

AVW Technical Guide

Residual Current Devices (RCDs)

Electrical Safety Protection for Stage and Automation Systems

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Introduction

Residual Current Devices (RCDs) provide protection against electric shock and earth faults by disconnecting the supply when current flows to earth.

In stage automation systems, electrical design must balance safety with reliability. Drives, power electronics and EMC filters introduce leakage currents that can cause unwanted tripping if RCDs are not selected and arranged correctly.

This guide outlines how RCDs work, the types available, and how to apply them practically in automation systems.

Key Points

RCDs detect imbalance between live and neutral currents. 30 mA devices provide additional protection for persons.

- Modern equipment often requires Type A, F or B RCDs.
 - Inverters and EMC filters create leakage current.
 - Effective solutions include correct RCD type, circuit separation, discrimination and appropriate upstream protection.
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What is a Residual Current Device?

An RCD monitors current flowing in the live and neutral conductors.

If some current flows to earth — through insulation faults, equipment frames or a person — the imbalance is detected and the device disconnects the supply.

Why RCD Protection is Important

Fuses and circuit breakers do not detect low-level earth leakage. RCDs provide:

- Protection against electric shock
- Detection of earth faults
- Reduced fire risk

Typical ratings:

- 30 mA – personal protection
 - 100 mA – fault protection / discrimination
 - 300 mA – fire protection / upstream use
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How an RCD Works

Live and neutral conductors pass through a sensing core.

- Equal currents cancel out.
 - An imbalance is assumed to be a residual current.
 - The device trips and disconnects the supply.
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Types of RCD

Different types of RCD are designed to detect different forms of residual current. The correct type must be selected based on the electrical equipment connected to the circuit.

Type A

- For pure AC loads only. Generally unsuitable for modern systems.

Type F

- Designed for single-phase drives and higher frequency leakage.

Type B

- Required for three-phase drives and smooth DC leakage. Typically, the correct choice for automation systems.
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Inverters, EMC Filters and RCD Tripping

Variable speed drives and EMC filters generate leakage current to earth. Issues arise when:

- Multiple drives share a 30 mA RCD
- Combined leakage approaches the trip level
- Capacitor charging causes inrush imbalance

This leads to nuisance tripping, particularly problematic in show-critical systems.

Effective solutions in Automation Systems

- Use the correct RCD type (Type B for most 3-phase drives, Type F where appropriate)
 - Avoid grouping multiple drives on a single 30 mA RCD
 - Apply discrimination (100 mA or 300 mA time-delayed upstream)
 - Separate socket circuits from fixed machinery
 - Split loads to reduce cumulative leakage
 - Consider isolation transformers if possible
 - Review EMC filters where appropriate
 - Use line or output filters where required
 - Sequence power-up of drives, if possible
 - Inspect drives, filters and earthing
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Summary

Residual Current Devices play an essential role in electrical safety by detecting earth leakage faults and disconnecting the supply before dangerous conditions develop.

In stage automation and entertainment environments, RCD protection helps safeguard technicians, performers and equipment while ensuring reliable operation of electrical systems.

Correct selection of the appropriate RCD type ensures compatibility with modern electronic equipment and supports safe, reliable installations.

AVW Technical Guide Series

This leaflet forms part of the **AVW Technical Guide Series**, developed to provide clear and practical guidance on electrical safety technologies used in modern installations and automation systems.

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