Western Automation
RESEARCH & DEVELOPMENT

Electrical Protection Technology

Electrical Protection Technology refers to the technology that WA designs and supplies to OEM customers for integration into products for protection against electric shock, fire and arc faults.

Electric Shock Protection

For electric shock protection, the technology will detect residual currents, differential currents, leakage currents or ground fault currents, and this technology can be integrated into Residual Current Devices (SRCDs, PRCD, RCCBs & RCBOs), Ground Fault Circuit Interrupters (GFCIs), Leakage Current Detectors (LCDs) and Equipment Leakage Current Interrupters (ELCIs).
(See articles: "Residual Current Devices (RCDs) for AC & DC Systems" and "Leakage Current Detection For AC & DC Applications")

When our technology is integrated into RCD type products, protection can be provided for any of the following fault conditions. AC residual currents, pulsating DC residual currents, DC residual currents, AC leakage currents, DC leakage currents, Multi-frequency residual currents or Multi-frequency leakage currents.
The following matrix may provide a better understanding of the options available.

Current Type	Product Type		
AC residual currents	Type AC RCCB, RCBO, SRCD or PRCD (Note 1)	GFCI	
AC & Pulsating DC residual currents. See Note 2	Type A RCCB, RCBO, SRCD or PRCD (Notes 1 & 5)	GFCI. Note 2.	
AC, Pulsating DC residual currents & DC residual currents	Type A RCCB, RCBO, SRCD or PRCD. (Note 1)		
AC leakage currents	Type A RCCB, RCBO, SRCD or PRCD. (Note 1)		LCD or ELCI
DC leakage currents	Type B RCCB or RCBO (Note 5 & 6)		
Multi-frequency residual currents or multi-frequency leakage currents.	Type B or Type F RCCB or RCBO (Notes 1 & 5)		LCD or ELCI Note 4.

- **Note 1:** IEC61008 & IEC61009 set out the trip times for RCCBs and RCBOs respectively. Such RCDs may have a non delayed response or a delayed response to a fault current. RCDs with a non delayed response are known as General Types, and RCDs with a delayed response are known as S Types.
- **Note 2.** In addition to detection of AC, Type A RCDs can detect pulsating DC with conduction angles from 0 – 135 degrees. GFCIs only detect half wave rectified AC.
- **Note 3.** Multi-frequency refers to the presence of residual currents at two or more frequencies over the range 10Hz – 1000Hz.
- **Note 4**. LCDs and ELCIs are only required to detect AC leakage currents. However, WA can provide DC detection in addition to AC detection in such devices where required by customers.
- **Note 5.** Type A & Type A+ and Type B & Type B + RCDs.Type A RCDs provide a higher level of protection than Type AC RCDs, but under certain conditions Type A RCDs may be prone to nuisance tripping, e.g. due to lightning surges. WA offers Type A+ RCD technology for applications requiring higher levels of immunity to nuisance.
- Note 6. Type B RCDs operate over the range DC -1KHz. Type B+ RCDs operate over the range DC – 100KHz.

RCD Trends

First generation RCDs provided protection against AC only. This was fine until the emergence of electronic power controls in tools, appliances and equipment. With power control came partial or full rectification of the AC supply, resulting in pulsating DC. Type AC RCDs were unable to detect pulsating DC residual currents, and this gave rise to the development of Type A RCDs.
Type AC and Type A RCDs were intended to operate at power frequency only, e.g. 50Hz or 60Hz, and were typically blind to residual currents at substantially lower or higher frequencies. However, the use of inverters and motor controllers gave rise to a need for RCDs that could operate over a wide range of frequencies, and this problem was met by the development of Type F RCDs.
Photovoltaic solar panels and electric vehicle charging gave rise to the risk of DC residual currents which could flow in the presence of an AC supply, and this gave rise to the need to detect either AC or DC or pulsating DC residual currents on a single installation. The Type B RCD was developed to meet this need.

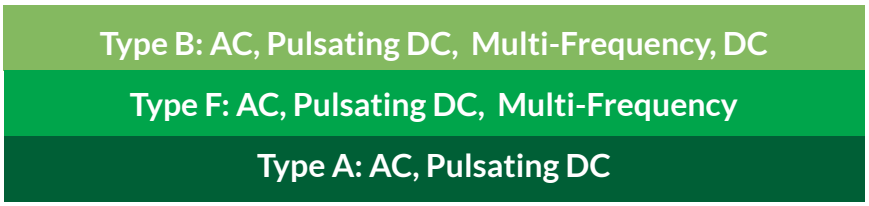
Important:

Due to the limited level of protection provided, the use of Type AC RCDs has declined over recent year, and in several countries such as Germany, Netherlands, Switzerland, etc. the use of AC Type RCDs for personal protection is not permitted or severely restricted. The Type A RCD is now the RCD of choice for most installations worldwide.

However, with the emergence of electric vehicles, it is quite likely that the use of Type B RCDs will increase rapidly over time because this is the only RCD that provides universal protection against all known types of residual fault currents on AC and DC systems.

The following chart shows the hierarchy of protection afforded by RCDs

RCD – Hierarchy Of Protection



It is generally accepted that Type B RCDs provide the greatest level of shock protection and AC types provide the lowest level of protection.

Self Testing RCDs (STEOL)

WA has developed technology to enable RCDs and GFCIs to carry out Self Testing (ST) and to indicate End of Life (EOL) when the eventually fail. Typically the device carries out a self-test every 2 – 3 seconds during which a residual current is generated and detected by the RCD. Self testing continues throughout the life of the product, but when a critical component in the product fails, the residual current will not be detected. At that point the RCD/GFCI will switch to the EOL state.
EOL Options: Users have two options for the EOL state:

a) The RCD/GFCI trips automatically and will trip automatically each time it is reset.
b) The RCD/GFCI will not trip automatically, but will give a visual indication of the EOL state

Fire & Arc Fault Protection

It is well know that arc fault currents can give rise to electrical fires. For arc fault protection & fire protection, our technology will detect fault currents arising from series or parallel arc faults, and this technology can be integrated into Arc Fault Circuit Interrupters (AFCIs) based on UL1699 requirements and Arc Fault Detection Devices (AFDDs) based on IEC62606 requirements.

Product Standards

All of the protective devices mentioned above must comply with a relevant national or international standard. Most countries have national standards, but many countries adopt an IEC standard or a European Standard (an EN) as a national standard.
Examples of typical product standards are UL943 for GFCIs, IEC61008 for RCCBs, IEC 61009 for RCBOs, IEC62423 for Type B and Type F RCCBs and RCBOs, IEC62640 for SRCDs and EN61540 for PRCDs.
In Europe, the IEC standards are redesignated as ENs (European Norms), e.g. EN61008, EN61009, EN62423, etc.