

Earth leakage devices - Explained



What is an RCD?

RCD (Residual Current Device) is a generic term describing a range of protective devices designed to detect and respond to earth leakage currents.

RCCB – Residual Current Circuit Breaker

This device is a mechanical switch with an RCD function added to it. Its sole function is to provide protection against earth leakages. There is no over-current or short-circuit protection.
Also known as a Safety Switch

RCBO – Residual Current Breaker with Over-current Protection

This device is an over-current circuit breaker (such as an MCB) with an RCD function added to it.

It has two functions;

- To provide protection against earth leakages
- To provide protection against overload currents and short circuits, ie. “normal” circuit breaker

Also known as a MCB/RCD combination units

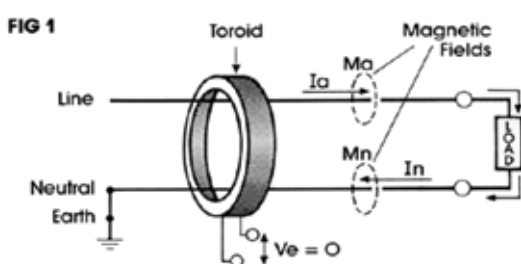
What does an RCD do?

RCDs are designed to detect an imbalance in the current flowing in the active/s and/ or neutral conductors of a circuit. If there is a current flowing to earth that results in an imbalance of greater than the RCD threshold trip value, the RCD should operate and trip to isolate the effected circuit to render it safe.

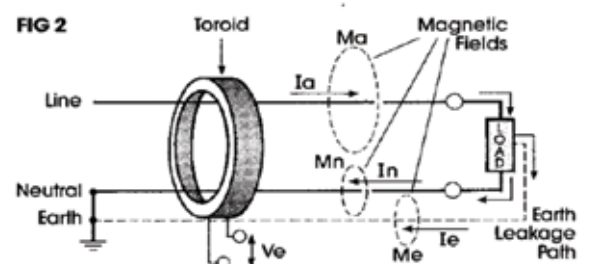
What is earth leakage?

Earth leakage is when the current flowing in a system finds an alternative return path other than active and neutral conductors.

The term “earth leakage” is associated with a residual current of small magnitude and is generally measured in the order of milli ampere (mA). Residual currents of higher magnitudes, measured in % of rated load current are commonly referred to as earth fault.



Balanced - No earth leakage



Unbalanced - Earth leakage Present



Why are RCDs needed?

Circuit breakers and fuses are designed to protect the cables in an installation and can also provide a level of equipment protection.

These devices are only designed to operate in response to an electrical overload or short circuit.

If a fault occurs and the electrical resistance in the earth fault current path is too high to allow a circuit breaker to trip (or fuse to blow), electricity can continue to flow to earth for an extended time. RCDs (with or without an over current protection) detect a very much lower level of electricity flowing to earth and immediately switch the electricity off. This offers high level of personnel protection.

RCDs have another important advantage as they reduce the risk of fire by detecting electrical leakage to earth in electrical wiring and accessories. This is particularly significant in older installations.

On a circuit protected by an RCD, if a fault causes electricity to flow from the Active conductor to earth through a person's body, the RCD will automatically disconnect the electricity supply, avoiding the risk of a potentially fatal shock.

NOTE: An RCD will significantly reduce the risk of electric shock, however, an RCD will not protect against all instances of electric shock. If a person comes into contact with both the Active and Neutral conductors while handling faulty plugs or appliances causing electric current to flow through the person's body, this contact will not be detected by the RCD unless there is also a current flow to earth.

What is the fault current rating on the MOD6 RCD/MCB?

6kA

Why does it have a black lead?

This is a neutral lead designed to pick up the line side neutral. This is a time saving feature, especially when fitting units into Loadcentres.

Why does the unit have a white tail?

This is an earth reference lead. This is a backup in case of loss of neutral. The RCD function is disabled without a voltage reference if the Neutral is lost.

Why is the earth lead white?

This is not an earth. The white lead is only a voltage reference "functional earth" for the operation of the electronics of the RCD which is common in 1 pole width RCBOs.

Do we have to connect the white wire "tail"?

The unit will still operate with the earth reference disconnected. However, if the neutral is lost with the white lead disconnected the unit will not trip on an earth leakage.

Is the product covered under warranty if reference tail is removed?

If the earth reference tail is removed from the device or the product has been altered from the Manufacturer's Specification then warranty is NOT VALID.

Can I fit auxiliary contacts to this unit?

No! The MOD6 family does not have any auxiliary/alarm options. NHP Din-T accessories cannot be fitted to MOD6 devices.

What is the biggest cable I can connect to the terminals?

25mm² M6RCBD and M6RCBS, load side MOD6RCBO1 and MOD6RCBO2

35mm² line side MOD6RCBO1 and MOD6RCBO2

What overload curve can we get these units in?

The MOD6 range are only manufactured as C curve breakers.

Can I reverse feed RCBO?

If the 1P wide RCBO terminals are marked Line and Load this must be respected.

2P RCBO terminals are not marked Line and Load so it can be feed from top or bottom terminals.

I have a 20A RCBO running at 6A but the unit still trips?

When selecting a RCBO the earth leakage current of the end devices needs to be considered not just the load current.

Typically a RCD device should be designed to run at not more than 1/3 of its rating

E.G 30mA device normally run at 10mA or less.

Device	Typical leakage current
Computer	1.5mA
Fluorescent light	0.5mA
Printer	0.8mA

Approximate values only, as leakage will vary from device to device, brand to brand.

When testing the RCD with an external tester the unit doesn't trip?

Disconnect any loads as they will affect the results of the test. Check connections.

Can the standard 1P (long) RCBO be used in Loadcentres?

No, the long units wont physically fit in the Loadcentres. It is recommended that the Compact 1P RCBO, M6RCBS, M6RCBD is used or alternatively MOD6RCBO2 (2 pole).

Common causes for earth leakage currents?

- Human contact (electric shock):- Person comes into contact with conductors directly or indirectly
- Faulty wiring:- Damaged wiring, poor/ degrading of wiring insulation, poor connections, exposed conductors.
- Moisture on loads:- Moisture affecting the insulating medium e.g. air or insulation.
- Line Filters:- EMC Filters in the end device. Capacitors going to ground, resulting in high transients currents on switch-on.
- Motors:- Motors, and their startup process can cause leakage currents to flow. Particularly with VSDs.
- UPS:- These units have a high frequency switching behavior.
- Capacitive leakage:- Long cable runs of bunched multiple circuits.
- Surge Currents:- AC motors, lighting ballasts and even switching of power supplies can develop extremely high inrush currents. For a short time, the current drawn is a high amplitude, high frequency burst which may affect the leakage sensing circuit. These start-up values can be read by the RCD circuit as leakage, and can cause nuisance tripping of the protective equipment.
- Summation of leakage currents:- The leakage currents originating from components of the load are a common cause for nuisance tripping of RCDs. This situation can arise when computers or other electronic equipment, which have characteristic standing leakages.

Tripping time for General type 30mA RCDs as per standards AS/NZS 61009 and AS/NZS61008

Test Leakage Current	Tripping Times
$I_{\Delta n}$ 30mA	$\leq 300\text{mS}$
$I_{\Delta n}$ 60mA	$\leq 150\text{mS}$
$I_{\Delta n}$ 150mA	$\leq 40\text{ms}$

NOTE: The threshold for an RCDs to trip is at a level anywhere between 50% - 100% of the rated residual operating current, or $I_{\Delta n}$. Overlooking this fact can lead to issues like nuisance tripping, particularly in circuits containing electronic loads where there is an accepted level of standing earth leakage due to normal operation.



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