FAQ

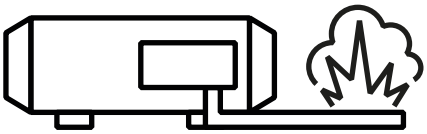
# Residual Current Circuit Breakers with Overcurrent Protection (RCBOs)

DS301C

# Table of contents

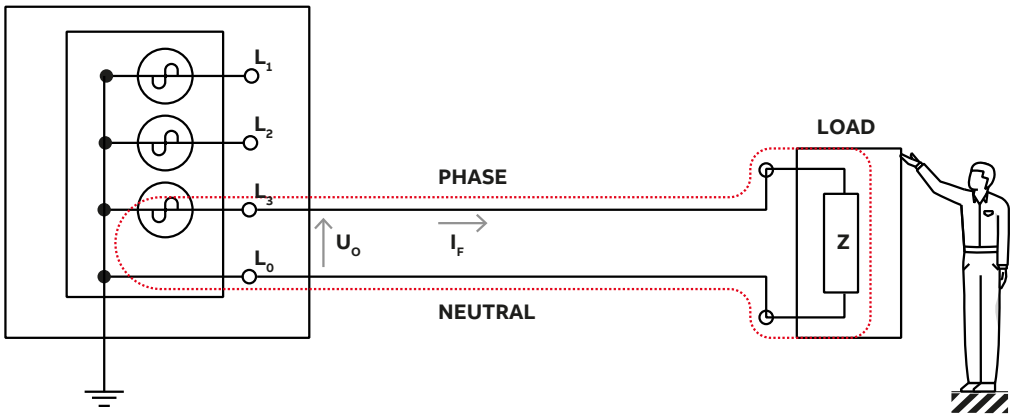
## What is the difference between direct and indirect contact?

Direct contact is when a person comes into contact with energized components or a conductor that are normally live. Protection is mainly provided by means of physical barriers such as insulation of cables.

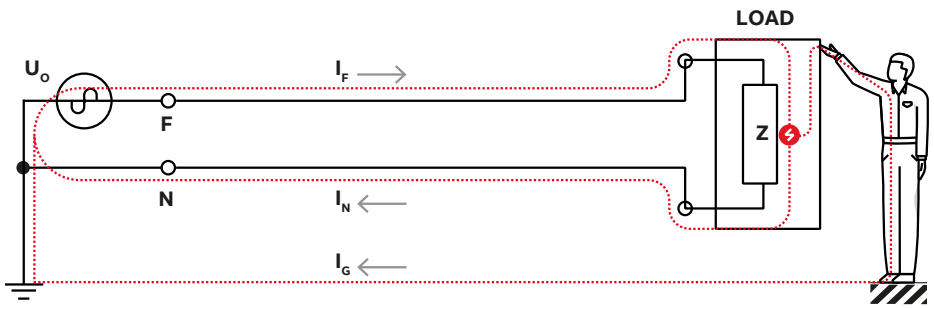


Indirect contact is when a person comes into contact with a current-conducting component that is not normally live, but has accidentally become a conductor due to a problem with the insulation or other issue.

"Normal" state:




"Defective" state:



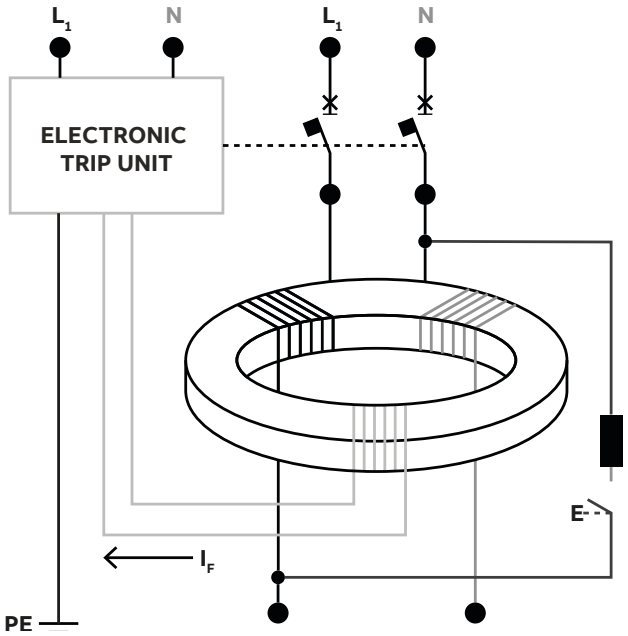

Insulation fault and current path

## What is protected by the DS301C RCBO?

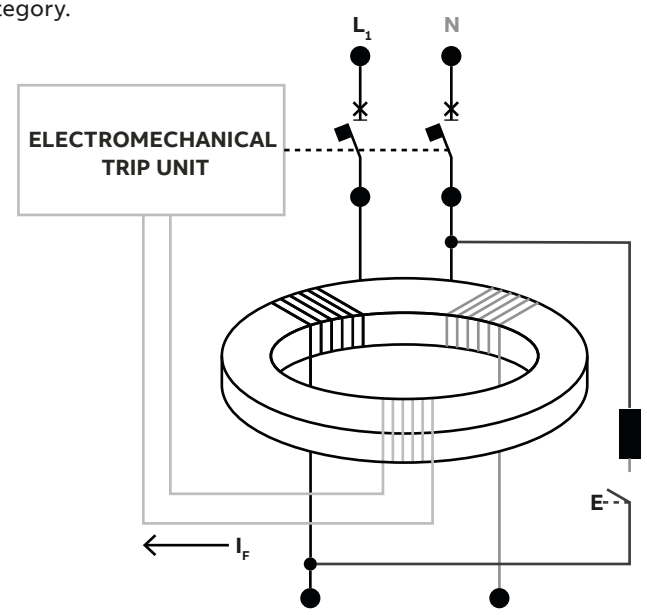
It protects people and equipment from the risk associated with electricity. It prevents people from being electrocuted by disconnecting the electrical circuit if it detects an abnormal voltage fluctuation, as is the case with faulty insulation. It also protects the equipment by disconnecting the circuit in the event of a short circuit or overloading.

## What is the difference between an electronic and electromechanical RCBO?

The “electronic” version requires a second power source to power the printed circuit board (PCB) in order to measure voltage deviations. If this source is interrupted, measurement can no longer occur. At ABB, examples would be the DSE201 or DSN201 RCBO range.



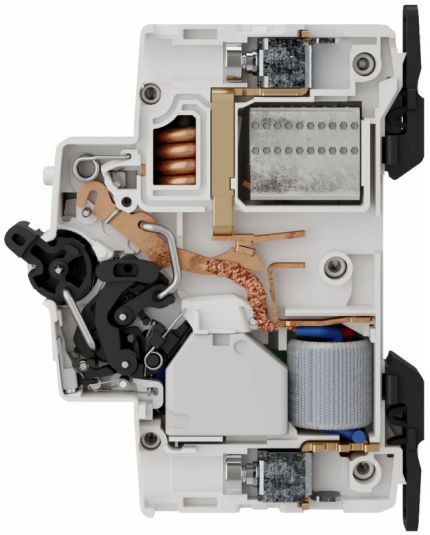

The “electromechanical” version gets around the aforementioned situation through the use of a magnetic relay, thereby ensuring stable and autonomous measurement. The DS301C, DS201, DS202C and DS203NC range falls into this category.



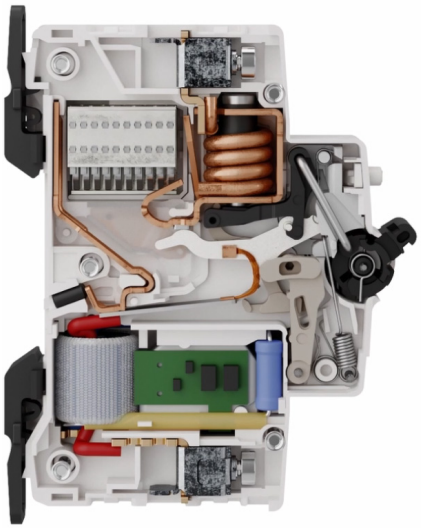
## How does the DS301C work?

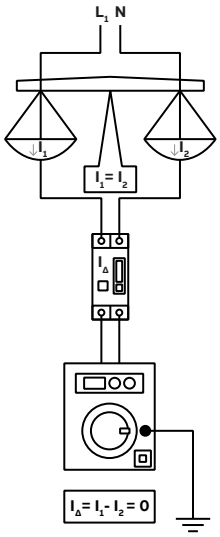
Scan this QR code to watch a demo video.

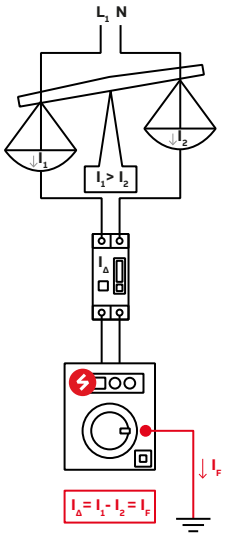
The protection against short circuits and overloading is designed like with a miniature circuit breaker (MCB), i.e. the current flows through the circuit breaker, where a bimetallic strip heats up, deforms and activates the trip if the current reaches too high a level.



The protection against earthing faults is based on the same technology as residual current circuit breakers (RCCBs) and uses a relay to continuously measure the current flowing through.
If a deviation is detected, the relay releases an element (an armature), which activates the mechanism for tripping the RCBO.

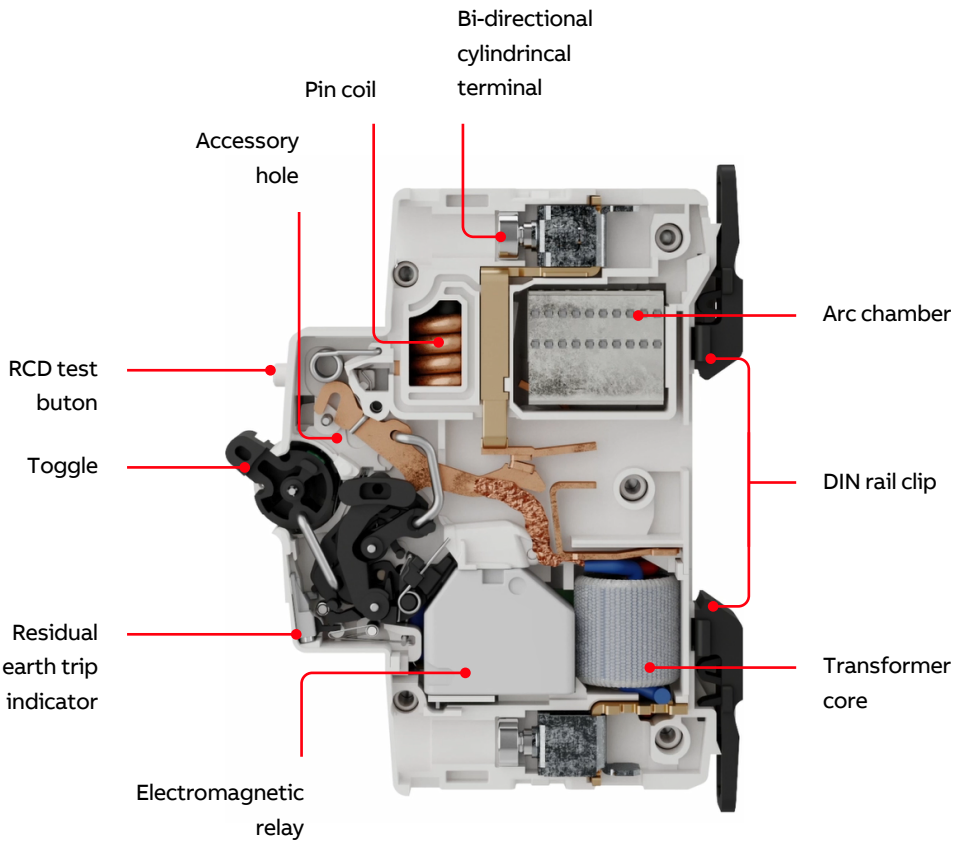




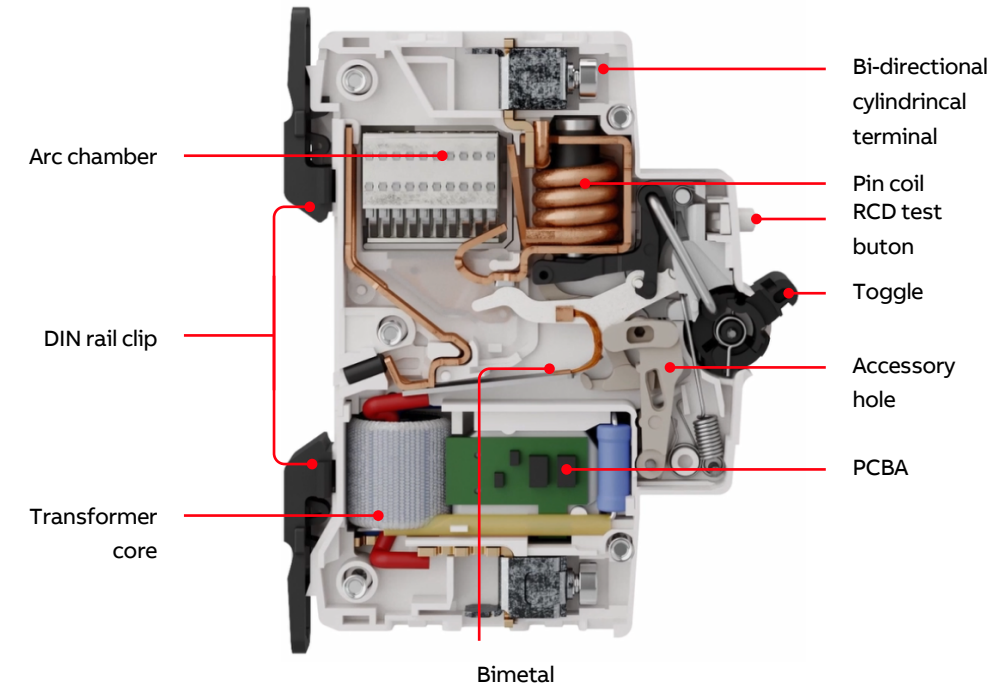



## What is inside the DS301C?

On the right-hand side:




On the left-hand side:



## Why use an RCBO rather than combining an MCB and an RCCB?

The difference lies in the fact that in the event of a problem arising from faulty insulation, having an RCBO allocated to each individual circuit means that just the circuit with a fault can be disconnected, while keeping the others running.

In the conventional case of combining an RCCB and downstream MCBs, the RCCB opens the circuit in the event of a fault, thereby cutting off all the downstream circuits until the fault has been resolved.

## Why use the DS301C rather than the DS201?

Due to its size. The DS301C actually serves the same function as the DS201 but has a single-module width (rather than two). This improvement requires less space in the electrical cabinets, with the result that they can be downsized for aesthetic or economic purposes or even to use the extra space for other circuits (future extensions, building control).

In a six-circuit configuration requiring 6×DS201, each two modules in width, you need 6×2 = 12 modules, which is equivalent to an entire rail.

With the same configuration with 6×DS301C, each one module in width, the row is six modules shorter.

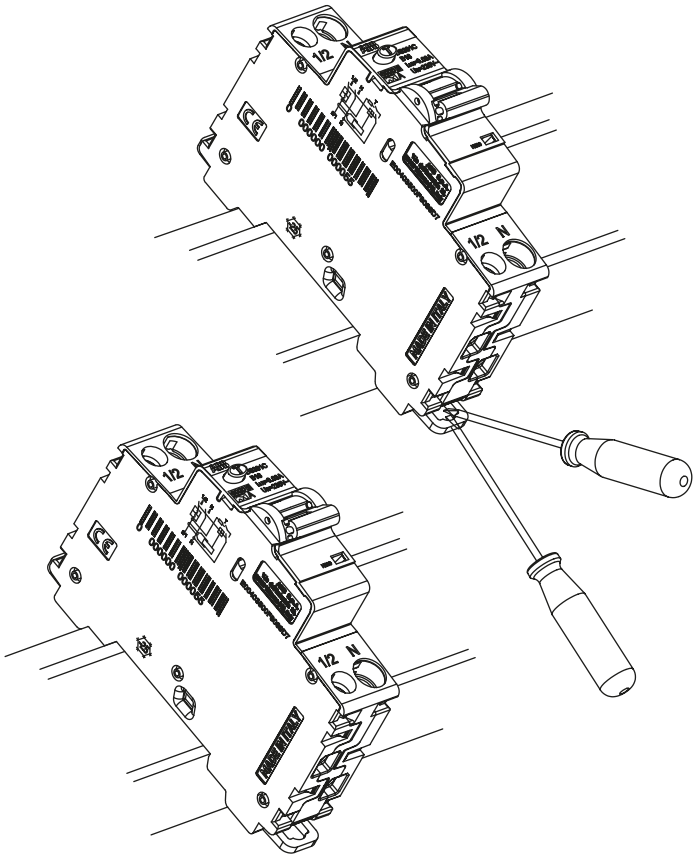
## What are the reference standards?

For residential and industrial applications, the RCBOs comply with the EN/IEC standard 61009-1. We also declare performance characteristics in line with other standards, for example the Icu stated in 60947-2 for industrial applications.

## Where do you install the DS301C?

You mount it to the DIN rail in electrical cabinets upstream of the circuits to be protected by it.

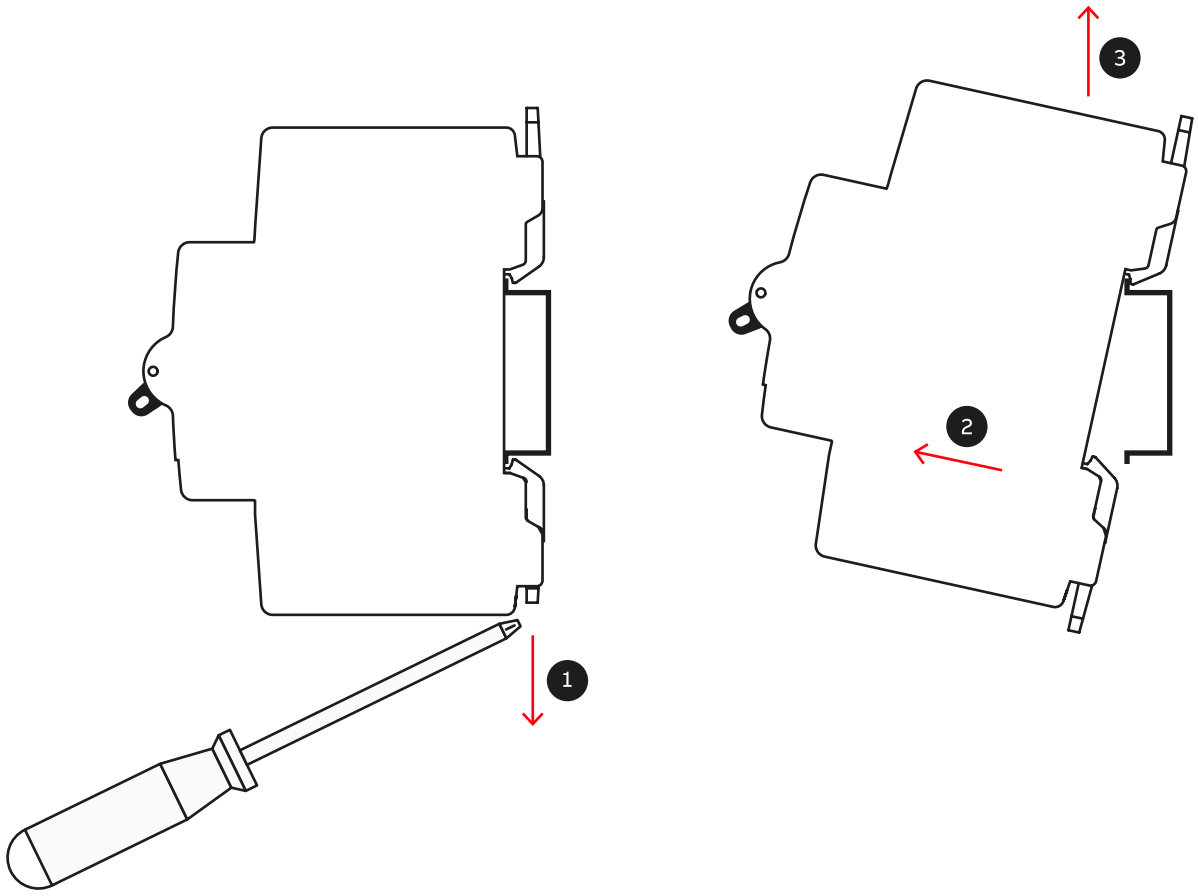
## How do you install the DS301C on the rail?



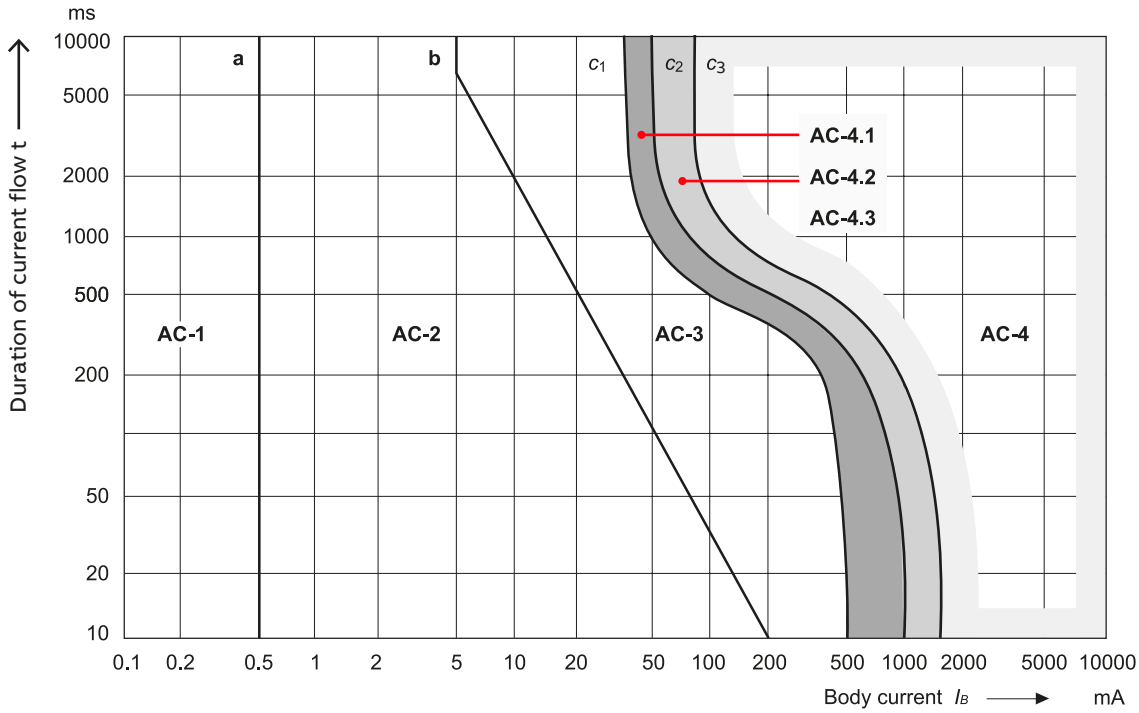
Using a screwdriver, pull down the DIN rail clip at the bottom, tilt the device, and place the rear upper recess on the top part of the rail, move the bottom part of the DS301C towards the rail, remove the screwdriver from the clip – the device is now installed.

## Is it possible to detach the DS301C from the rail without having to remove the busbar?

Yes,  start by unscrewing the screws, then use a flat-head screwdriver to access the DIN rail clip at the bottom of the DS301C and pull it down. Once you have unclipped the DS301C, you can remove it by pulling it up.



## Why is the DS301C designed for 30 mA?




- AC-1: up to 0.5 mA curve A – the current can be felt.
- AC-2: from 0.5 mA up to curve B – the current can be clearly felt and involuntary muscle contractions occur, but these are not harmful.
- AC-3: curve B and above – strong involuntary muscle contractions, difficulty breathing, cardiac arrhythmia, but no damage to vital organs.
- AC-4: up to curve C1 – cardiac arrest, respiratory arrest, damage to cells.
- AC-4: C1-C2 – probability that ventricular fibrillation will increase by +5%.
- AC-4: C2-C3 – probability that ventricular fibrillation will increase by up to 50%.
- AC-4: above C3 – probability that ventricular fibrillation will increase by more than 50%.

The most dangerous zone is AC-4, where physical damage occurs. When a current greater than 30 mA passes through a part of someone's body, that person is in serious danger unless the current is interrupted extremely quickly.

IEC 60364-4-41 recommends setting the sensibility threshold at 30 mA for AC/DC current.

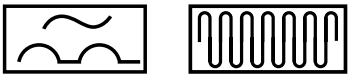
## How do you select the right tripping curve based on the application?

| Standard | Curve | Thermal disconnection (overload) | | | | Electromagnetic disconnection (short circuit) | | | | Type of application |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-tripping current | Disconnection time | Disconnection current | Disconnection time | Retained current | Disconnection time | Disconnection current | Disconnection time | |
| IEC/EN 60898-1 | B | 1.13 In | > 1 h | 1.45 In | < 1 h | 3 In | > 0.1 s | 5 In | < 0.1 s | Protection of long cables, lighting circuit |
| | C | 1.13 In | > 1 h | 1.45 In | < 1 h | 5 In | > 0.1 s | 10 In | < 0.1 s | Protection of cables powering various devices |

## What types of applications is the DS301C intended for?

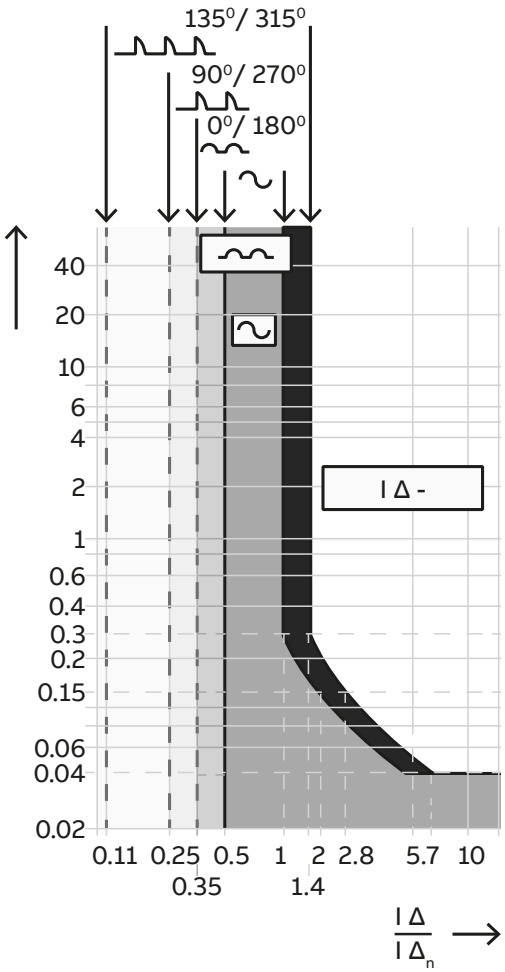
The AC type offers residual current protection for conventional 50Hz electrical circuits (plug sockets, lighting, radiators, etc.); the tripping range lies between 0.5 and 1 IΔn.

Type A covers the scope of the AC type and adds protection for circuits that use DC current (cooking hobs, washing machines, etc.); the tripping range lies between 0.35 and 1.4 IΔn.

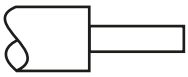


Type F is designed to detect high frequency leakage currents, providing protection for circuits that require high sensitivity to ground fault currents. Its tripping range is between 0.5 and 1 IΔn.

Type G is designed to detect low-frequency leakage currents, providing protection for sensitive circuits that require even higher sensitivity compared to type F. Its tripping range is between 0.03 and 0.3 IΔn.



## What cross-sections does the DS301C permit?



1.5 to 16 mm²

The minimum cross-section is 1.5 mm² and the maximum is 16 mm².

## What kind of screwdriver should be used to tighten the screw terminals?

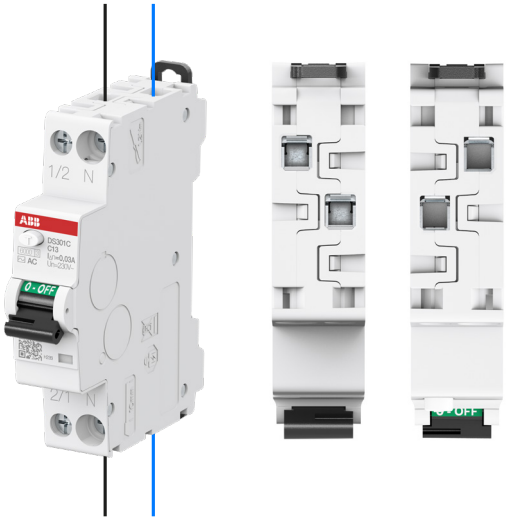
We recommend using a PZ2 (Pozidriv) screwdriver.

## Do the screw terminals of the DS301C feature “fail-safe” technology?

Yes, as with the rest of the range, we integrate this technology, which ensures that the wire can only be inserted in the clamp part of the terminal to prevent installation errors.

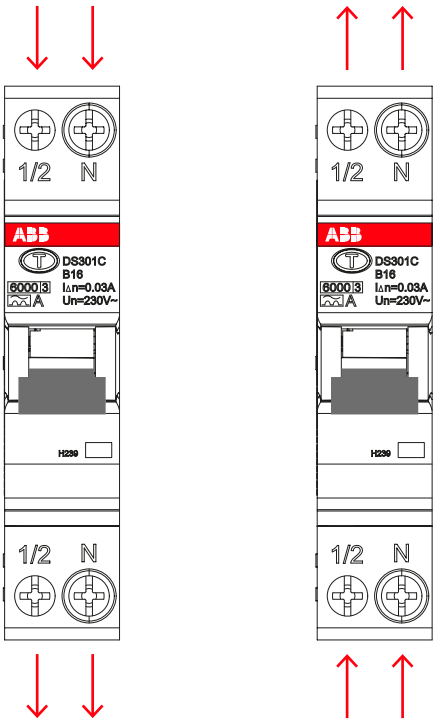
## How do you connect the DS301C?

Once the DS301C has been attached to the rail, insert the phase wire in the screw terminal block, tighten the screw using the PZ2 screwdriver, insert the neutral wire in the screw terminal block, tighten the screw using the same screwdriver, and repeat this step for the load.




## Is the DS301C bidirectional?

Yes, you can also connect the load to the top or bottom terminals.



## How do variations in temperature affect the performance characteristics of the DS301C?

The rated value of the current of a RCBO with B and C characteristic refers to a reference ambient temperature of 30 °C.

The following table contains the derating of the load capability at ambient temperatures from −40 to 70 °C for the characteristics B and C.

| In [A] | Temperature (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | −25 | −20 | −10 | 0 | 10 | 20 | 30 | 40 | 50 | 55 | 60 | 70 |
| 6 A | 8.3 | 7.8 | 7.3 | 7.0 | 6.7 | 6.3 | 6.0 | 6.0 | 5.9 | 5.8 | 5.7 | 5.7 |
| 10 A | 13.8 | 13.5 | 12.7 | 12.1 | 11.0 | 10.4 | 10.0 | 9.5 | 9.2 | 9.0 | 8.9 | 8.8 |
| 13 A | 17.8 | 17.1 | 16.5 | 15.8 | 14.8 | 13.9 | 13.0 | 12.4 | 12.2 | 12.0 | 11.9 | 11.8 |
| 16 A | 20.6 | 19.9 | 19.0 | 18.4 | 17.7 | 16.6 | 16.0 | 15.4 | 15.0 | 14.8 | 14.6 | 14.5 |
| 20 A | 25.8 | 24.8 | 23.5 | 22.9 | 21.9 | 20.8 | 20.0 | 19.4 | 18.7 | 18.2 | 18.0 | 17.9 |

## How do adjacent devices influence ?

If several RCBO are installed directly side by side with high load on all poles, a correction factor has to be applied to the rated current (see table).
If distance pieces are used, the factor is not to be considered.

| Number of devices | 1 | 3 | 5 | 7 | 9 |
|---|---|---|---|---|---|
| Correction factor | 1 | 0.9 | 0.85 | 0.81 | 0.79 |

**Example**
DS301C C16 A30 at T = 40 °C

| Type of use | Values to use | Calculation | Result |
|---|---|---|---|
| Load at ambient temperature | In (40 °C) | | In = 15.4 A |
| Load at ambient temperature with 8 adj. devices | In (40 °C), Factor F | 15.4 A × 0.8 | In = 12.24 A |

## How does the altitude affect the use of the DS301C?

Performance is regarded as stable up to an altitude of 2.000 m (as per IEC/EN 60947-2). At altitudes higher than this, the atmospheric properties change in terms of their composition, electricity, cooling power and pressure, which affects the mechanical components inside the DS301C. The recommendations in the following table must be applied in order to compensate for these changes and ensure the proper functioning of the DS301C.

| Altitude | Nominal current | Nominal voltage | Breaking capacity |
|---|---|---|---|
| 3.000 m | 0.96×In | 0.877×Un | The RCBO must be oversized to ensure the same scope of performance. For example, if a 6 kA RCBO is required, a 10 kA model would need to be selected. |
| 4.000 m | 0.94×In | 0.775×Un | |
| 5.000 m | 0.92×In | 0.676×Un | |
| 6.000 m | 0.90×In | 0.588×Un | |

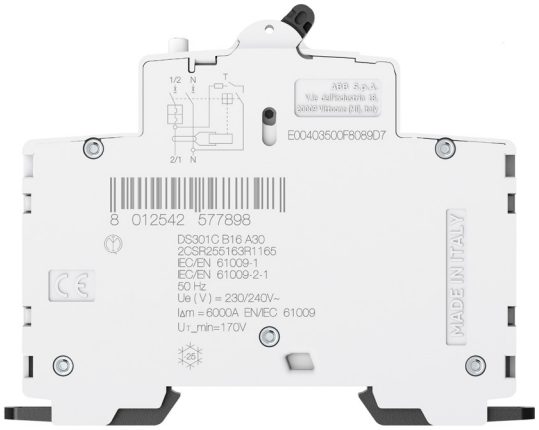
## What does the labelling on the front of the DS301C mean?

| | |
|---|---|
| **1/2** | phase wire inlet |
| **2/1** | phase wire outlet (towards the load) |
| **N** | neutral wire inlet/outlet |
| **DS301C** | name of the range |
| **B16** | curve and nominal current (curve B, In 16 A) |
| **IΔn = 0.03A** | detection sensitivity in the event of a leak (30 mA) |
| **Un = 230V** | nominal voltage of 230 V |
| **6000** | breaking capacity, 6 kA |

| | |
|---|---|
| **3** | energy limiting class as per standard EN 61009-1 |
| **A** | type of residual current protection |
| **0 - OFF** | indicates that the circuit is disconnected |
| **QR code** | direct link to the product page on new.abb.com |
| **O235I** | manufacturing code specifying the year, day of the year and country of manufacture |


## What does the labelling on the left-hand side of the DS301C mean?

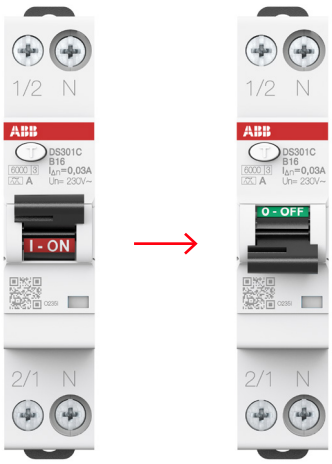
| | |
|---|---|
| **Diagram** | indicates the inner workings of the test button |
| **E00403500F8089D7** | serial number for product traceability |
| **Barcode** | can be scanned using a barcode reader to identify the product |
| **8012542577898** | EAN code for generating the barcode, specifies the company and country of the product |
| **Markings** | indicate the standards according to which the DS301C is approved |
| **DS301C B16 A30** | product description |
| **2CSR255163R1165** | international code of the product |
| **IEC/EN 61009-1** | reference standard of the product |
| **IEC/EN 61009-2** | reference standard of the product |
| **50 Hz** | frequency at which the product is to be installed |
| **Ue ( V ) = 230/240 V~** | nominal voltage at which the product is to be installed |



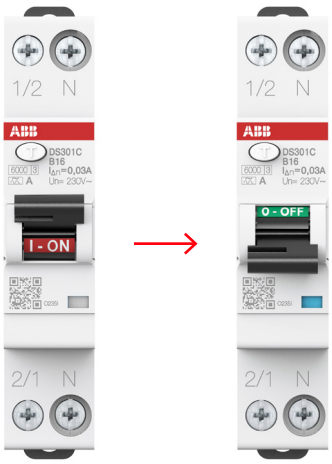

| | |
|---|---|
| **Idm = 6.000 A EN/ IEC 61009** | breaking capacity as per the reference standard |
| **Ut min = 170 V** | minimum voltage required for the test circuit to work |
| **–25** | lowest possible operating temperature down to –25 °C |

## How do you identify the different fault types?

If a short circuit or overload fault has occurred, the toggle switch will be in the bottom position and show “0 - OFF” and the indicator to the right of the QR code will be grey.



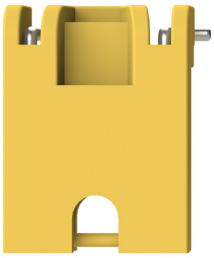

If a residual current fault has occurred, the toggle switch will be in the bottom position and the indicator to the right of the QR code will be blue.




## Is it possible to add DIN rail accessories from the ABB Pro M compact range?

This is not currently possible, but an interface accessory will be offered at a later date to make the DS301C compatible with the accessories from the Pro M compact range.

## Can the DS301C be sealed off?



Yes, the DS301C can be locked using the ABB accessory SA1.

# What busbars are recommended for the DS301C?

Besides the standard BS9 busbars portfolio we have in our offer and which is suitable for both top and bottom connection of slim devices, a new compact range of busbars called PSc busbar has been specifically designed for quick and easy bottom wiring of DS301C RCBOs in all applications.

**Main features of PSc busbars range**

- Busbar height 13.7 mm
- 1- and 3-phases types
- 12 modules and 1 meter long versions
- Suitable for bottom connection of DS301C devices with 1P+N in one module
- Rated current up to 63 A
- PSc-END end caps and BSKc tooth covers are available as accessories

| PSc Busbars | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No.of Modules | Phases | mm² | EAN | Type code | Order code | Space for auxiliary | Weight 1 piece | Pack unit |
| 12 | 1 | 10 | 4053546050516 | PSc 1/24/10 N | 2CDL210331R1012 | | 0.103 | 10 |
| 18 | 1 | 10 | 4053546163636 | PSc 1/36/10 N | 2CDL230331R1018 | | 0.166 | 10 |
| 56 | 1 | 10 | 4053546050530 | PSc 1/114/10 N | 2CDL210331R1060 | | 0.511 | 10 |
| 10 | 3 | 10 | 4053546163513 | PSc 3/20/10 N | 2CDL230331R1010 | | 0.115 | 10 |
| 12 | 3 | 10 | 4053546050554 | PSc 3/24/10 N | 2CDL230331R1012 | | 0.145 | 10 |
| 56 | 3 | 10 | 4053546050561 | PSc 3/114/10 N | 2CDL230331R1060 | | 0.725 | 10 |
| 8 | 1 | 10 | 4053546055221 | PSc 1/16/10 NH | 2CDL210332R1012 | ■ | 0.094 | 10 |
| 39 | 1 | 10 | 4053546055252 | PSc 1/78/10 NH | 2CDL210332R1060 | ■ | 0.464 | 10 |
| 8 | 3 | 10 | 4053546055276 | PSc 3/16/10 NH | 2CDL230332R1012 | ■ | 0.12 | 10 |
| 39 | 3 | 10 | 4053546055290 | PSc 3/78/10 NH | 2CDL230332R1060 | ■ | 0.65 | 10 |

## Accessories

| End Caps | | | | |
|---|---|---|---|---|
| EAN | Type code | Order code | Weight 1 piece | Pack unit |
| 4053546051131 | PSc-END | 2CDL200331R0003 | 0.015 | 10 |

| Shock protection Caps | | | | |
|---|---|---|---|---|
| EAN | Type code | Order code | Weight 1 piece | Pack unit |
| 4053546051124 | BSKc | 2CDL200331R0013 | 0.001 | 10 |

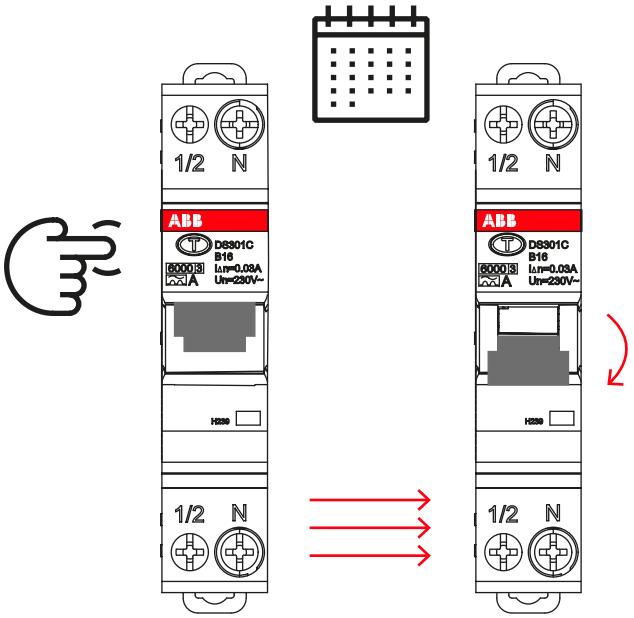
| Feeder terminal IP 20 | | | | |
|---|---|---|---|---|
| EAN | Type code | Order code | Weight 1 piece | Pack unit |
| 4053546143133 | AST 25/25 QIR | 2CDL200003R2525 | 0.014 | 10 |

## Does the DS301C need to be tested?

In compliance with IEC regulations, an RCBO must be equipped with a test button, which must be actuated on a regular basis. Unless specific local regulations state otherwise, IEC 62350 recommends a test every six months.
We advise scheduling such tests for 30 June and 31 December.

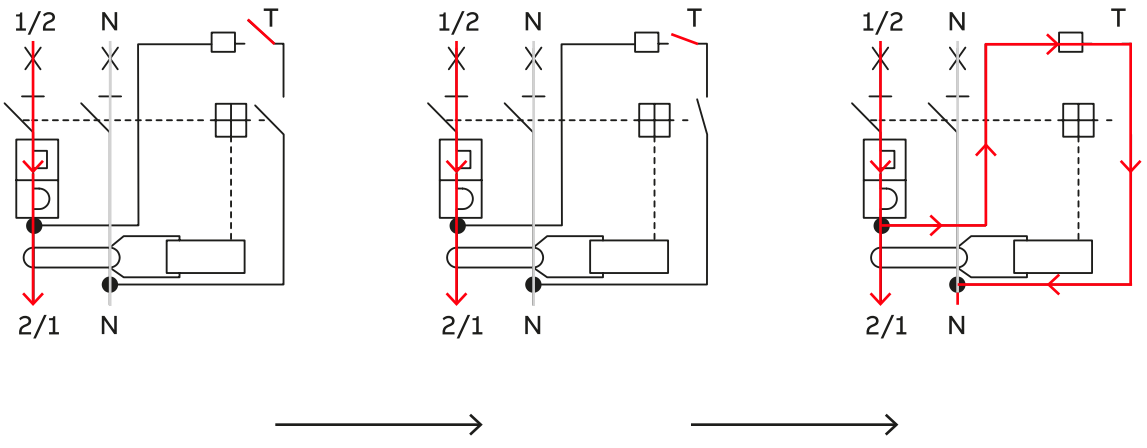
## How do you carry out the test?

As outlined in the instructions printed inside the packaging, all you need to do is press the button with your finger and check that the toggle switch lowers properly, thereby cutting off the supply to the protected circuit.
If the toggle switch does not lower when you press the button, replacement is necessary.



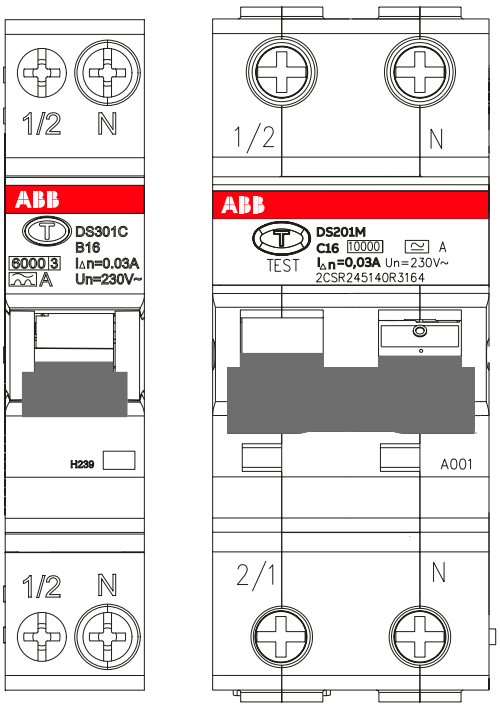

## What happens during the test?

When the “test” button is pressed, a new path is created for the current to reach the neutral, thereby leading to an imbalance in the relay and causing the circuit to open.



## How wide is the DS301C compared to the DS201?

The DS301C has a width of 17.6 mm and the DS201 has a width of 35 mm.




## What versions are covered by the DS301C compared to the DS201?

| Icn | 4.5 | 6 | 10 |
|---|---|---|---|
| DS201 | • | • | • |
| DS301C | | • | |

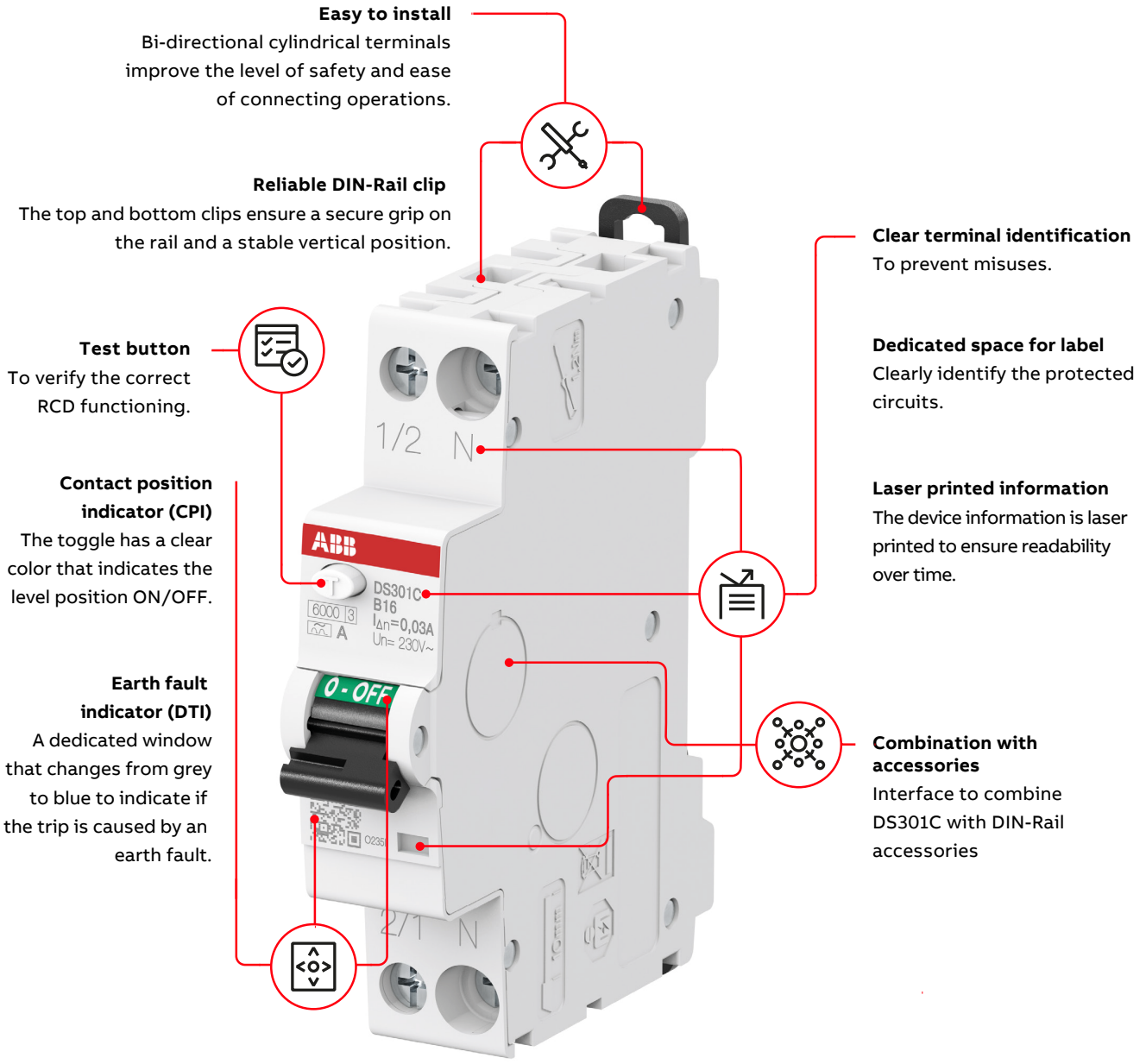
| Sensitivity | B | C | K |
|---|---|---|---|
| DS201 | • | • | • |
| DS301C | • | • | |

| Type | AC | A | A-S | APR | F | G | B | B+ |
|---|---|---|---|---|---|---|---|---|
| DS201 | • | • | | • | • | • | | |
| DS301C | • | • | | | • | • | | |

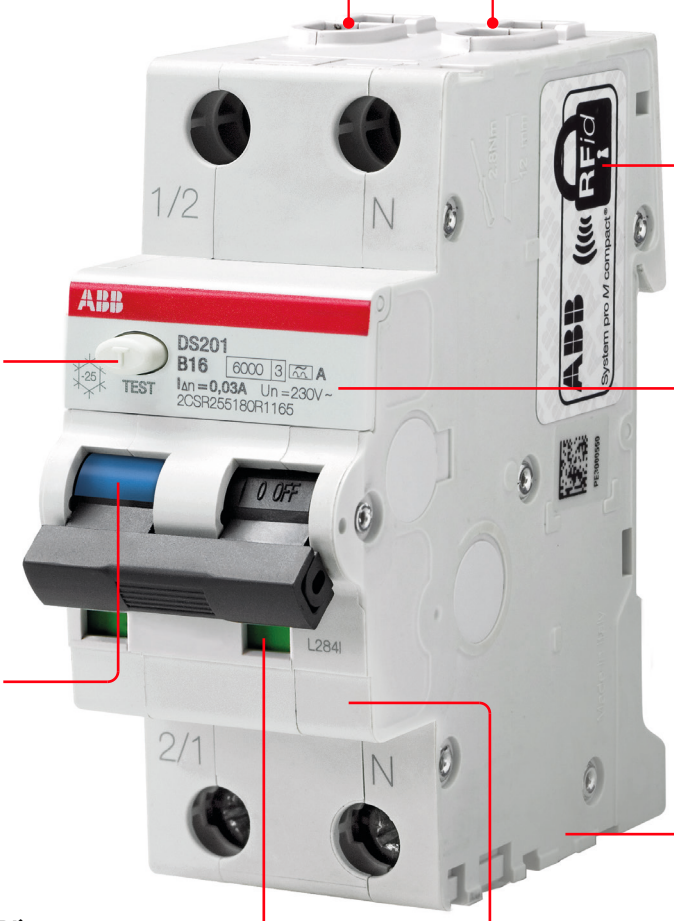
| Rating | 1 | 2 | 4 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS201 | • | • | • | • | • | • | • | • | • | • | • | • |
| DS301C | | | | • | | • | • | • | • | | | |

| Sensitivity | 10 | 30 | 100 | 300 |
|---|---|---|---|---|
| DS201 | • | • | • | • |
| DS301C | | • | | |

## What are the visual differences between the DS301C and the DS201?




- The CPI is no longer a separate indicator but is marked on the toggle switch.
- The DTI is no longer an indicator on the toggle switch but rather a separate window to the right of the QR code.
- The external appearance is similar to ABB SN201 MCBs.
- The toggle switch is the same as the one used on ABB S200 MCBs.
- There is only one screw terminal block (in contrast to two in the case of the DS201) for housing the wires and busbars.




**Easy to install**
Bi-directional cylindrical terminal ensures improved safety of connecting operations, making them easier.

**Anti counterfeiting**
DS201 is equipped with a tag RFid in order to authenticate the product.

**Test pushbutton**
Test pushbutton to verify the correct functioning of the device.

**Laser printed information**
Information on the device are laser printed to ensure readability over time.

**Earth fault indicator**
Blue flag on the toggle to identify earth fault trips. I 0N – 0 0FF indication molded on the toggle.

**Contact position indicator (CPI)**
To indicate the status of the contacts independently from the toggle position: green (open), red (closed).

**Combination with accessories**
Improved combination with System pro M compact® accessories, including also the auxiliary contact for bottom fitting and motor operating device.

**Dedicated space for label**
Dedicated space to insert labels in order to clearly identify the protected lines.

## What does the QR code printed on the front mean?

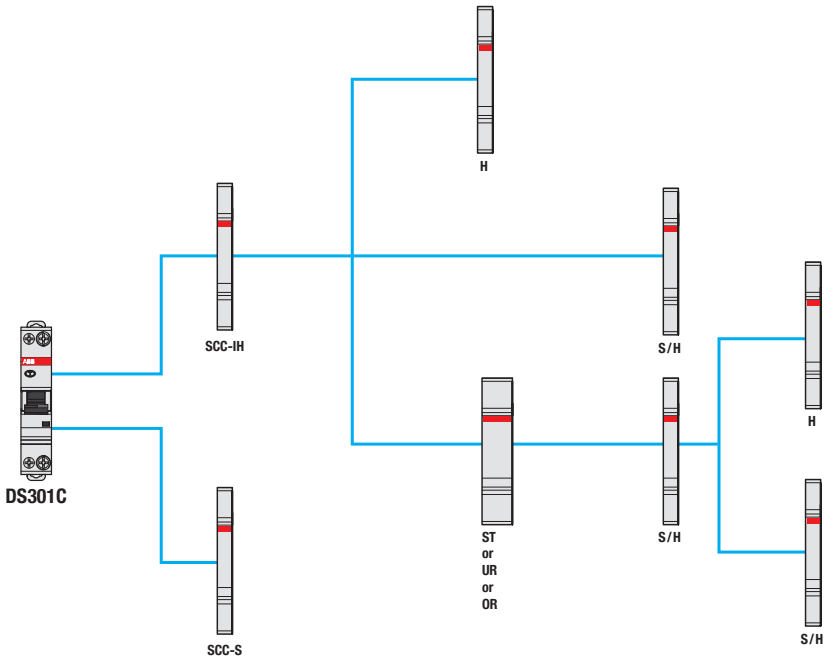
If you scan this QR code with your smartphone, you will be taken to the product page where you will find all the information available online (performance characteristics, manuals, certificates, etc.).


## What accessories are compatible with the DS201 but not with the DS301C?

| | | | DS201 | DS301C |
|---|---|---|---|---|
| H | Auxiliary contact | S2CH6R | • | • |
| H-R | Auxiliary contact | S2C-H6-xxR | • | |
| New | Auxiliary contact (interface) | | | |
| S/H | Signal / auxiliary contact | S2C-S/H6R | • | • |
| S/H (H) | Signal / auxiliary contact | S2C-S/H6R | • | |
| New | Signal / auxiliary contact (interface) | | | |
| ST | Shun trip | S3C-A | • | • |
| UR | Undervoltage release | S2C-UA | • | • |
| OR | Overvoltage release | S2C-OVP | • | • |
| H-BF | Auxiliary contact for bottom fitting | S2C-H01 / S2C-H10 | • | |
| MOD-S | Motor operating device | S3C-MOD | • | |

# DS301C
## Accessories

### Combination of auxiliary elements with DS301C




| | | |
|---|---|---|
| **SCC-IH** | **Auxiliary slim range adapter** | **SCC-IH6R** |
| **SCC-S** | **Signal slim range adapter** | **SCC-S6R** |
| **H** | **Auxiliary contact** | **S2C-H6R** |
| **S/H** | **Signal/auxiliary contact** | **S2C-S/H6R** |
| **ST** | **Shunt trip** | **S3C-A** |
| **UR** | **Undervoltage release** | **S2C-UA** |
| **OR** | **Overvoltage release** | **S2C-OVP** |

## What is dissipated power and why is it important?

A current that flows through a circuit breaker circulates in the metallic conducting components, which become warm and generate heat. This is referred to as dissipated power and is expressed in watts (W). The greater the nominal current, the more heat will be emitted by the devices . An electrical cabinet permits a maximum level of dissipated power; it thus must be ensured that the combined power dissipation of the individual devices making up the cabinet does not exceed this limit. Otherwise, a means of diffusing the heat or cooling systems must be integrated or a bigger electrical cabinet may even need to be selected.

## What does the DS301C offers in term of power dissipation performance?

The significant improvement in power dissipation of the DS301C (1.5 W vs 3.3 W with the DS201), with a lower amount of emitted heat combined with its compact size, makes it possible to choose smaller electrical cabinets.

| Characteristic | In [A] | Voltage drop [V] | Powerloss [W] | | | | Int. res. [mΩ] |
|---|---|---|---|---|---|---|---|
| | | | Average per pole | Phase pole | Neutral pole | Total | |
| B | 6 | 0,4 | 1,10 | 2,1 | 0,1 | 2,2 | 61,0 |
| | 10 | 0,3 | 1,30 | 2,35 | 0,25 | 2,6 | 26,0 |
| | 13 | 0,2 | 1,24 | 2,12 | 0,35 | 2,47 | 14,6 |
| | 16 | 0,0 | 1,42 | 2,11 | 0,72 | 2,83 | 11,1 |
| | 20 | 0,2 | 1,83 | 2,88 | 0,78 | 3,66 | 9,2 |
| C | 6 | 0,3 | 0,78 | 1,47 | 0,09 | 1,56 | 43,3 |
| | 10 | 0,2 | 0,75 | 1,25 | 0,25 | 1,5 | 15,0 |
| | 13 | 0,2 | 1,13 | 1,95 | 0,3 | 2,25 | 13,3 |
| | 16 | 0,2 | 1,24 | 1,84 | 0,64 | 2,48 | 9,7 |
| | 20 | 0,2 | 1,70 | 2,6 | 0,8 | 3,4 | 8,5 |

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