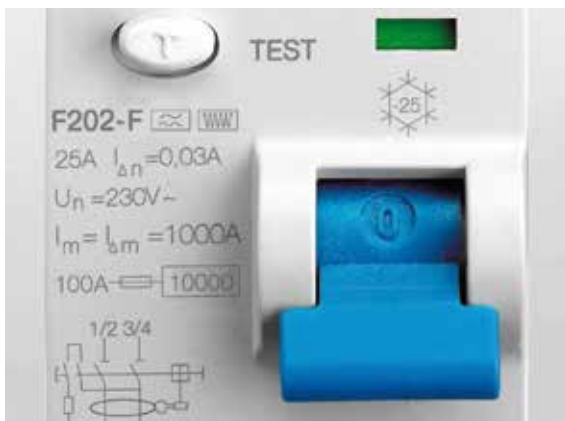




RCCBs F200 can be used in ambient conditions where the temperature of the surrounding atmosphere has values between  $-25^{\circ}\text{C}$  (snowflake laser printed on the front of the device) and  $+55^{\circ}\text{C}$ .



The availability of two terminals offers different connection solutions thanks to the possibility to connect two independent cables in the same device: the second terminal can be used for an auxiliary circuit or for the supply of devices with small section cables without connecting them together with the main circuit.



High performances:

- rated breaking capacity and rated residual breaking capacity laser printed on the device:  $I_m = I_{\Delta m} = 1000 \text{ A}$
- coordination with a 100 A rated current SCPD (short-circuit protective device) = 10000 A.



The F 202 can be coupled with the autoreclosing unit F2C-ARH in order to ensure continuity of service for the whole installation of your home avoiding lack of supply.

# RCBO DS201 type F. The details make the difference

A range designed to ensure efficiency and protection

Contact position indicator (CPI):  
red - closed contacts;  
green - open contacts.

Bi-directional cylindrical terminal ensure higher safety of connecting operations, making them easier.

Information on the device are laser printed to ensure readability over time (including product code).

The label carrier to clearly identify the protected circuit.

Test pushbutton to verify the correct functioning of the device

Each RCBO of the DS201 range is equipped with an Rfid tag containing a unique serial number assigned to ABB according to the standard ISO/IEC FCD 15693-3 in order to authenticate the product.





Any earth fault can be immediately identified through the blue indicator, that signals the differential tripping and which cannot be activated in case of manual operation on the toggle. This prevents any misinterpretations of the device and system status.



The terminals available on DS201 make easier the supply operation in parallel with busbars as they are composed by two different seats, a front seat for 25 mm<sup>2</sup> cables and a back seat for 10 mm<sup>2</sup> busbars.



Label carrier for clear and reliable identification. With the practical label carrier fitted in the new circuit breakers you can give maximum visibility to the information relating to the protected loads.



All the devices of the DS201 series have been tested in a wide range of temperatures: from -25 °C (as indicated by the snowflake marked on the front side) up to +55°C.

# DDA 200 type F - The details make the difference

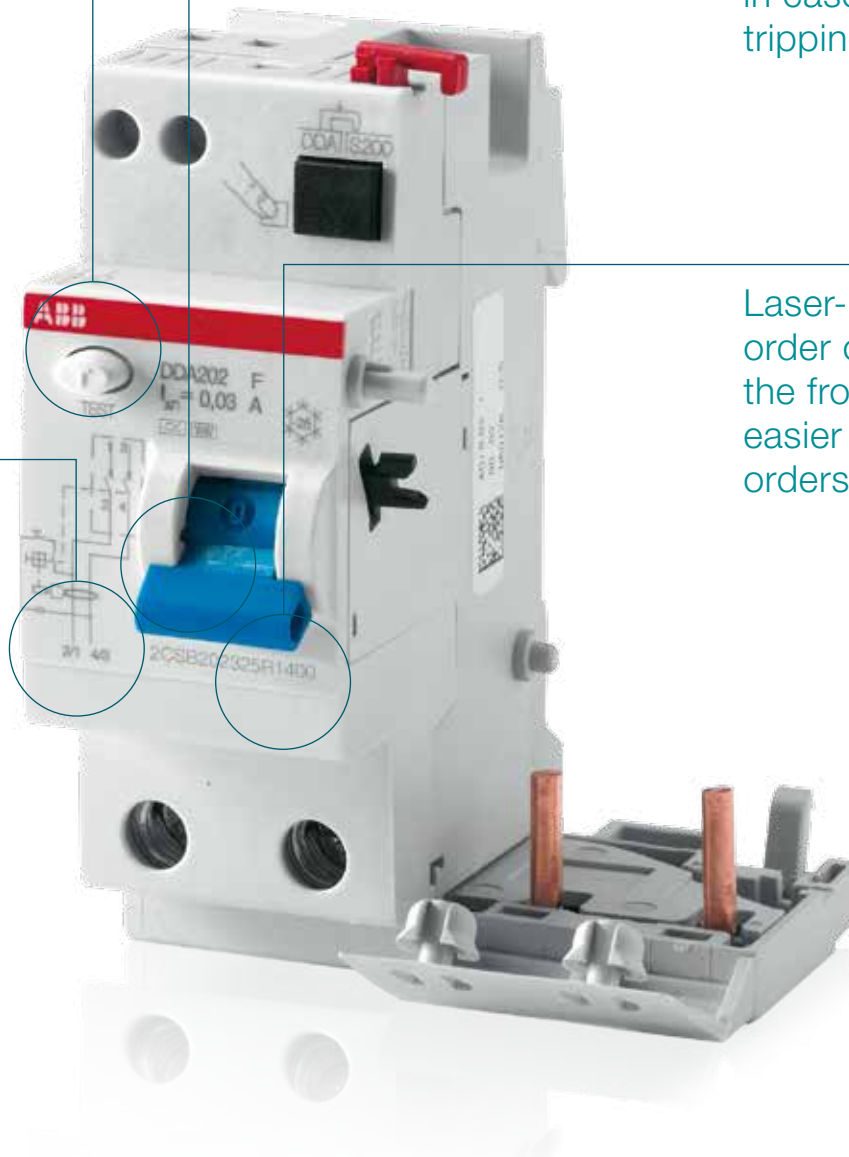
## A range designed to ensure efficiency and protection

Test pushbutton to verify the correct functioning of the device

RCD tripping indicator: Blue lever goes down in case of RCD tripping

Information on the device is laser printed to make it clearly visible and long lasting.

Laser-marked order code on the front to make easier future orders.



DDA200 RCD block mounted with S200 MCB.



DDA200  
RCD block



S200 MCB



RCBO





#### Flexibility

DDA200 is suitable for mounting with S200 extensive range of MCBs, covering applications in 2P up to 63A with breaking capacity up to 25kA.



RCD block DDA200 can be used in ambient conditions where the temperature of the surrounding atmosphere has values between  $-25^{\circ}\text{C}$  (snowflake laser printed on the front of the device) and  $+55^{\circ}\text{C}$ .



Possibility to connect a remote test button for 63A versions.



#### No misuse

Mistakes in assembling the MCB on the DDA200 are avoided thanks to a mechanical key that avoids mounting an MCB with higher rated current than the RCD block.

# Range

## Technical features

	Standards			
<b>Electrical features</b>	Type			
	Number of poles			
	Rated current $I_n$			
	Rated sensitivity $I_{\Delta n}$			
	Rated voltage $U_e$			
	Insulation voltage $U_i$			
	Max. / Min. operating voltage of circuit test			
	Rated frequency			
	Rated breaking capacity acc. to IEC/EN 61009		ultimate $I_{cn}$	
	Rated breaking capacity acc. to IEC/EN 60947-2 1P+N @230 VAC		ultimate $I_{cu}$ service $I_{cs}$	
	Rated residual breaking capacity $I_{\Delta m}$			
	Rated conditional short-circuit current $I_{nc}=I_{\Delta c}$		SCPD - fuse gG 100 A	
	Rated impulse withstand voltage (1.2/50) $U_{imp}$			
	Dielectric test voltage at ind. freq. for 1 min.			
	Thermomagnetic release characteristic		B: $3 I_n \leq I_m \leq 5 I_n$ C: $5 I_n \leq I_m \leq 10 I_n$	
Surge current resistance (wave 8/20)				
<b>Mechanical features</b>	Toggle			
	Flag indicators		contact position indicator (green/red) differential trip indicator	
	Electrical life			
	Mechanical life			
	Protection degree		housing terminal	
	Environmental conditions (damp heat) acc. to IEC/EN 60068-2-30			
	Reference temperature for setting of thermal element			
	Ambient temperature (with daily average $\leq +35$ °C)			
	Storage temperature			
	<b>Installation</b>	Terminal type		
		Terminal size top/bottom for cables		
Terminal size top/bottom for busbar				
Tightening torque top/bottom				
Tool				
Mounting				
Connection				
<b>Dimensions and weight</b>		Dimensions (H x D x W)		
	Weight			
<b>Combination with auxiliary elements</b>	Combinable with:			

(1) RCD-blocks DDA 200 with rated current 63 A are provided with two additional terminals for remote tripping.



F200 Type F	DS201 M Type F	DDA200 Type F
IEC/EN 61008, IEC/EN 62423 2 <sup>nd</sup> ed	IEC/EN 61009, IEC/EN 62423 2 <sup>nd</sup> ed	IEC/EN 61009 App.G, IEC/EN 62423 2 <sup>nd</sup> ed
	F	
2P, 4P	1P+N	2P
25, 40, 63 A	$6 \leq I_n \leq 40$ A	40, 63 A <sup>(1)</sup> (to mount with MCB with $I_n = 0,5 \dots 63$ A)
	0.03 A	
2P: 230 V - 4P: 400 V	230 V	230 V
	500 V	
	254 V / 170 V	
	50...60 Hz	
-	10000 A	same as coupled MCB
-	10 kA	same as coupled MCB
-	7.5 kA	same as coupled MCB
1 kA	6 kA	same as coupled MCB
10kA	-	-
	4 kV	
	2.5 kV	
-	■	same as coupled MCB
-	■	same as coupled MCB
	3000 A	
blue sealable in ON-OFF position	black sealable in ON-OFF position	blue sealable in ON-OFF position
yes	yes	On MCB
lever position	yes	Indication with levers position: - Both MCB/RCD block down: RCD tripping - MCB down, RCD block up: MCB tripping
	10000 cycles	
	20000 cycles	
	IP4X	
	IP2X	
	28 cycles with 55°C/90-96% and 25°C/95-100% [°C/RH]	
	30 °C	
	-25...+55 °C	
	-40...+70 °C	
failsafe bi-directional cylinder-lift terminal at top and bottom (shock protected)		Top: failsafe bi-directional cylinder-lift terminal (shock protected) Bottom: failsafe cylinder-lift terminal (shock protected)
	25/25 mm <sup>2</sup>	
10/10 mm <sup>2</sup>		10/- mm <sup>2</sup>
	2.8 Nm	
	N°2 Pozidriv	
	on DIN rail EN 60715 (35 mm) by means of fast clip device	
	from top and bottom	
2P: 85 x 69 x 35 mm; 4P: 85 x 69 x 70 mm	1P+N: 85 x 67 x 35 mm	2P: 93 x 69 x 69,5 mm
2P: 225 g; 4P: 375 g	1P+N: 240 g	2P: 180 g
auxiliary contact, signal contact, shunt trip, undervoltage release (see next pages)		

# Type F codes



2CSC423001F0901

Number of poles	Rated residual current I $\Delta$ n mA	Rated current In A	EAN 8012542	Order details		Weight 1 piece kg	Pack unit pc.
				Type code	Order code		
<b>RCCB F200</b>							
2	30	25	992738	F202 F-25/0,03	2CSF202325R1250	0.225	1/6
		40	992837	F202 F-40/0,03	2CSF202325R1400	0.225	1/6
		63	992936	F202 F-63/0,03	2CSF202325R1630	0.225	1/6
4	30	25	993032	F204 F-25/0,03	2CSF204325R1250	0.375	1/3
		40	993131	F204 F-40/0,03	2CSF204325R1400	0.375	1/3
		63	993230	F204 F-63/0,03	2CSF204325R1630	0.375	1/3



2CSC423002F0901

<b>RCBO DS201 - B curve</b>							
1P+N	30	6	994138	DS201 M B6 F30	2CSR275540R1065	0.240	1/5
		10	994237	DS201 M B10 F30	2CSR275540R1105	0.240	1/5
		13	994336	DS201 M B13 F30	2CSR275540R1135	0.240	1/5
		16	994435	DS201 M B16 F30	2CSR275540R1165	0.240	1/5
		20	994534	DS201 M B20 F30	2CSR275540R1205	0.240	1/5
		25	994633	DS201 M B25 F30	2CSR275540R1255	0.240	1/5
		32	994732	DS201 M B32 F30	2CSR275540R1325	0.240	1/5
		40	994831	DS201 M B40 F30	2CSR275540R1405	0.240	1/5



2CSC423003F0901

<b>RCBO DS201 - C curve</b>							
1P+N	30	6	993339	DS201 M C6 F30	2CSR275540R1064	0.240	1/5
		10	993438	DS201 M C10 F30	2CSR275540R1104	0.240	1/5
		13	993537	DS201 M C13 F30	2CSR275540R1134	0.240	1/5
		16	993636	DS201 M C16 F30	2CSR275540R1164	0.240	1/5
		20	993735	DS201 M C20 F30	2CSR275540R1204	0.240	1/5
		25	993834	DS201 M C25 F30	2CSR275540R1254	0.240	1/5
		32	993933	DS201 M C32 F30	2CSR275540R1324	0.240	1/5
		40	994039	DS201 M C40 F30	2CSR275540R1404	0.240	1/5



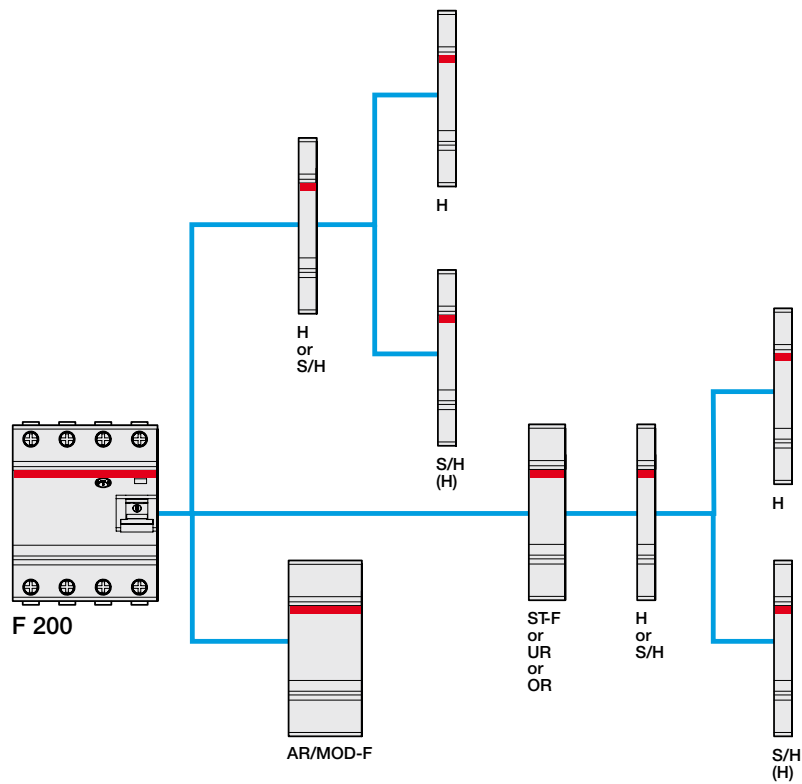
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<b>RCD block DDA 200</b>							
2	30	40	801221	DDA 202 F-40/0,03	2CSB202325R1400	0.180	1
		63	801122	DDA 202 F-63/0,03	2CSB202325R1630	0.180	1

# Accessories

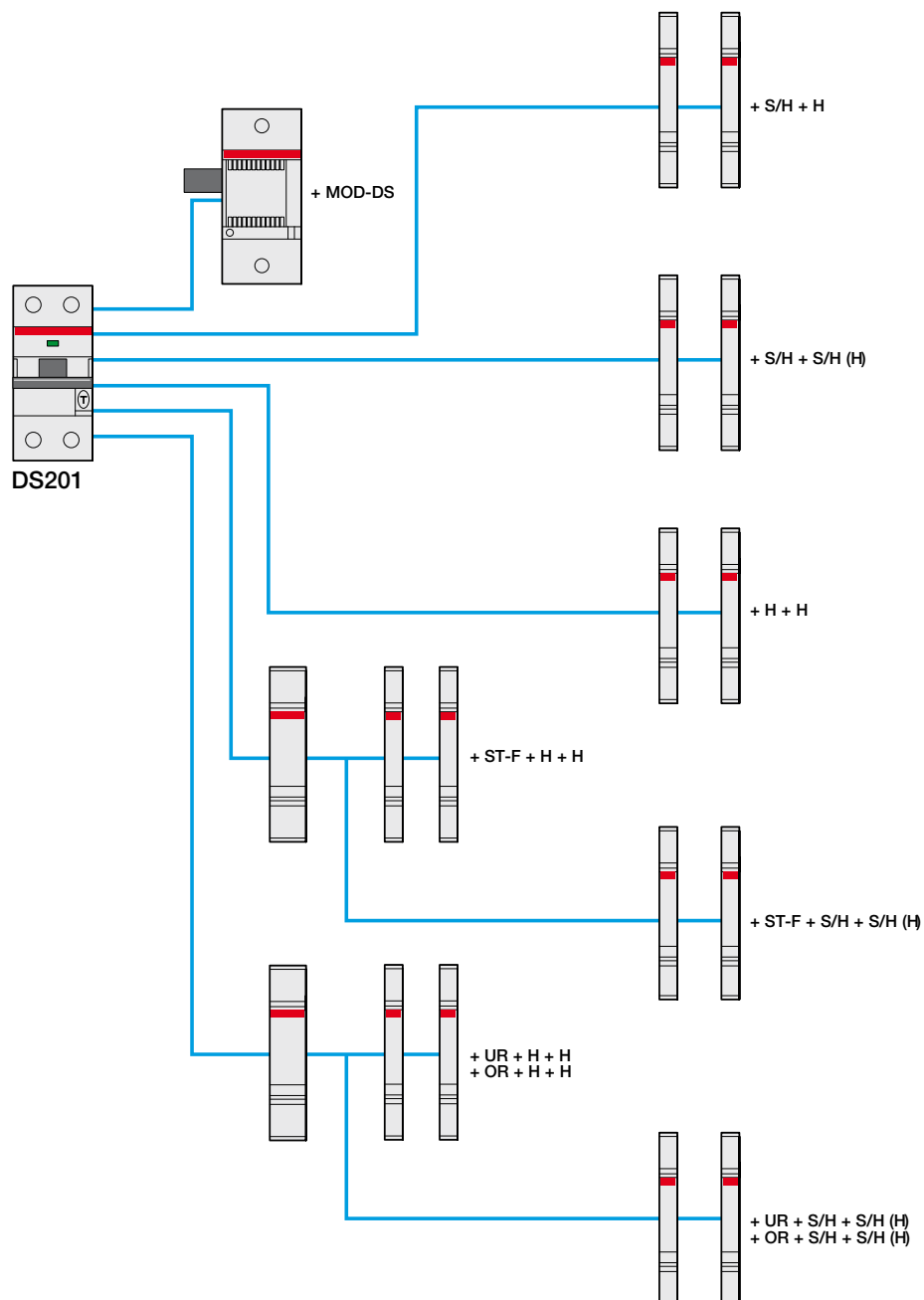
## Combination of auxiliary elements with F 200

<b>H</b>	Auxiliary contact	S2C-H6R
<b>S/H</b>	Signal/Auxiliary contact	S2C-S/H6R
<b>S/H (H)</b>	Signal/Auxiliary contact used as auxiliary contact	S2C-S/H6R
<b>UR</b>	Undervoltage release	S2C-UA
<b>OR</b>	Overvoltage release	S2C-OVP
<b>AR</b>	Auto reclosing unit	F2C-ARI / F2C-ARH
<b>MOD-F</b>	Motor operating device	F2C-CM
<b>ST-F</b>	Shunt trip for F 200 RCCB	F2C-A



## Combination of auxiliary elements with DS201

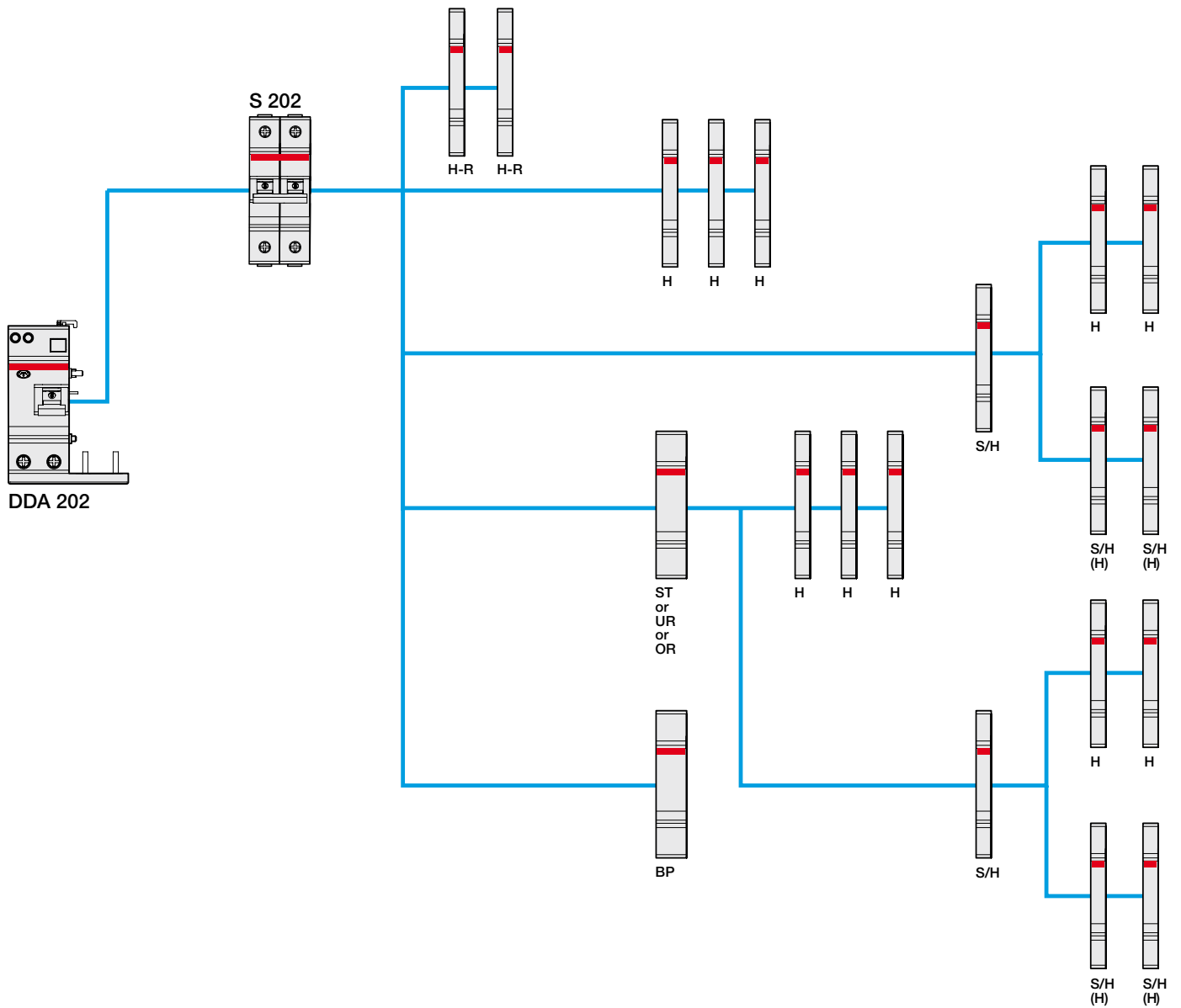
<b>H</b>	Auxiliary contact	S2C-H6R
<b>S/H</b>	Signal/Auxiliary contact	S2C-S/H6R
<b>S/H (H)</b>	Signal/Auxiliary contact used as auxiliary contact	S2C-S/H6R
<b>UR</b>	Undervoltage release	S2C-UA
<b>OR</b>	Overvoltage release	S2C-OVP
<b>MOD-DS</b>	Motor operating device	DS2C-CM
<b>ST-F</b>	Shunt trip for F 200 RCCB	F2C-A





### Combination of auxiliary elements with DDA200

<b>H</b>	Auxiliary contact	S2C-H6R
<b>H-R</b>	Auxiliary contact	S2C-H6-...R
<b>S/H</b>	Signal/Auxiliary contact	S2C-S/H6R
<b>S/H (H)</b>	Signal/Auxiliary contact used as auxiliary contact	S2C-S/H6R
<b>ST</b>	Shunt trip for S 200 MCB	S2C-A...
<b>UR</b>	Undervoltage release	S2C-UA
<b>OR</b>	Overvoltage release	S2C-OVP
<b>BP</b>	Mechanical tripping device	S2C-BP





## Auxiliary contact

	Bbn 4016779 EAN	Order details Type code	Order code	Weight 1 piece [kg]	Pack unit pc.
Change-over 1CO	563826	S2C-H6R	2CDS200912R0001	0,04	1
Auxiliary contact 1NO/1NC	697941	S2C-H6-11R	2CDS200946R0001	0,04	1
Auxiliary contact 2NO	697958	S2C-H6-20R	2CDS200946R0002	0,04	1
Auxiliary contact 2NC	697965	S2C-H6-02R	2CDS200946R0003	0,04	1



## Signal / Auxiliary contact

	Bbn 4016779 EAN	Order details Type code	Order code	Weight 1 piece [kg]	Pack unit pc.
Change-over 1CO	563819	S2C-S/H6R	2CDS200922R0001	0,04	1



## Undervoltage releases

	Bbn 8012542 EAN	Order details Type code	Order code	Weight 1 piece [kg]	Pack unit pc.
Undervoltage release 12 V DC	839705	S2C-UA12 DC	2CSS200911R0001	0,09	1
Undervoltage release 24 V AC	839804	S2C-UA24 AC	2CSS200911R0002	0,09	1
Undervoltage release 24 V DC	896401	S2C-UA24 DC	2CSS200911R0007	0,09	1
Undervoltage release 48 V AC	839903	S2C-UA48 AC	2CSS200911R0003	0,09	1
Undervoltage release 48 V DC	896500	S2C-UA48 DC	2CSS200911R0008	0,09	1
Undervoltage release 110 V AC	840008	S2C-UA110 AC	2CSS200911R0004	0,09	1
Undervoltage release 110 V DC	896609	S2C-UA110 DC	2CSS200911R0009	0,09	1
Undervoltage release 230 V AC	840107	S2C-UA230 AC	2CSS200911R0005	0,09	1
Undervoltage release 230 V DC	896708	S2C-UA230 DC	2CSS200911R0010	0,09	1
Undervoltage release 400 V AC	840206	S2C-UA400 AC	2CSS200911R0006	0,09	1



## Overvoltage releases

	Bbn 8012542 EAN	Order details Type code	Order code	Weight 1 piece [kg]	Pack unit pc.
Overvoltage release (max tripping voltage AC: 275V)	748137	S2C-OVP1	2CSS200910R0005	0,1	1/5
Overvoltage release (max tripping voltage AC: 290V)	952039	S2C-OVP2	2CSS200993R0005	0,1	1/5



2CSS42309FF0901

### Auto-reclosing units

	Bbn 8012542 EAN	Order details		Weight 1 piece [kg]	Pack unit pc.
		Type code	Order code		
Auto-reclosing unit for 2P and 4P F200 RCCBs	026655	F2C-ARI	2CSF200996R0013	0.166	1
Home automatic resetting unit (30 mA)	732433	F2C-ARH	2CSF200992R0005	0.200	1
Home automatic resetting unit (30 mA) with RCCB autotest	733232	F2C-ARH-T	2CSF200991R0005	0.200	1



2CSS423010FF0901

### Motor operating devices

	Bbn 8012542 EAN	Order details		Weight 1 piece [kg]	Pack unit pc.
		Type code	Order code		
Motor operating device for 2P and 4P F200 RCCBs	026556	F2C-CM	2CSF200997R0013	0.166	1
Motor operating device for 1P+N DS201 RCBOs	135951	DS2C-CM	2CSR201997R0013	0.166	1



2CSS423011F0901

### Shunt trips for RCD Block DDA200 with MCB S200

	Bbn 4016779 EAN	Order details		Weight 1 piece [kg]	Pack unit pc.
		Type code	Order code		
AC/DC 12...60 V	570992	S2C-A1	2CDS200909R0001	0.15	1
AC 110...415 V / DC110...250 V	571005	S2C-A2	2CDS200909R0002	0.15	1



2CSS423012F0901

### Shunt trips for RCCB F200 and RCBO DS201

	Bbn 8012542 EAN	Order details		Weight 1 piece [kg]	Pack unit pc.
		Type code	Order code		
Shunt trip 12/60 V AC/DC	974901	F2C-A1	2CSS200933R0011	0.15	1
Shunt trip 110-415 V AC /110-250 V DC	975007	F2C-A2	2CSS200933R0012	0.15	1



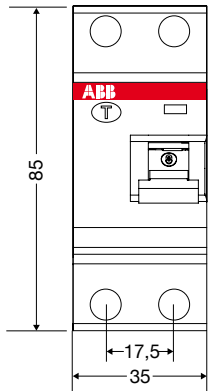
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### Mechanical tripping device

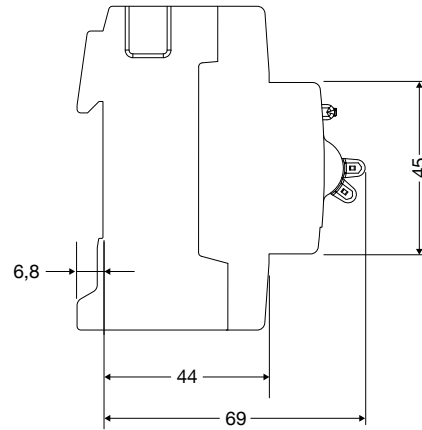
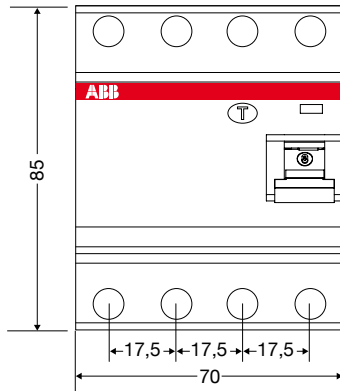
	Bbn 8012542 EAN	Order details		Weight 1 piece [kg]	Pack unit pc.
		Type code	Order code		
Mechanical tripping device	941309	S2C-BP	2CSS200998R0001	0.048	1

# Overall dimensions

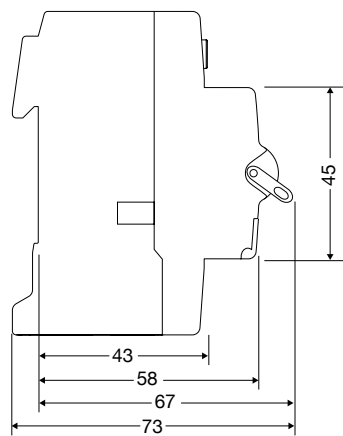
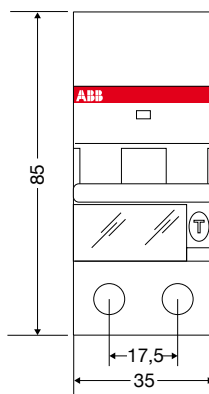
F202



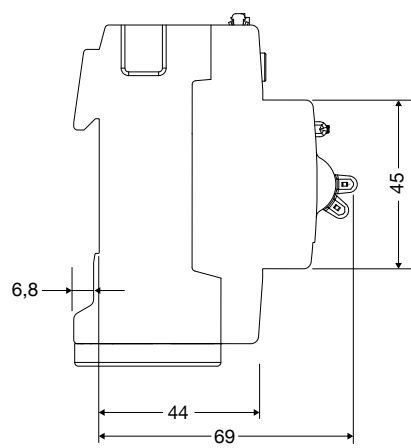
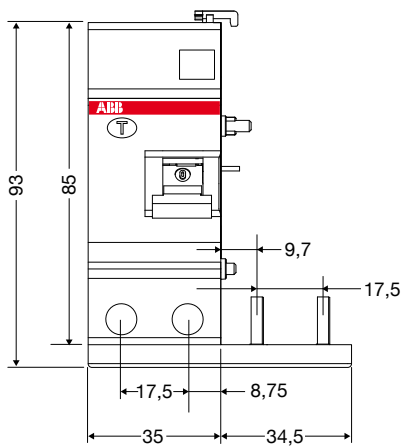
F204



DS201



DDA 202



Dimensions in mm

# FAQ - Frequently Ask Questions

## Is it possible to realize selectivity with type F RCDs?

### What about the coordination with MCBs?

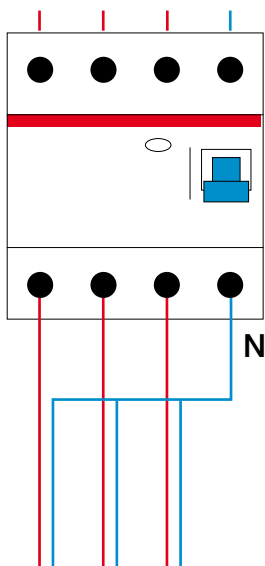
The coordination and selectivity rules are common for Type AC, A, A-APR and F RCDs. For an RCD type F, the first level of selectivity can be realized with any RCD in selective version. Selectivity is guaranteed thanks to the time delay and higher sensitivity of the RCD upstream. For any detail regarding the coordination, please refer to the System pro *M* compact®.



## Why ABB proposes RCCB in four poles versions in Type F, dedicated people protection for single phase inverter lines?

An RCCB 4P can be used for the protection of single phase lines, by wiring each line downstream the protection, earning two modules inside the switchboard (4 modules instead of 6 modules with 3 x F202). Moreover, four poles RCCB are commonly used upstream multiple single phase lines in certain countries.

### Three-phase supply



### Single phase circuits

## What happens if two loads with single phase inverters are connected at the same time downstream a Type F RCD?

RCD Type F ensure people protection in the same way as other types of RCD. The RCD, as prescribed by international standard, must not trip when residual current value is below  $0.5 I_{dn}$ , can trip between  $0.5 \dots 1 I_{dn}$  and must trip from  $1 \times I_{dn}$  onwards. Respecting those values, loads with and without single phase inverters can be supplied, regardless their number. This could be the case, for example in a house, if a washing machine is running while the user switches-on a Hoover.

## How many fluorescent bulbs and computers can be connected simultaneously if a 30mA APR type RCD is installed?

APR RCDs are characterized by their high resistance to line overvoltages from atmospheric origin, grid interference and leakage currents. One of the main factors concerning the origin of leakage currents is the connection of numerous computers and fluorescent bulbs with electronic ballast at the same time. APR RCDs, thanks to their anti-interference characteristics, reduce the risks of unwanted tripping, significantly improving operational continuity for numerous applications (offices, supermarkets, datacentres, schools etc.). The most critical aspect for dimensioning lines supplying fluorescent lights or computers is undoubtedly the interference these devices emit. Today it is impossible to give exact indications on how many bulbs and computers may be connected, as this is variable and depends on the connected load. Despite this, we can try, as we have done in the table below, to give a general indication which can help facilitate dimensioning of these lines.

RCD type	N. of electronic ballasts	N. of workstations (computers / printers)
Standard	20	2
A-APR Type	50	5







# Contact us

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