

Residual Current Devices (RCDs)

Standards and approvals

All Sentry RCDs are designed to fully comply with the requirements of BS EN 61008: 1995, IEC 1008:1990

They all feature positive contact status indication in accordance with the 17th Edition IEE Wiring Regulations (537.2.2.1 and 537.3.2.2).

Technical specification

Electrical

Rated making and breaking capacity / m:

16 - 40A = 500A
63 - 80A = 800A
100A = 1000A

Type AC

Rated short-circuit current / inc:

16A - 40A = 10,000A (63A Fuse)
63A - 80A = 10,000A (100A Fuse)
100A = 10,000A (125A Fuse)

Rated residual short-circuit current / Δ m:

16 - 100A = 10,000A

Rated voltages:

2 pole devices, 110V and 230V
4 pole devices, 230V to 440V

Operating voltages:

2 pole devices, 110V - 100V to 250V
230V - 100V to 250V

4 pole devices, 185V - 440V

Tripping Time:

1 x $I_{\Delta n} \leq 300$ ms
5 x $I_{\Delta n} \leq 40$ ms
Time delay version
1 x $I_{\Delta n} - 150 - 500$ ms
5 x $I_{\Delta n} - 50 - 150$ ms

Physical

Ambient operating temperature:
-25°C to +40°C

IP rating:
Front face after installation of enclosure IP40

Terminal capacity:
Solid standard - 1 x 1.5 - 50mm²
Flexible with female - 1 x 1.5 - 35mm²

Tightening torque:
3Nm

Max. installation altitude:
2000 metres



Description

The Sentry range of RCDs offers a comprehensive selection of devices designed to meet most residential, commercial and light industrial requirements.

The range includes two and four pole, a.c., d.c. fault current sensitive and time delayed models and a selection of current ratings from 16 to 100A is available in a variety of tripping sensitivities.

When in the OFF position a contact gap of 4mm is present, enabling Sentry RCDs to be used as isolating switches where appropriate.

Positive indication of the opening of the contacts is only given when contact status indicator shows green.

The operating dolly may be locked in either the ON or OFF position without affecting the ability of the trip mechanism to operate, i.e. the RCD is 'trip-free'. It is not possible to hold the contacts closed when a fault condition exists.

All Sentry RCDs incorporate a filtering device to provide protection against transient surges in the supply to the unit, thus reducing the occurrence of unwanted tripping.

Features

- Meet BS EN and IEE Wiring Regulation requirements
- Extensive range to suit all specifications
- Protect against unwanted tripping
- Positive contact status indication
- Suitable for most residential, commercial and light industrial applications
- Offer a high degree of protection against electrocution in accidental shock hazard situations
- Two module, double pole units available up to 100A
- Indication of earth fault, via central dolly position

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Rating specification

Double pole, 2 module

Rating	Tripping current	List No.
16A, 110V	10mA	6016s
16A, 110V	30mA	6416s
16A, 230V	10mA	6316s
16A, 230V	30mA	5716s
32A, 110V	30mA	6032s
32A, 230V	30mA	6730s
40A, 230V	30mA	5740s
63A, 230V	30mA	5760s
63A, 230V	100mA	6160s
63A, 230V	300mA	5860s
80A, 230V	30mA	5780s
80A, 110V	30mA	6080s
80A, 230V	300mA	5880s
80A, 230V	100mA	6180s
100A, 230V	30mA	7700s
100A, 230V	100mA	6600s
100A, 230V	300mA	7800s

Double pole, pulsating d.c., fault current sensitive, 2 module

16A, 230V	10mA	6216s
16A, 230V	30mA	6716s
32A, 230V	30mA	6630s
40A, 230V	30mA	5640s
63A, 230V	30mA	5660s

Time delayed, 2 module

80A, 230V	100mA	6980s
100A, 230V	100mA	6400s

Four pole, 4 module

25A, 230/400V	30mA	6425s
40A, 230/400V	30mA	6440s
40A, 230/400V	100mA	6240s
63A, 230/400V	30mA	6463s
63A, 230/400V	100mA	6363s
63A, 230/400V	300mA	6263s

Four pole, pulsating d.c., fault current sensitive, 4 module

40A, 230/400V	30mA	6640s
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Installation

Sentry RCDs must never be used as the sole method of basic protection, but are invaluable in providing supplementary protection in high risk environments where damage may occur.

Application

The choice of the most suitable RCD for a particular application should take into account the following considerations:

1. Sensitivity

10mA RCDs offer a high degree of protection against electrocution in an accidental shock hazard situation. They are of particular value in a high risk area where resistances external to the body are likely to restrict the earth fault current flowing through the body to less than 30mA and where 110V supply is being used.

30mA RCDs offer a high degree of protection in an accidental shock hazard situation and are by far the most popular sensitivity used in the United Kingdom. In a shock situation, the current flowing through the human body at 240V 50Hz could be between 80 and 240mA, depending on the resistance of the body in question. To ensure that there are no harmful physiological effects in such a situation, it is necessary for the RCD to operate within 300ms at 30mA and 40ms at 150mA. As the Sentry RCD typically operates well below these times, it clearly more than satisfies this requirement.

100mA RCDs may, in some circumstances, provide protection against electrocution in an accidental shock hazard situation. However, it is important to note that there is a likelihood that the earth fault current may be below the sensitivity of the RCD. This becomes increasingly likely if additional resistances to that of the human body are in the current path.

300mA RCDs provide protection against the risk of fire only. They do not provide protection against electrocution in an accidental shock hazard situation. A typical application would be lighting circuits where it is deemed that the risk of electric shock is small.

It is important to note that a current of less than 500mA flowing in a high resistance path is sufficient to bring metallic parts to incandescence and, potentially, initiate a fire.

2. Requirements of the IEE Wiring Regulations BS 7671

RCDs may be used to provide additional protection against both fault protection and basic protection.

Fault Protection

Defined as protection against electric shock under single fault conditions.

Effective earthing in conjunction with automatic disconnection should always be employed to protect against the effects of fault protection. The provision of a low resistance path back to the supply from the fault should ensure that the overcurrent device operates before damage occurs. This is the earth fault loop impedance.

In circumstances where the earth fault loop impedance in the circuit is too high to ensure operation of the overcurrent device, then the IEE Wiring Regulations allow the installation of an RCD. To comply with the Regulations, the earth loop impedance of the circuit (in ohms), multiplied by the rated tripping current of the RCD (in amperes) must not produce a value greater than 50. With this in mind, the maximum values of earth loop impedance permissible when installing an MK Sentry RCD are as follows:

$$Z_s (\text{max}) = \frac{50}{I_{\Delta n}} = \frac{50}{0.03} = 1666 \text{ ohms}$$

Rated Tripping Current of RCD	Maximum Permissible Earth Fault Loop Impedance
10mA	5000 ohms
30mA	1666 ohms
100mA	500 ohms
300mA	166 ohms

RCD's are further specified for fault protection on TT systems (Regulation 411.5.2, 411.5.3 apply)

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Application (continued)

Direct Contact

Defined as "contact of persons or livestock with live parts which may result in electric shock".

The Regulations recognise four main means of providing protection against direct contact which include enclosures and the use of extra low voltage systems.

However, the use of RCDs is specified by the Regulations in the following instances:

- A socket outlet rated at 32A or less which may reasonably be expected to supply portable equipment for use outdoors shall be protected by an RCD having the characteristics specified in Regulation 412-06-02. (Regulation 471-16-01 applies.)
- Where socket outlets are used to supply caravans on caravan sites, then they must be protected by an RCD having the characteristics specified in Regulation 412-06-02.

Regulation 412-06-02 stipulates among other things that where supplementary protection is provided by residual current devices, their rated residual operating current must not exceed 30mA and that they must trip within 40ms at 5 times rated operating current.

Although RCDs must never be used as the sole method of direct contact protection, they are invaluable in providing supplementary protection in high risk environments where damage may occur. Typical applications include situations where equipment may be used outside or fed by trailing sockets, equipment accessible to children or equipment used in wet areas. For these reasons RCDs are commonly found in schools, hospitals and residential installations.

3. Types of fault current

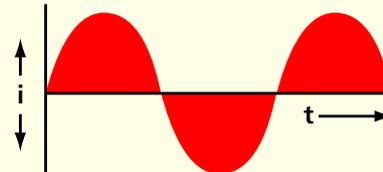
In an installation different types of fault current can occur. MK offer RCDs to suit these conditions.

Sentry Type AC RCDs are suitable for situations where there are residual sinusoidal alternating currents, whether applied suddenly or rising slowly. This is the most commonly used type of RCD in the UK.

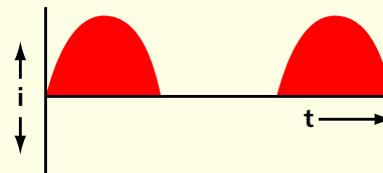
Sentry Type A RCDs (i.e. pulsating d.c. fault current sensitive) are suitable for situations where there are residual sinusoidal alternating currents, whether suddenly applied or slowly rising. These situations can occur with the use of semiconductor devices in modern electrical and electronic equipment, such as computers, printers, plotters, televisions, video cassette recorders and hi-fi equipment, is growing.

Such devices may result in the normal sinusoidal a.c. waveform generated by the mains electrical supply being 'modified'. For example, the waveform may be rectified or, as in asymmetric phase control devices, the waveform may be chopped. The resulting waveforms are said to contain a pulsating d.c. component as illustrated below.

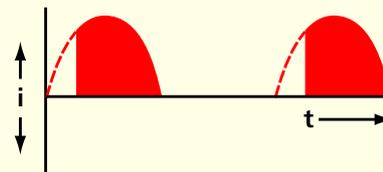
Normal a.c. waveform



Pulsating d.c. waveform
Half wave rectified



Pulsating d.c. waveform
Typical asymmetrical
phase control



Residual Current Devices (RCDs)

Application (continued)

Pulsating d.c. fault current sensitive RCDs

Should a waveform containing a pulsating d.c. component develop an earth fault, then it is possible that it may not be detected by an "a.c. only" sensitive RCD. For this reason, the Sentry range contains RCDs designed to be sensitive to pulsating d.c. fault currents thus maintaining the intended degree of protection.

Type B RCDs are suitable for situations where there are residual sinusoidal alternating currents, residual pulsating direct currents and smooth d.c. and a.c. residual current of various frequencies, which would not trip Type AC or A RCDs.

These situations can occur in 50Hz a.c. installations with electronic equipment, e.g. frequency converters, UPS installations, power supply unit or high-frequency power converters.

The following symbols are used on the front plate of the device to indicate the type of RCD.

-  – type AC RCD.
-  – type A RCD.
-  – type B RCD.

4. Temperature

All Sentry RCDs are suitable for use in the temperature range -25°C to $+40^{\circ}\text{C}$. This is indicated on the RCD by the symbol .

5. Time Delayed RCDs Type S (or selective)

When two or more Sentry RCDs are installed in series with one another, measures must be taken to ensure that they discriminate properly. In event of an earth fault, only the RCD immediately upstream from the fault should operate.

RCDs do not discriminate on rated tripping current alone, i.e. a 100mA rated RCD situated upstream from a 30mA rated RCD, will not offer inherent discrimination.

In order to ensure that discrimination is achieved, a Sentry Time Delayed RCD should be used. The in-built time delay period ensures that the downstream RCD opens the circuit before the upstream RCD starts to operate.

The maximum tripping time of a Sentry Time Delayed RCD is 500ms. Typical applications are:

- i) as main incomers on TT systems where all sockets are already protected by a 30mA instantaneous RCD, but where unwanted tripping may become a problem.
- ii) as the main in-comer of split load consumer unit arrangement where all circuits are protected by a 10 or 30mA instantaneous RCD or otherwise comply with the direct and indirect contact protection requirements of the Wiring Regulations.

The Sentry Time Delay RCDs are clearly identified with the internationally agreed representative symbol .

6. 3 phase, 3 wire systems

Sentry 4 pole RCDs may be used to provide earth fault protection on 3 phase, 3 wire systems, as the current balance mechanism does not require a neutral to be connected in order to operate effectively.

Residual Current Devices (RCDs)

Operation

The RCD provides an indication of an earth fault and contact status as detailed below.

The operating dolly provides the following indication:

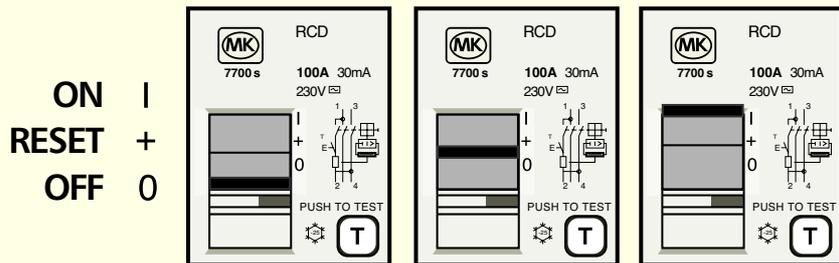
- I** = Switched ON
- +** = Switched OFF due to Earth Fault or test button operation
- 0** = Switched OFF

The contact status is shown through the window.

Red = contact closed

Green = contact open (RCD is switched off)

In the event of an Earth Fault in the installation or the operation of the test button, the dolly will move to the central position (+) and the contact status indicator shows green. To re-connect the supply the dolly must be reset by moving to the off position before switching on.



Testing

If an RCD is installed for additional protection against indirect contact, it is a requirement of the IEE Regulations that the effectiveness of the RCD be verified. This must be achieved by a test simulating an appropriate fault condition and be independent of any test facility incorporated in the RCD. The test currents to be applied are as follows:

Test current	Condition
$0.5 \times I \Delta n$	RCD must not trip
$1.0 \times I \Delta n$	RCD must trip within 300ms
$5.0 \times I \Delta n$	RCD must trip within 40ms

Where $I \Delta n$ is the RCD's rated tripping current in accordance with wiring regulations and product standard BS EN 61008.

For time delay RCD $1.0 \times I \Delta n$ RCD must trip between 130-500ms.

Residual Current Devices (RCDs)

Dimensions (mm)

