AFDD+
Range brochure

*Live*Safe

Technology to protect what matters

Electrical circuit protection for low voltage residential and light commercial installations

EATON
Powering Business Worldwide

People, assets, property and your reputation are all things that matter to you. You can protect them all with Eaton electrical safety systems for low-voltage residential and light commercial installations.

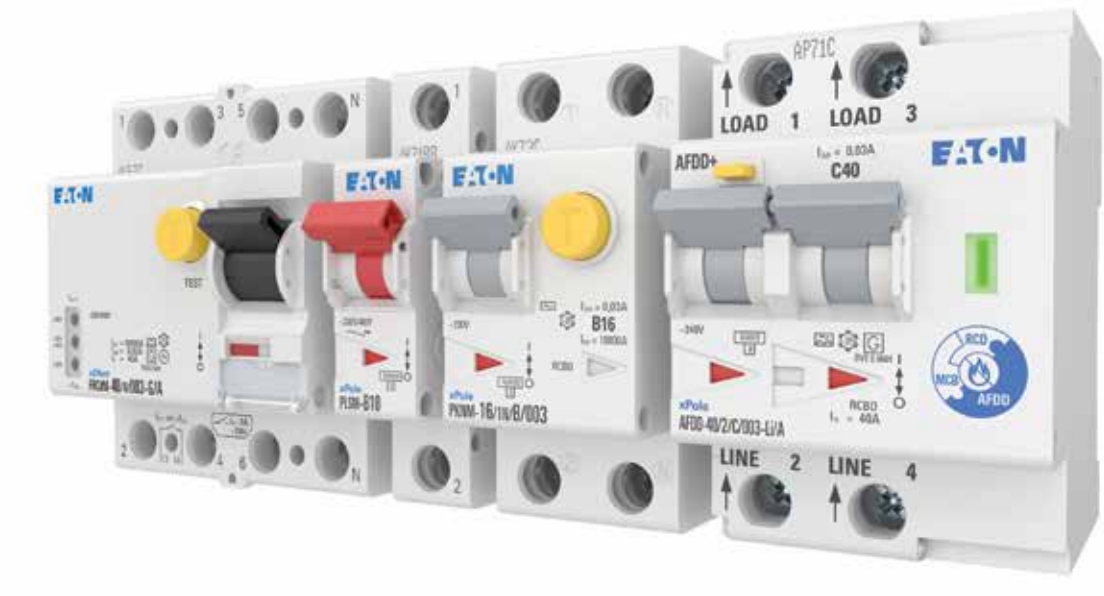
EATON offers state-of-the-art protection devices to protect against all types of fault currents.

Protect against short circuits and overcurrents with an EATON Miniature Circuit Breaker (MCB). Protect against earth fault currents – to prevent electric shock – with an EATON Residual Current Circuit Breaker (RCCB). Or combine both functions in the EATON Residual Current operated circuit Breaker with Overcurrent protection (RCBO).

Now Eaton also provides the highest level of advanced protection in end circuits, adding arc fault detection to the RCBO functionality, in a revolutionary all-in-one Arc Fault Detection Device (AFDD+).

Additional digital features increase the sensitivity and robustness of the protection devices, and the availability of installations and systems.

The EATON electrical safety range has everything you need, to protect what matters.



Types of fault

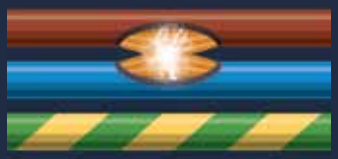
The following types of fault can lead to severe hazard and danger.

Overcurrents

A moderate increase in current which does not immediately damage the wiring but results in a thermal overload over time. May increase over a period or almost instantaneously jump to a steady state current.

Typical causes

- Insulation defects
- Breakdowns between phases
- Breakdowns between phase and neutral



Short circuit currents

Faults with very low impedance and very high currents which can be up to 20 times the nominal current.

Typical causes

- Phase and neutral short-circuiting over very low impedance, due to:
  - Insulation breakdown
  - Mechanical damage to wiring
  - Water

Fault currents

High or low impedance faults between phase and earth. They can result in very low leakage and fault currents, either much lower than nominal current or in very high currents.

Typical causes

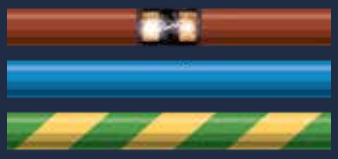
- Changes in insulation and insulation resistance, due to:
  - Humidity
  - Aging
  - Mechanical stress
  - Dust
  - Dirt etc.

Arc fault currents

Typically at nominal current or just below, and therefore difficult to detect. Small arcs can grow over time as insulation is increasingly damaged. Identified by high frequency noise and breakdown of the fault current close to the zero-crossing of the driving voltage.

Typical causes

Broken or squashed wires leading to an arc continually or intermittently burning and damaging insulation.



Serial arc faults – the most common. Originate from a fault across the phase or neutral. Only detectable by AFDD+.

Parallel arc faults – originate from a fault between phase and neutral. Total current in the circuit increases depending on load impedance and fault impedance.

90%

OF FIRES IN EU HAPPEN IN BUILDINGS

2,000,000

FIRES REPORTED IN EUROPE EACH YEAR

Effects of faults

Loss of power

Usually caused by very high overcurrents destroying wiring, installation devices or busbars. MCBs are designed to protect wiring against short circuits and overcurrents in low voltage residential installations.

Loss of life, property and assets

Electricity is a recognized ignition source for a number of fire hazards. Many fault currents are detectable, but serial and parallel arc faults were undetectable until the invention of the AFDD.

Electric shock can cause fatal injuries and loss of life. RCDs are the most important devices for protection against electric shock. Protection devices which can detect and disconnect high frequency fault currents are increasingly important, as electronic devices with integrated electronic inverters become more common.

Combined with digital arc fault detection technology, the EATON AFDD+ minimizes the risk of electrically ignited fire hazard, and provides protection against loss of power, property, assets and life.

4000

PEOPLE ARE KILLED BY FIRE IN EUROPE EVERY YEAR

11 **PER DAY**

70,000

PEOPLE ARE HOSPITALIZED IN EUROPE EACH YEAR DUE TO SEVERE FIRE INJURIES

€126,000,000,000

IS EATEN UP BY FIRE DAMAGE EACH YEAR *(1% OF EUROPEAN GDP!!!)* *SOURCE: FIRE SAFE EUROPE*

IN EUROPE MORE THAN 25% OF FIRES ARE IGNITED BY ELECTRICAL FAILURE

SOURCE: GENEVA ASSOCIATION, RISK AND INSURANCE ECONOMICS

How protection has evolved

It was in 1957 that F&G (which later became part of Eaton) filed a patent for its first Residual Current Circuit Breaker (RCCB) device. Now, 60 years later, the latest Eaton Arc Fault Detection Device is the most recent development in an ever-evolving range of Eaton circuit protection solutions.

Miniature Circuit Breaker (MCB)

Shortening of the load path via a very low impedance path is a recognizable fault cause. Circuit breakers prevent the problem by detecting the high fault current and quickly interrupting it. MCBs combine current-dependent overcurrents protection with very fast current independent short circuits protection.

Residual Current Circuit Breaker (RCCB)

Earth leakage currents exhibit serious threats for humans and can cause ventricular fibrillation of the heart. RCCBs detect asymmetric and unbalanced fault currents and disconnects the circuit. RCCBs protect against electric shock and provide a very basic fire protection capability. Digital RCCBs were introduced in 2009 providing additional safety features and higher functionality.

Residual Current Circuit Breaker with Overcurrent Protection (RCBO)

RCBOs provide protection against high short circuit currents and protection against electric shocks caused by low leakage currents in one device to increase safety.

Arc Fault Detection Device (AFDD+)

A new device combining short circuit and fault current protection capability from RCBOs with an AFDD (arc fault detection device), the next generation of detection technology. AFDD+ applies an algorithm in the integrated electronic circuit to ensure sensitive detection of fault currents, which indicates the presence of dangerous arc faults.

The next step in the evolution of protection

The EATON AFDD+ is not simply a development of devices that already exist. It is the next step in the evolution of protection devices, incorporating the benefits of digitalization.

A complete range of devices, that offer protection for people, property and assets including the next step in protection - prevention against electrically ignited fires caused by serial and parallel arcs.

People

The use of electricity and the operation of electrical installation should not result in any risk to people or assets. By continually devising new and innovative protection devices, EATON is striving to protect people's lifes.

Property and assets

Property and other assets require protection against electrically-ignited fire hazards, to prevent damage, loss and financial consequences.

MCB	RCCB	RCBO	AFDD+
			Arc fault protection
Short circuit & overcurrent protection	Earth fault current protection	Earth fault current protection	Earth fault current protection
		Short circuit & overcurrent protection	Short circuit & overcurrent protection

PROTECTION ↑

FUNCTIONALITY →

Basic fire protection	Basic fire protection	Increased fire protection	Enhanced fire protection
-	Shock prevention	Shock prevention	Shock prevention

MCBs

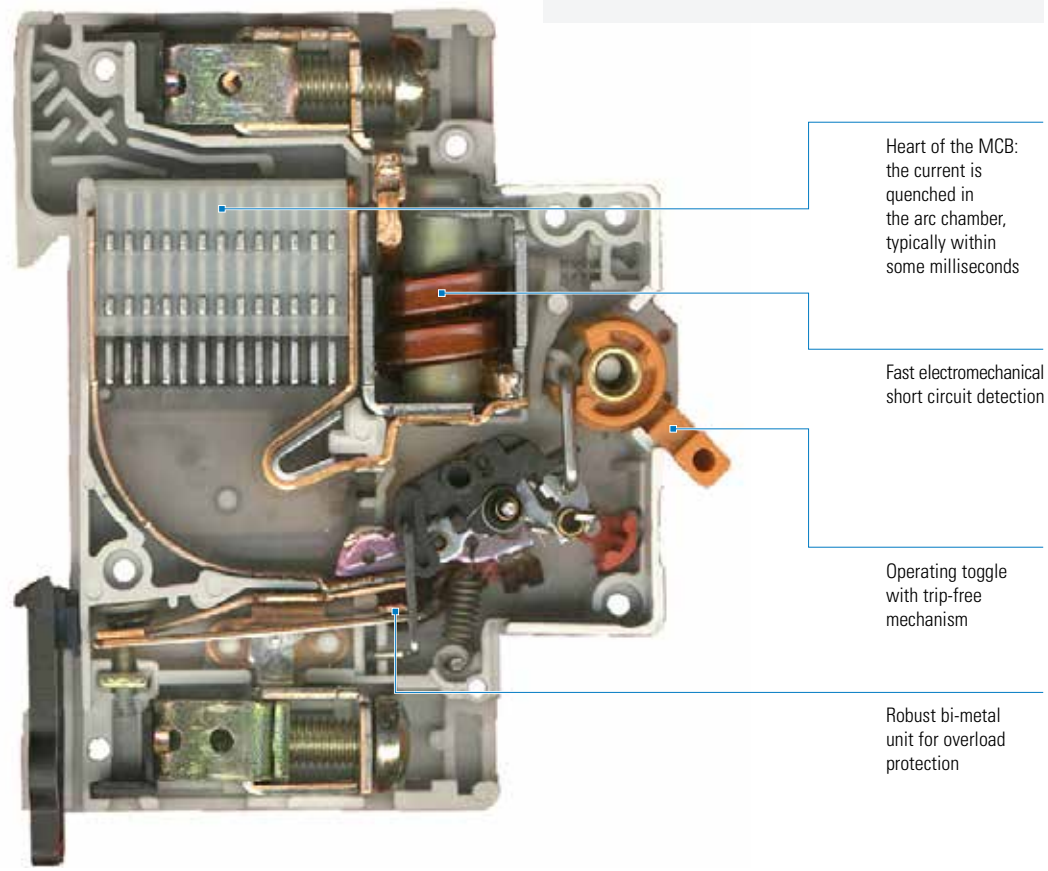
Miniature Circuit Breakers (MCBs) are used in almost every electrical installation to protect against short circuits and overcurrents.

Overload currents can cause hazardous dissipation of high energy along the wire, leading to its heating and destruction. MCBs combine relatively slow, current-dependent, overcurrent protection and very fast, current independent short circuit protection.

Eaton offers a broad range of MCBs with the following characteristics:

- Rated current: 0.16 A up to 125 A
- Configuration: 1, 1+N, 2, 3, 3+N, 4
- Rated breaking capacity: 4.5 kA up to 25 kA
- Tripping characteristics: B, C, D, K, S, Z

Eaton MCB - Robust and Reliable Protection



RCDs

Since the widespread application of RCDs in the 1960s, the number of injuries from electric shock has declined dramatically.

1957

Gottfried Biegelmeier pioneered the development of time-delayed tripping and secured the first patent for an applicable residual current circuit breaker (RCCB). He had recognized the need to disconnect fault currents by detecting unbalanced currents and found a reliable way to realize this in protection devices. Biegelmeier was chief technical officer of Felten & Guillaume, which later became part of Eaton, and is recognised as the father of the RCD for the robust tripping mechanism he invented.

EATON is the world's leading manufacturer of digital protection devices, and the first to offer RCDs with digital features that provide higher levels of functionality and availability.

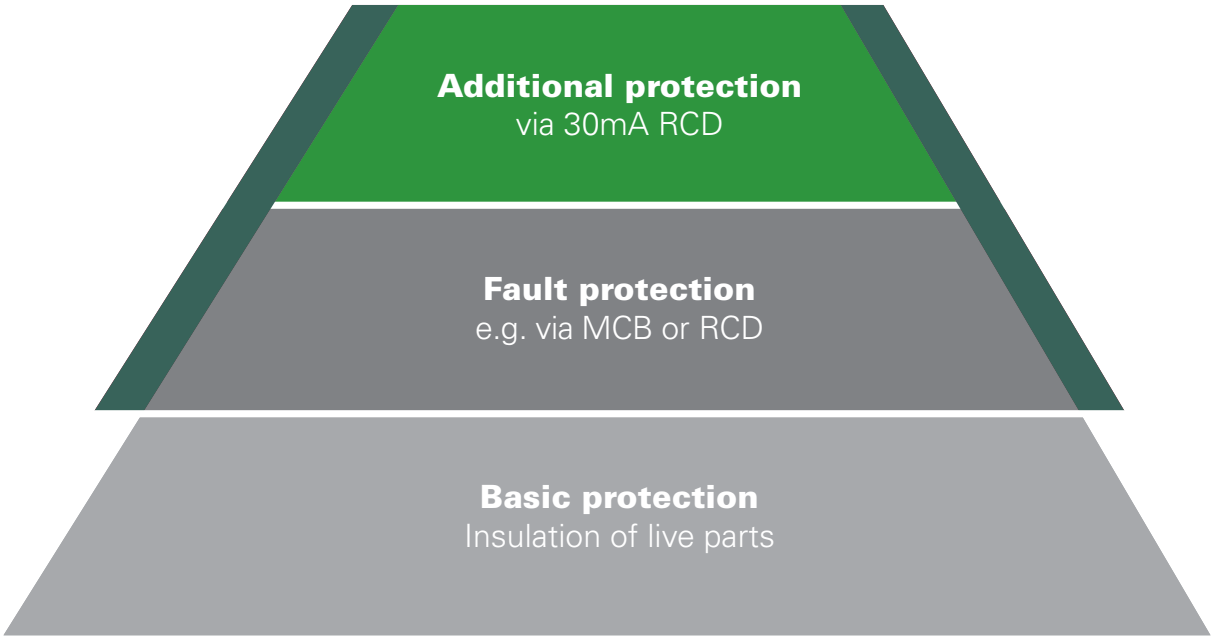
The requirements for protection against electric shock are set out in IEC 61140:
Hazardous live parts shall not be accessible and accessible
Conductive parts shall not be hazardous

This requirement needs to apply under:

Normal condition	**Protection against direct contact**
Single fault condition	**Protection against indirect contact**

The requirement is the foundation for three very important protection schemes:

Basic protection:	Insulation of live parts (class II equipment, cable insulation, barriers or enclosures)
Fault protection:	e.g. automatic disconnection of the power and the fault
Additional protection:	Residual current protection device, 30mA for socket outlets.



Choosing your EATON RCD

B+

To achieve COMPREHENSIVE safety

Full type B safety level + increased sensitivity to frequencies up to 20 kHz for fire protection with a maximum tripping value of 420 mA.

- Fire danger areas, motors driven by three-phase inverters with very high frequency e.g. agricultural applications, farms, fuel station
- Superior protection against thermal hazards and reduction of the risk of electrically ignited fires due to leakage currents

B/ Bfq

To manage ALL-ROUND safety

Full type F safety level + detection of smooth DC currents.

- Installations with electronic loads with 50/60 Hz e.g. residential PV applications, electric car charging, hospitals, medical centres
- Type Bfq is less sensitive for higher frequencies and better suited for industrial premises
- Provides all-round protection for various applications and occurring waveforms according to IEC/EN 62423

F

To ensure ADVANCED safety

Full type A safety level + detection of fault currents with frequency mixtures up to 1 kHz. Smooth DC currents up to 10 mA do not influence detection.

- Speed controlled appliances e.g. household appliances like washing machine, dishwasher, washer dryer
- Provides the advanced operator protection where circuits with electronic loads are used

A

To perform in STANDARD applications

Full type AC safety level + detection of pulsating DC residual currents. Smooth DC currents up to 6 mA do not influence detection.

- Home appliances where pulsating DC residual currents may occur e.g. loads with electronics or rectifiers like ventilator/fans, food processor, LED/energy saving lamp
- Typical in most of today's applications

AC

To provide MINIMUM* requirements

Detects alternating residual currents only.

- Basic home appliances e.g. oven, lights, iron
- Minimum requirements in most countries in residential application - higher level of safety is recommended

Time delayed tripping in surge sensitivity environment
- min 10 ms time delay

Selectivity to downstream RCDs
- min 40 ms time delay

* Depends on the local wiring regulations, please check your local regulations

Type F to ensure ADVANCED safety

Especially designed for circuits with energy efficient home appliances, for example washing machines and dishwashers, that contain single-phase frequency inverters.

New energy efficient devices and appliances are increasingly equipped with high power electronics and frequency inverters which are used for changing the speed in asynchronous motors. These appliances can cause fault currents with superimposed high frequencies and DC leakage / high in-rush currents which can cause traditionally used RCDs to trip in undesirable situations or to not (timely) trip in case of an earth fault. The reason is increasing earth leakage current of interference filters and stray capacities, which increases with rising frequency. This carries a safety risk for life and equipment and needs to be addressed by using a type F RCD.

Application for type F RCDs

Whenever energy efficient devices and appliances are equipped with high power electronics or frequency inverters type F RCDs should be used. This will ensure a timely tripping in case of a residual fault current and ensure a high degree of safety.

Examples of appliances / devices/ applications for which a type F RCD should be used:

- Washing machines
- Dishwasher
- Heat pumps
- Ventilation applications
- Air-Condition systems
- Welding equipment

Type F properties

Detects alternating residual and pulsating DC residual currents +detection of fault currents with frequency mixtures up to 1 kHz, smooth DC currents up to 10 mA do not influence detection.

RCD type	Symbols	Sensitivity to residual current	Properties	Standards
F *		Alternating and pulsating direct current	Sinusoidal AC and pulsating DC up to 10 mA	IEC/EN 62423

What advantages does a RCD type F provide?

- **Advanced availability of the installation.** A type F has a high reliability against nuisance tripping due to a time delayed tripping behavior. In addition the surge current proof RCD (up to 3 kA) can handle end circuits where inrush currents can be expected during everyday use e.g. energy efficient appliances which typically have a low impedance which contributes to high inrush current.
- **Advanced frequency immunity.** Whereas a type A RCD will be affected and trip sooner at residual current with higher frequencies, the type F maintains a stable tripping level. (according IEC/EN 62423)
- **Advanced DC immunity.** The F type is not affected by superimposed DC current up to 10 mA. This is relevant when multiple appliances are used in a single end circuit.
- **Type F RCDs** have been specifically designed **for single phase inverter applications like energy efficient home appliances.**

* The predecessor is type U, which was introduced to the market many years ago, when the definition of properties of type F was not yet available. Since the introduction of IEC/EN 62423 this is the new denomination.

	Type F RCCB	Type F RCBO 1+N (PKNM)	Type F RCBO 2-pole (PKPM2/PKP62)	Type F Digital RCBO	Type F AFDD+
Rated current:	25 - 63 A	13 - 40 A	6 - 40 A	6 - 25 A	6 - 40 A
Tripping behavior	Short-time delayed, selective	Short-time delayed	Short-time delayed	Short-time delayed	Short-time delayed
Rated tripping current:	30 mA, 300 mA	10 mA, 30 mA, 300 mA	30 mA	10 mA, 30 mA, 100 mA	10 mA, 30 mA
Configuration:	2-pole, 4-pole	1+N	2-pole	2-pole	2-pole
Tripping characteristics:	-	B, C, D	B, C	B, C, D	B, C

Type B to manage ALL-ROUND safety

Especially designed for applications with 3-phase frequency inverters, EV charging or PV installations.

In residential installations or temporary power distribution boards at construction sites where (3-phase) frequency inverters, photovoltaic inverters, electrical vehicles (EV) chargers and other equipment with power semiconductor elements are applied, direct residual currents (DC) may occur. In these situations there is a high probability that a fault current may not pass through zero, these superimposed DC currents may cause oversaturation of a RCD. Oversaturation from either solely DC fault currents or high frequency noise can hinder a conventional RCD (e.g. Type A) from tripping in a timely manner or even totally hinder the detection. This oversaturation can happen if a root RCD supplies a variety of end circuits. Mains filters in consumer devices in one circuit can cause leakage current up to a defined value which can cause a root RCD to become "blind" or desensitized for fault currents the RCD was designed to detect. This carries a risk for life, equipment and vehicle(s) and needs to be addressed.

The application of type B RCDs
When using any 3-phase frequency inverters it is necessary to use type B RCDs, which are designed and tested for this purpose. This ensures a timely tripping and a high degree of safety.

Examples of applications for which a RCD type B/Bfq/B+ should be used:

EV Charging: Power electronics can produce DC fault and leakage currents during the charging process of an electric vehicle. Currents that are caused by line filters of the charging electronics of the EV charging station or the electric vehicle. According to the standards, EV charging stations require a RCD which can detect DC fault currents.

PV installations: Power inverters in PV installations and energy storage batteries can generate DC fault currents.

Heat pumps / HVAC Systems: This and similar applications often have 3-phase frequency inverters

Type B RCDs properties

Establishes a full type F safety level with additional detection of smooth DC currents. Type B RCDs are available in 3 versions:

RCD type	Symbols	Sensitivity to residual current	Properties	Standards
B		Alternating and pulsating direct current and flat direct current	All kinds of current up to 1 kHz	IEC/ TR 60755 IEC/ EN 62423
B+	kHz	Alternating and pulsating direct current and flat direct current	All kinds of current up to 20 kHz	VDE 0664-440
Bfq		Alternating and pulsating direct current and flat direct current	The special Eaton's B type with adapting tripping curve up to 50 kHz	IEC/ EN 62423

What advantages does a RCD type B/Bfq or B+ provide?

- Enhanced availability of the installation. Type B/Bfq/B+ RCDs have higher reliability than type F RCDs due to increased sensitivity for higher frequencies and are not hindered by DC fault currents, ensuring stable tripping level under harsh circumstances.
- Superior protection. Type B+ RCDs are suitable for all types of residual current with additionally altered tripping characteristics according to the requirements for protection from fire, with tripping residual current up to 420 mA and for frequency up to 20 kHz.
- Best frequency immunity. Type Bfq and B+ RCDs have increased sensitivity for higher frequencies up to 20 kHz (B+) and 50 kHz (Bfq).

NEW

- Rated current: 25 - 125 A
- Tripping behavior: short time delayed, selective
- Rated tripping current: 30 mA, 300 mA, 500 mA
- Configuration: 2-pole, 4-pole
- Sensitivity: B, B+, Bfq

RCDs type A, type F and type B

Application of RCDs type A

Type A RCDs are applicable in cases where equipment with semiconductors and rectifiers is used. In case of a fault, the generated residual currents have AC and pulsating DC components. The fault detection of type A is not influenced by a DC overlay of 6 mA.

Application of RCDs type F

RCDs type F not only provide safe and reliable protection against AC currents and pulsating DC fault currents, but they are also capable of handling residual currents with mixed frequencies of up to 1 kHz in accordance with the IEC 62423 standard. This type of mixed frequency often occur at the outlet of an internal variable frequency drive that is used in energy efficient devices. The trip behavior of Type F RCDs will not be influenced by DC fault currents of up to 10 mA, have a short delay before tripping and distinguish themselves from other devices thanks to their high resistance to power surges. This ensures a high degree of safety.

Application of RCDs type B

Modern and future sustainable applications need comprehensive and high level of accuracy with a detection of every possible fault current that can occur. Your most valuable items need to be protected with the highest safety standard and even above standard. These types can and often must be used when EV charging stations are used, PV Panels and inverters are installed or heat pumps are driven.

Comparison type A, F and B:

	A	F	B
Sensitive to AC fault current	•	•	•
Sensitive to AC and pulsating DC fault current	•	•	•
Detection of mixed frequencies up to 1kHz (acc. IEC 62423)		•	•
Time delay (10ms)		•	•
Not influenced by 10mA DC overlay		•	•
Surge current proof 3kA		•	•
For use in application with 1-phase motors		•	•
Sensitive to smooth DC fault currents			•
For use in application with 3-phase motors			•
Suitable for EV-charging stations			•

Fault currents protection

Residual Current Circuit Breakers are mandatory to provide additional protection against electric shock for socket outlets and are often applied for fault protection.

RCCBs are applied in the root of an installation or additionally in specific branches/circuits where a special fault current characteristic is needed. RCCBs are available for residual currents from 10mA to 500mA and above, delayed and no-delay tripping, and with selective characteristics.

EATON Digital RCCBs

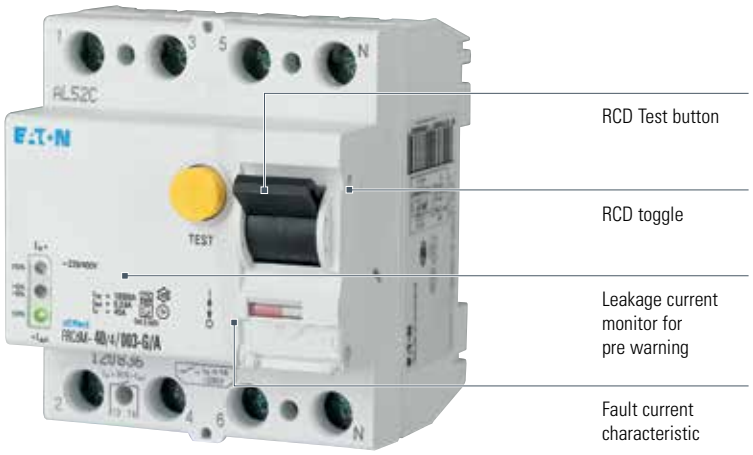
Combining protection with digital features, EATON Digital RCCBs are unique – providing maximum circuit status information together with increased protection and availability.

The devices continually measure the residual current value in real time, and use the results to drive local warning LEDs and remote warning potential-free outputs.

This allows time to resolve developing problems before they lead to interruptions or failures. System status is always available at a glance, which can save money by preventing out-of-hours service call-outs. The mandatory test intervals can be reduced to just once a year.

System availability is enhanced by the shorter time-delayed tripping characteristic of the digital protection devices, and the optimized tripping thresholds. These ensure that brief malfunctions do not cause nuisance tripping and loss of system availability.

The digital RCCBs are equipped with a voltage-independent protection function and digital features. EATON Digital RCCBs are available as Types A, B, Bfq and B+.



Eaton offers a broad range of RCCBs with the following characteristics:

- Rated current: 16 A up to 125 A
- Configuration: 1+N and 3+N
- Rated tripping current: 10 mA up to 500 mA
- Sensitivity: AC, A, F, B, Bfq, B+
- Tripping behavior: Instantaneous, short-time delayed, selective

Digital RCCB LEDs and their meaning

Red

When the red LED lights up, the leakage current is already higher than 50 percent of the nominal fault current. Therefore the system is in a critical status - the digital RCCB only trips when the fault current continues to increase.

Yellow

The yellow LED shows a residule current in the ambit of 30 to 50 percent of the nominal fault current. Before the system is shut down, professional countermeasures can be taken.

Green

If the current flow in the system to ground is in the ambit from 0 to 30 percent of the nominal fault current, the green LED indicates the proper status.

Short circuits, overcurrents and residual fault currents protection – RCBOs

The Residual Current Circuit Breaker with Over Current Protection is a compact combination of short circuit, overcurrent and residual fault current protection, ideally suited to fault and additional protection in individual end circuits.

End users benefit from RCBOs compared with the MCB/RCCB combination in the case of an earth fault, when only the particular circuit will trip so other circuits are not left without power. This also makes earth fault finding easier.

Different residual current characteristics enable the optimal protection for the specific applications. RCBOs are available for residual fault currents from 10mA to 300mA, delayed and no-delay tripping, with different sensitivities and breaking capacities.

EATON offers a broad range of RCBOs which are available as line voltage dependent and independent devices with the following characteristics:

Residual Current Circuit Breaker with Over Current Protection, **1+N** version **(line voltage-independent)**

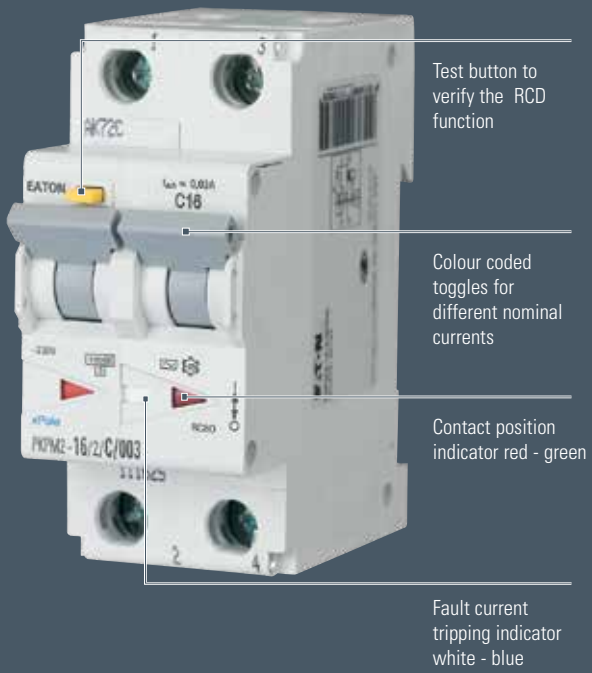
Residual Current Circuit Breaker with Over Current Protection, real **2-pole** version, **(line voltage-independent)**

Residual Current Circuit Breaker with Over Current Protection as **digital** version for leakage current indication **(line voltage-dependent)**

Mechanical RCBO:

1+N and 2-pole version, line-voltage independent

- Rated current: 2 A - 40 A
- Rated breaking capacity: 4.5, 6 and 10 kA
- Configuration: 1+N
- Rated tripping current: 10 mA up to 300 mA
- Tripping characteristics: B, C, D
- Sensitivity: A, F
- Tripping behavior: Instantaneous, short-time delayed



- Rated current: 6 A - 40 A
- Rated breaking capacity: 6 kA up to 10 kA
- Configuration: 2-pole
- Rated tripping current: 30 mA, 100 mA
- Tripping characteristics: B, C (-OL)

Unique: Eaton's digital RCBO

line voltage-dependent

This state of art Digital Residual Current Operated Circuit Breaker with integrated Overcurrent Protection (RCBO) protects people and technical equipment conveniently and reliably against faulty currents. Besides its outstanding protection characteristics the integrated digital RCCB monitors electrical installations and provides advanced warning of critical current flows, helping to avoid undesired shutdowns.

This is the world's first RCBO on the market that alerts actual fault current with LED, providing increased security, control and security for both installer and customer. It handles electronic noise better than any other protection devices on the market, and only trips when required.

The protection is maintenance-free, reduces the test interval to only once every 12 months, is highly accurate and actually allows to reads fault leakage current through an LED.

Eaton Digital RCBO:

- New and patented technology that makes the digital RCBO highly accurate with a very small margin of error on earth fault protection
- High immunity against electronic noise
- Digital LED enables the customer to self-monitor the status of the electric circuit, and it makes it easy for the installer to identify the type of error
  - Visual leakage warning (LED)
  - Read leakage current on protection (LED)
  - The digital RCBO has a 3-colored LED which indicates the amount of leakage
- Test interval 12 months
- Works in cold environments (-25 degrees Celsius)
- Surge current proof up to 3 kA
- 10 ms time-delayed tripping

Test button to verify the RCD function

Color coded toggles for different nominal currents

LED indication of leakage current

Contact position indicator red - green

Fault current tripping indicator white - blue

• Rated short circuit capacity:	10 kA
• Rated current:	6 - 25 A
• Configuration:	2-pole
• Rated tripping current:	30 mA, 100 mA
• Sensitivity:	F
• Tripping behavior:	Short-time delayed

Digital RCBO LEDs and their meaning

Red

When the red LED lights up, the leakage current is already higher than 50% of the rated residual current. Therefore the system is in a critical status - the digital RCCB only trips when the fault current continues to increase.

Yellow

The yellow LED shows a residual current in the range of 30% to 50% of the rated residual current. Before the system is shut down, professional countermeasures can be taken.

Green

If the current flow in the system to ground is in the range of 0% to 30% of the nominal fault current, the green LED indicates the proper status.

Electrically-ignited fire hazard protection – AFDD+

As described in IEC 62606, AFDD allow the detection and disconnection of hidden arc faults that can cause severe damage. Only an AFDD can detect and disconnect serial and parallel arc faults in electric installations.

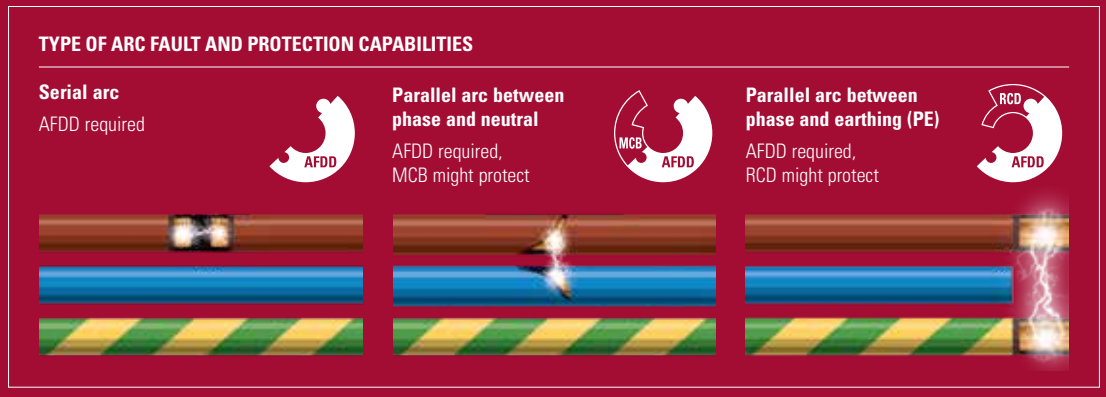
To also reduce the risk when dealing with electricity in end circuits, AFDD is the missing link which needs to be implemented with short circuit & overcurrent and earth fault protection. Eaton's AFDD+ is the industry's first protection device that provides these three levels of protection in one device.

Earth fault currents
Detected via balance transformer

Short circuit & overcurrents
Thermal & magnetic detection

Serial & parallel arc fault
Digital arc fault detection

Protection according to the IEC 62606



Electrically-ignited fires are a hidden but significant threat only recently beginning to be addressed.

Arc faults, which occur out of sight within installations, have the potential to ignite fires and cause enormous damage. Statistics show that the source of over 25% of fires is an electrical system.

What?

Serial Arc Fault

- Occurs when there is an interruption of conduction
- Can go undetected for long period of time

Parallel Arc Fault

- Originates from a fault between phase and neutral
- Total current in the circuit increases

Where?

Arc faults can occur in:

- Cables or wires
- Fixed installations
- Cables of directly connected devices or devices connected via sockets

When?

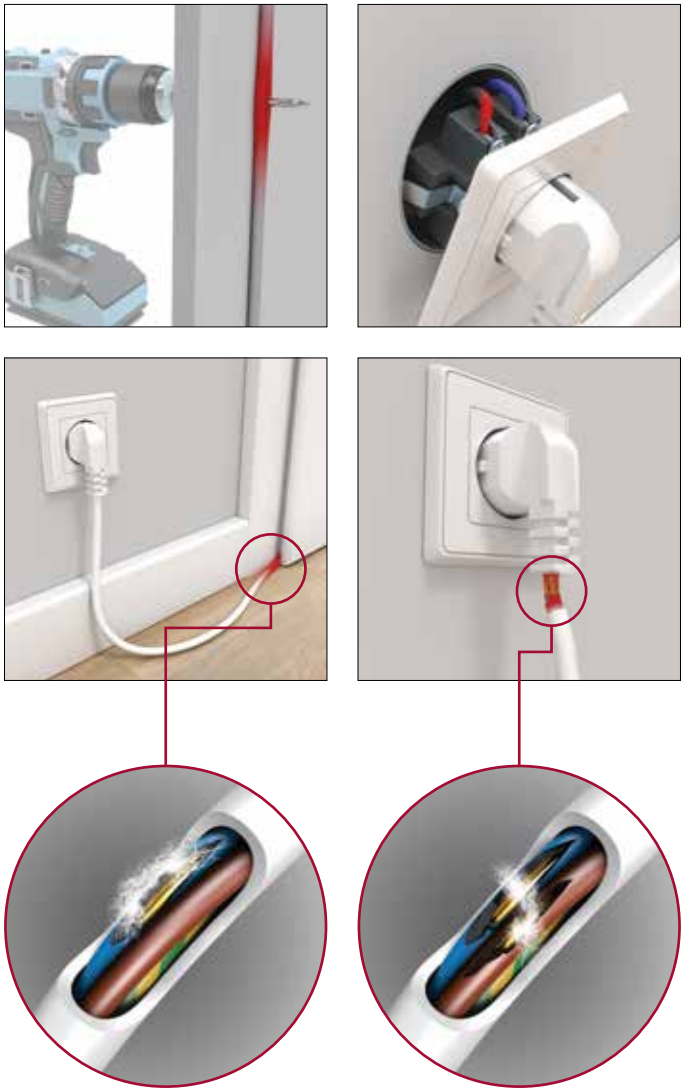
Arc faults occur when:

- Wires are faulty or damaged, due to:
  - external influences
  - ageing
- Terminal connections are loose

Why?

The most frequent causes of arc faults are:

- Crushed wires
- Damage to wire insulation caused by nails, screws etc.
- Ageing installations
- Broken cables or interruptions in a wire
- UV rays
- Pets and rodent bites
- Loose contacts and connections
- Bent plugs and wires
- Wires are treated carelessly or exposed to stress



How it works

An AFDD+ uses embedded processing and smart evaluation of current signals, to provide sensitive detection of fault currents, combined with avoidance of nuisance tripping.

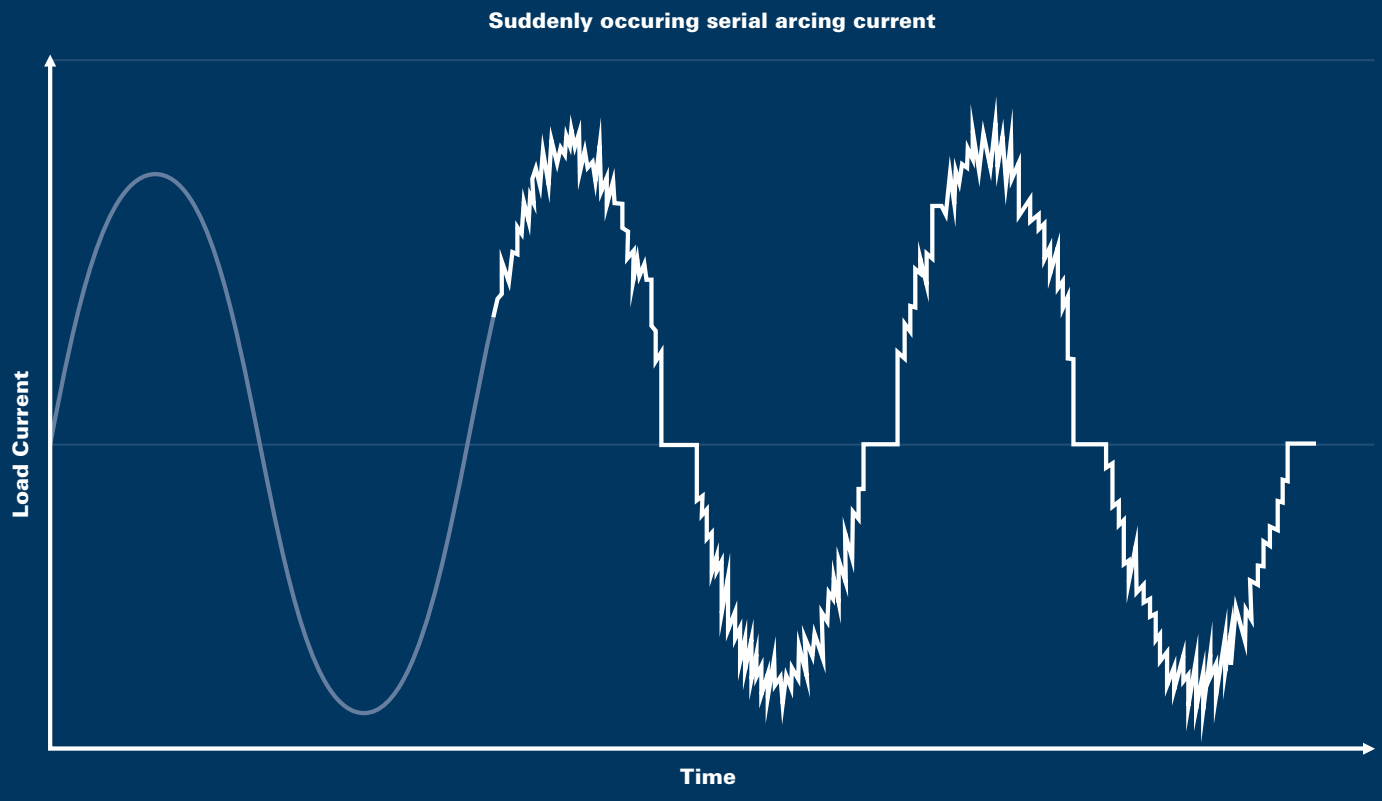
When an arc fault occurs it has unique and readily identifiable characteristics. These are:

- high-frequency noise within the fault current and
- a breakdown of the fault current, close to the zero-crossing of the driving voltage

The EATON AFDD+ uses these characteristics to detect arc fault and at the same time to prevent nuisance tripping. Detection is achieved using digital technology with embedded processing to monitor the wire for specific frequencies, and through smart evaluation of the fault currents.

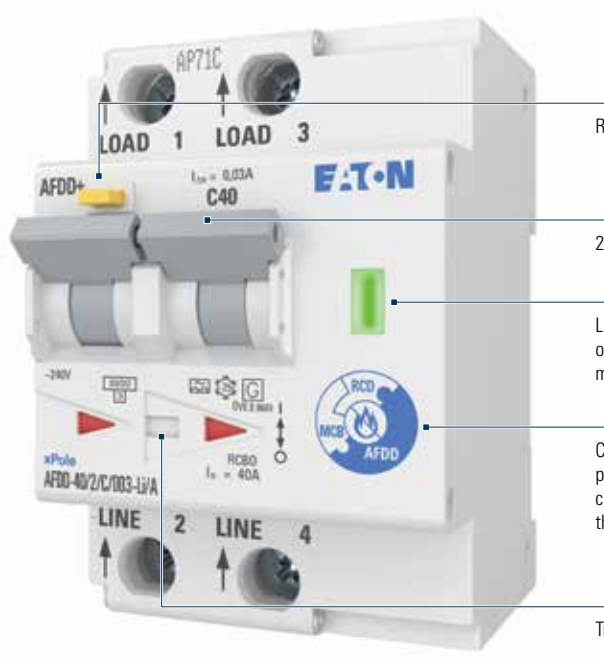
Avoiding arc fault masking

Power line communication can cause intense signals that mask the noise generated by arc faults. The EATON AFDD+ has been developed to ensure this does not interfere with its detection capability.



Status and tripping information

1 The LED indicator displays the status and the type of arc fault (serial or parallel) that tripped the device, which can be important for a fault finding.



RCD Test button

2-pole toggle

LED – AFDD+ status or tripping reason monitor

Comprehensive fire protection in end circuit only with this SIGNET

Tripping indicator

AFDD+ status

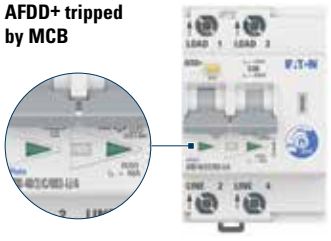
OK

Call an electrician (when toggle is in "up" position)

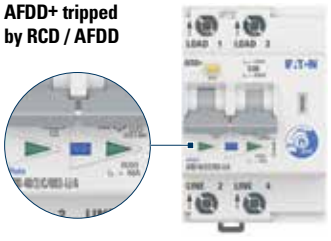
Call an electrician (after the reset)

2 When the AFDD+ trips, the tripping indicator shows which function tripped the device.

AFDD+ tripped by MCB

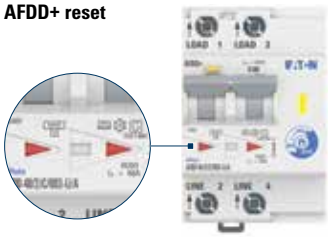


AFDD+ tripped by RCD / AFDD



3 After reset the tripping reason can be recalled and will be shown by a blinking LED. The LED indicator displays the status and detailed fault.

AFDD+ reset



Blinking LED

- **x 1** - serial arc
- **x 2** - dimmed serial arc
- **x 3** - parallel arc
- **x 4** - overvoltage
- **x 5** - overheating
- **x 6** - call an electrician

Extended protection for people, property and assets

Protection against electrical hazards has evolved and improved to arrive at today's state-of-the-art EATON solutions.

Money-saving

Billions of dollars are lost because of fires. The AFDD+ makes a definite and significant contribution to reducing this loss, by offering installers for the first time a single compact device which not only increases safety but also reduces the risk of fire hazards.

Time-saving

Easy to operate and with no assembly required, the EATON AFDD+ is a fully integrated device, resistant to nuisance tripping, with sensitivity above the requirements of the product standard.

In case of an earth fault, having all protection in one device makes fault finding easier. And, as the AFDD+ provides tripping reason indicators, you, as a professional electrician, know immediately what to look for.

End User Convenience

In the case of any (earth) fault, only the circuit that caused the fault will trip so other circuits will remain powered.

Market-leading

EATON's long experience in developing electronic protection devices ensures the company's leading position in providing reliable and safe electronic protection devices – of which the AFDD+ is the latest in a long line.

Comprehensive protection in final end circuits

The AFDD+ provides threefold protection in the end circuits, in one compact device

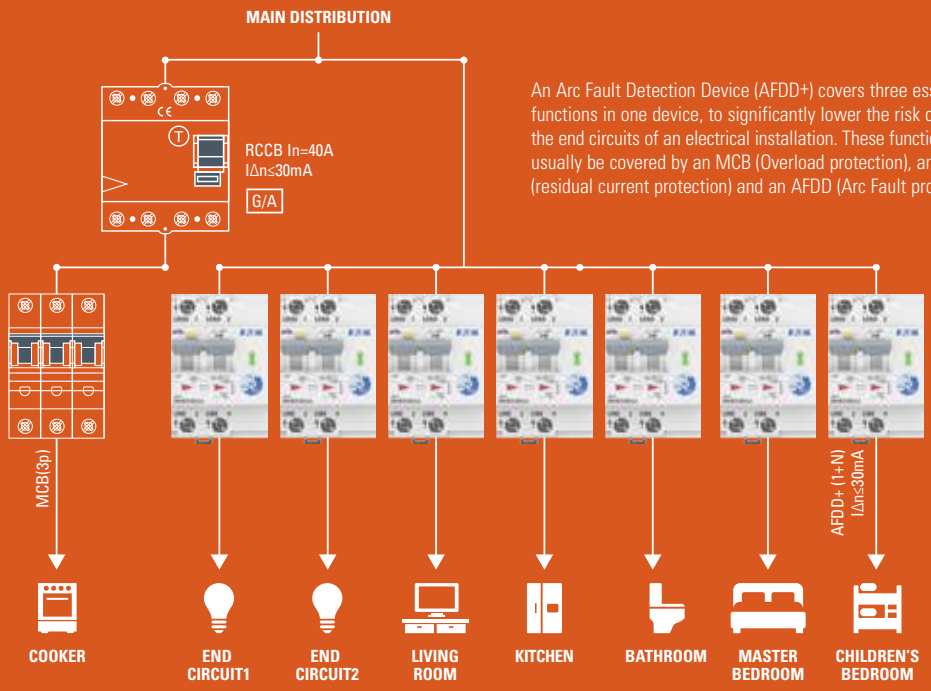
ARC FAULT PROTECTION
+ ADDITIONAL PROTECTION
+ FAULT PROTECTION

EATON's extended protection concept reduces the remaining risk in low voltage electrical installations.

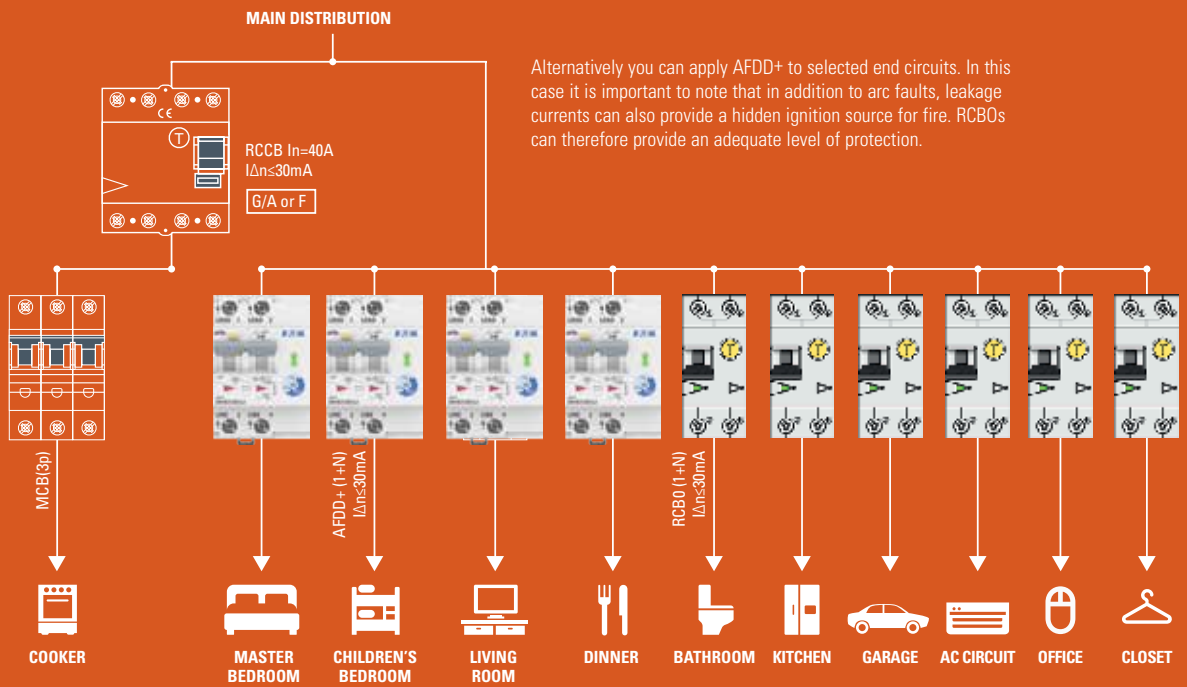
Choose your level of protection according to your needs

The most comprehensive protection can be achieved by installing AFDD+ for every end circuit.

However you can instead apply AFDD+ to most important selected end circuits. In this case it is important to note that in addition to arc faults, leakage currents can also provide a hidden ignition source for fire. In this situation a type B characteristic RCD needs to be added as a complementary measure in the root, to reduce the overall fire risk. Moreover selective type RCDs (type S; 100 mA, 300 mA) are well suited to detecting leakage currents.



An Arc Fault Detection Device (AFDD+) covers three essential functions in one device, to significantly lower the risk of fires in the end circuits of an electrical installation. These functions would usually be covered by an MCB (Overload protection), an RCD (residual current protection) and an AFDD (Arc Fault protection).

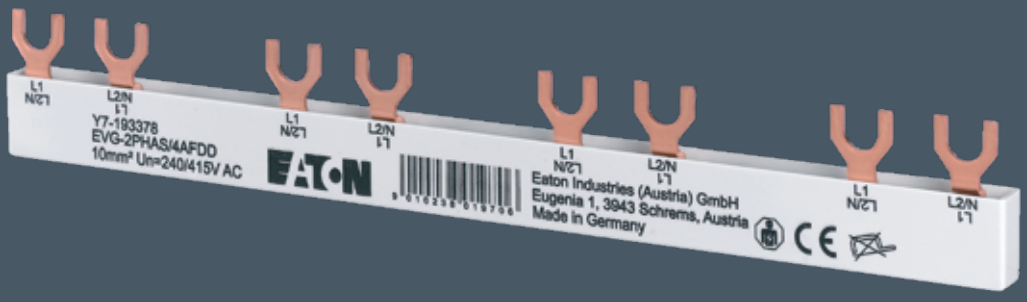


Alternatively you can apply AFDD+ to selected end circuits. In this case it is important to note that in addition to arc faults, leakage currents can also provide a hidden ignition source for fire. RCBOs can therefore provide an adequate level of protection.

AFDD+ Busbar

Busbar systems are commonly used worldwide and are rapidly gaining broader acceptance. In specific the AFDD+ busbar offers installers the highest,

- **Flexibility** and eases installation
- **Safety**
- **Cost reduction** within:
  - Overall design (less material, intuitive installation, less connection failures)
  - Integration (easier installation, less time consuming)
  - Better overview (no cable clutter!)



Eaton's mission is to improve the quality of life and the environment through the use of power management technologies and services. We provide sustainable solutions that help our customers effectively manage electrical, hydraulic, and mechanical power – more safely, more efficiently, and more reliably. Eaton's 2019 revenues were $21.4 billion, and we sell products to customers in more than 175 countries. We have approximately 93,000 employees. For more information, visit Eaton.com.

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