



**SENTRON**

# Residual current protective devices, type F

Reliable touch protection for electrical loads with frequency converters

## All-round protection

Residual current operated circuit breakers type F have been specially developed to offer protection against electric shock when using electrical loads with frequency converters in single-phase AC networks. Instead of DC residual currents, this type of electrical equipment generates residual currents with mixed frequencies. The tripping characteristic of RCCBs type F lies between type A and type B, which ensures reliable coverage of the type of fault current forms that can arise when using single-phase loads with frequency converters.

## High operational reliability

RCCBs type F are characterized by a short-time delayed residual current tripping, which means they are far less prone to false tripping in the event of leakage current spikes. They also offer an increased current withstand capability of at least 3 kA and can handle loads of smooth DC residual currents up to 10 mA. The broad range of residual current protective devices type F includes RCCBs, RC units and RCBOs

## Highlights

- Maximum protection thanks to reliable detection of mixed frequencies
- Fewer false trippings thanks to short-time delay
- Increased current withstand capability of 3 kA
- Higher load rating with smooth DC residual currents up to 10 mA

Answers for infrastructure.

# Residual Current Protective Devices

## Residual current protective devices, type F

### Application

Residual current protective devices type F not only offer the full range of protection and function features provided by type A, they are also ideal for the detection of residual currents with mixed frequencies, as found on the outgoing terminal of frequency converters. This ensures coverage of the type of fault current forms that can arise when using single-phase loads with frequency converters.

They also offer the following characteristics:

- Short-time delay in order to prevent unwanted trippings caused by transient leakage currents up to 10 ms.

- Increased current withstand capability of > 3 kA (8/20  $\mu$ s).
- The tripping characteristics are not influenced by DC residual currents up to 10 mA.

They are suitable for electronic loads with frequency converters, such as those found in washing machines and heating pumps.

The following table offers an overview of which type of residual current protective device is suitable for which electronic switching operation (in equipment). RCCBs type F are suitable for circuits 1 to 7.

| Suitable RCCB type |   | Circuits | Load current | Residual current |
|--------------------|---|----------|--------------|------------------|
| B                  | F | 1        |              |                  |
| F                  | F | 2        |              |                  |
| F                  | F | 3        |              |                  |
| F                  | F | 4        |              |                  |
| F                  | F | 5        |              |                  |
| F                  | F | 6        |              |                  |
| F                  | F | 7        |              |                  |
| F                  | F | 8        |              |                  |
| F                  | F | 9        |              |                  |
| F                  | F | 10       |              |                  |
| F                  | F | 11       |              |                  |
| F                  | F | 12       |              |                  |
| F                  | F | 13       |              |                  |

Table: Possible fault current forms and suitable residual current devices

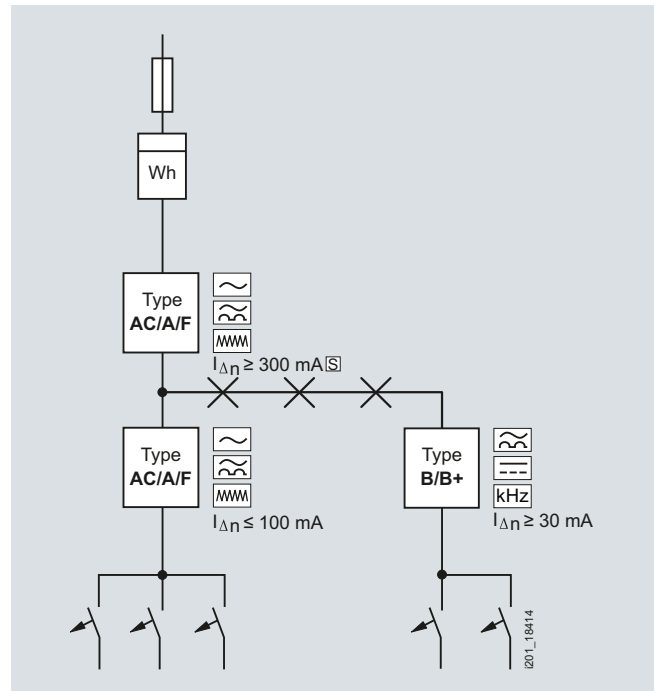
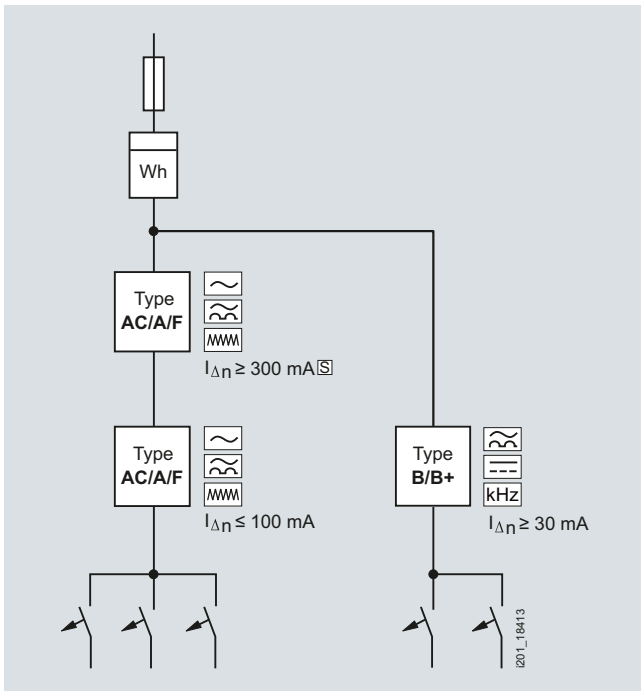
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### Configuration

When using residual current protective devices type F, please note the following:

- They are not suitable for equipment that can generate smooth DC residual currents (see Table, page 2, circuits 8 to 13).
- They are not suitable for installation in networks with frequencies that deviate from the rated frequency (50 Hz) (not at the outgoing terminal of a frequency converter).

- When configuring and setting up electrical plants with type F, the same applies as for residual current protective devices type A, i.e. electrical loads that can generate smooth DC residual currents in the event of a fault are assigned their own circuit with a universal current-sensitive residual current protective device (type B or type B+).




It is not permitted to branch off electrical circuits with these types of electrical loads downstream of pulse-current-sensitive residual current protective devices (type A or type F).

# Residual Current Protective Devices

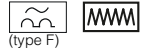
## Residual current protective devices, type F

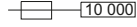
### Technical data

|  |  | 5SM3 ... -3<br>RCCBs  | 5SM2 ... -3<br>RC units | 5SU1 354-3KK.. /<br>5SU1 354-4KK..<br>RCBOs |
|--|--|---|-------------------------|---|
| <b>Standards Approvals</b>   |  | IEC/EN 62423 (VDE 0664-40)<br>DIN EN 62423 (VDE 0664-40)  |                         |   |
| <b>Versions</b>  |  | 1P + N; 3P + N  | 2P                      | 1P + N                                      |
| <b>Surge current withstand capability</b><br>with current waveform 8/20 µs | kA   | > 3   | > 3                     | > 3   |
| <b>Minimum operational voltage for test function operation</b>             | V AC   | 100   | 195                     | 100   |
| <b>Terminal/conductor cross-sections</b>                                   |  |   |                         |   |
| • for 2 MW   | at $I_n = 25\text{ A}, 40\text{ A}$              | mm <sup>2</sup> 1.0 ... 16  |                         | 0.75 ... 35                                 |
| • for 2.5 MW   | at $I_n = 63\text{ A}$                           | mm <sup>2</sup> 1.5 ... 25  | 1.5...25                |   |
| • for 4 MW   | at $I_n = 25\text{ A}, 40\text{ A}, 63\text{ A}$ | mm <sup>2</sup> 1.5 ... 25  |                         |   |
| <b>Terminal tightening torques</b>   | Nm   | 2.5 ... 3.0   |                         |   |
| <b>Mains connection</b>  |  | Top or bottom   |                         |   |
| <b>Mounting position</b>   |  | Any   |                         |   |
| <b>Degree of protection</b>  | acc. to EN 60529<br>(VDE 0470-1)                 | IP20, with connected conductors   |                         |   |
| <b>Touch protection</b>  | acc. to EN 50274<br>(VDE 0660-514)               | Finger and back-of-hand safe  |                         |   |
| <b>Service life</b>  | Test cycle acc. to IEC/EN 62423                  | > 10000 operating cycles  |                         |   |
| <b>Storage temperature</b>   | °C   | -40 ... +75   |                         |   |
| <b>Ambient temperature</b>   | °C   | -25 ... +45,<br>Marked with  |                         |   |
| <b>Resistance to climate</b>   | acc. to IEC 60068-2-30                           | 28 cycles (55 °C; 95 % rel. air humidity)   |                         |   |
| <b>Overvoltage category</b>  |  | III   |                         |   |
| <b>Degree of pollution</b>   |  | 2   |                         |   |
| <b>CFC and silicone-free</b>   |  | Yes   |                         |   |

## Residual current protective devices, type F

## Selection and ordering data



| Rated residual current | Rated current | Max. permissible short-circuit series fuse  | Mounting width | DT | Order No. | Price per PU | PU (UNIT, SET, M) | PS*/P. unit | PG | Weight per PU approx. |
|------------------------|---------------|---|----------------|----|-----------|--------------|-------------------|-------------|----|-----------------------|
| $I_{\Delta n}$<br>mA   | $I_n$<br>A    |  10 000<br>A | MW             |    |           |              |                   |             |    | kg                    |

**RCCBs, type F**

1P + N; 230 V AC, 50...60 Hz

|    |    |     |     |  |                   |  |   |        |  |       |
|----|----|-----|-----|--|-------------------|--|---|--------|--|-------|
| 30 | 25 | 63  | 2   |  | <b>5SM3 312-3</b> |  | 1 | 1 unit |  | 0.250 |
|    | 40 |     |     |  | <b>5SM3 314-3</b> |  | 1 | 1 unit |  | 0.247 |
|    | 63 | 100 | 2.5 |  | <b>5SM3 316-3</b> |  | 1 | 1 unit |  | 0.329 |

3P + N; 400 V AC, 50 ...60 Hz

|    |    |     |   |  |                   |  |   |        |  |       |
|----|----|-----|---|--|-------------------|--|---|--------|--|-------|
| 30 | 25 | 100 | 4 |  | <b>5SM3 342-3</b> |  | 1 | 1 unit |  | 0.515 |
|    | 40 |     |   |  | <b>5SM3 344-3</b> |  | 1 | 1 unit |  | 0.520 |
|    | 63 |     |   |  | <b>5SM3 346-3</b> |  | 1 | 1 unit |  | 0.519 |

**RC units, type F**

For 5SY miniature circuit breakers; not suitable for use with 5SY5, 5SY8 and 5SY6 0..., 2P, 230 ... 400 V AC, 50 ... 60 Hz



|    |            |  |   |  |                   |  |   |        |  |       |
|----|------------|--|---|--|-------------------|--|---|--------|--|-------|
| 30 | 0.3 ... 40 |  | 2 |  | <b>5SM2 322-3</b> |  | 1 | 1 unit |  | 0.215 |
|    | 0.3 ... 63 |  | 2 |  | <b>5SM2 325-3</b> |  | 1 | 1 unit |  | 0.214 |

| Rated residual current | Rated current | Mounting width | DT | Tripping characteristic B |              |       | Tripping characteristic C |              |       | PU (UNIT, SET, M) | PS*/P. unit | PG | Weight per PU approx. |
|------------------------|---------------|----------------|----|---------------------------|--------------|-------|---------------------------|--------------|-------|-------------------|-------------|----|-----------------------|
|                        |               |                |    | Order No.                 | Price per PU | PG DT | Order No.                 | Price per PU | PG DT |                   |             |    |                       |
| $I_{\Delta n}$<br>mA   | $I_n$<br>A    | MW             |    |                           |              |       |                           |              |       |                   |             |    | kg                    |

**RCBO, type F**

1P+N, 230 V AC, 50 ... 60 Hz



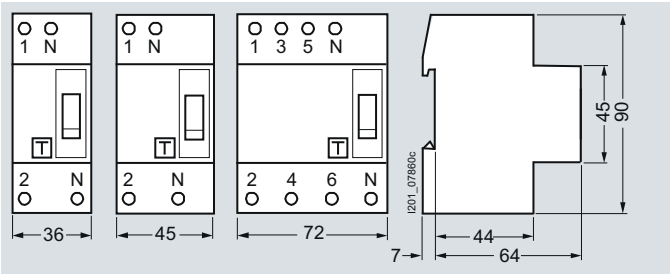
|    |    |   |  |                       |  |  |                       |  |   |        |  |       |
|----|----|---|--|-----------------------|--|--|-----------------------|--|---|--------|--|-------|
| 30 | 6  | 2 |  | <b>5SU1 354-3KK06</b> |  |  | <b>5SU1 354-4KK06</b> |  | 1 | 1 unit |  | 0.290 |
|    | 10 |   |  | <b>5SU1 354-3KK10</b> |  |  | <b>5SU1 354-4KK10</b> |  | 1 | 1 unit |  | 0.293 |
|    | 13 |   |  | <b>5SU1 354-3KK13</b> |  |  | <b>5SU1 354-4KK13</b> |  | 1 | 1 unit |  | 0.295 |
|    | 16 |   |  | <b>5SU1 354-3KK16</b> |  |  | <b>5SU1 354-4KK16</b> |  | 1 | 1 unit |  | 0.296 |
|    | 20 |   |  | <b>5SU1 354-3KK20</b> |  |  | <b>5SU1 354-4KK20</b> |  | 1 | 1 unit |  | 0.285 |
|    | 25 |   |  | <b>5SU1 354-3KK25</b> |  |  | <b>5SU1 354-4KK25</b> |  | 1 | 1 unit |  | 0.295 |
|    | 32 |   |  | <b>5SU1 354-3KK32</b> |  |  | <b>5SU1 354-4KK32</b> |  | 1 | 1 unit |  | 0.296 |
|    | 40 |   |  | <b>5SU1 354-3KK40</b> |  |  | <b>5SU1 354-4KK40</b> |  | 1 | 1 unit |  | 0.293 |

# Residual Current Protective Devices

## Residual current protective devices, type F

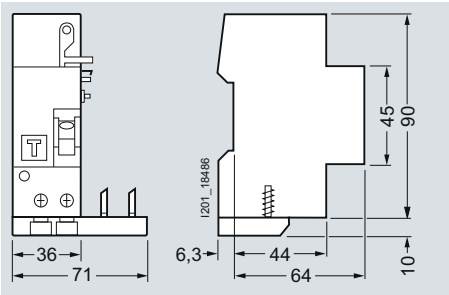
### Dimension drawings

#### RCCBs, type F



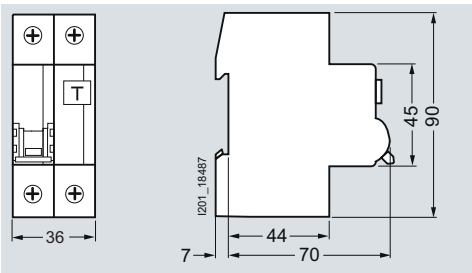
1P+N 1P+N 3P+N  
25/40 A 63 A 25 ... 63 A

#### RC units, type F



2P

#### RCBO, type F

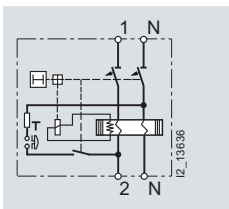


1P+N

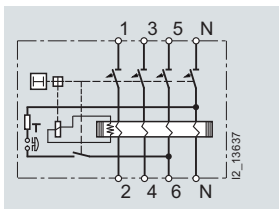
## Residual current protective devices, type F

### Circuit diagrams

#### RCCBs, type F

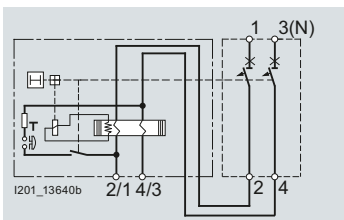


1P+N



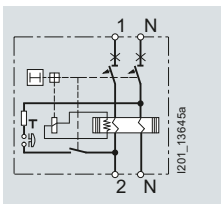
3P+N

#### RC units, type F



2P

#### RCBO, type F



1P+N

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Subject to change without notice  
PDF only: (E86060-K8210-E350-A1-7600)  
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