Increasing *availability* of LV electrical *networks*

Unsupervised installations
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1.1. Purpose of electrical switchgear

1.1.1. The requirements

For users and operators, electrical power must be:
- risk-free (safety requirement for equipment and people)
- always available.

Safety of the electrical installation is ensured by:
- compliance with electrical installation standards
- implementation of protection switchgear conform to product standards
- in terms of availability, by increased availability of electrical networks, i.e.:
  - co-ordination of protection devices to limit tripping of several protection devices when a fault occurs (a single tripping on the lowest rating)
  - choice of products not affected by the electrical disturbances experienced on the network.

1.1.2. The protection plan

These requirements are expressed by the following, as regards the protection plan:
- in terms of safety, by solutions guarding against the risks caused by insulation faults. These faults are:
  - electrification or electrocution of people
  - destruction of loads and risk of fire.

The occurrence of an insulation fault is not negligible.

1.1.3. The resetting operation

Compliance with these principles guarantees optimum operation of electrical power distribution.

However, it is a fact that all faults occurring on the installation result in partial placing out of operation of the latter and require the installation to be reset, after any necessary inspections and repairs.
Electrical switchgear

On the other hand, for specific applications, placing out of operation, even partially, of the installation may:
- generate serious malfunctioning of the application that might interfere with safety
- be durable if the installation is not very accessible
- be caused by transient phenomena that do not affect, or only temporarily, installation safety. Consequently, the installation of a resetting device on the electrical switchgear ensuring automatic re-energisation after tripping of a device, considerably reduces the risk of loss of availability and contributes to overall safety of the application.
Faults and disturbances in low voltage networks

2.1. The short-circuit

Short-circuits are normally caused by accidental contact between two power or earth conductors. NB: a phase-to-earth insulation fault is equivalent to a phase-to-neutral short-circuit in TN.S earthing systems.

Phase-to-neutral, phase-to-phase and phase-to-earth short-circuit.

Rodents can survive for a number of months, without water, feeding only on the electrical cables placed in busbar trunkings. Crawling animals, that are longer, can bring two live parts of an electrical installation into contact. Routings of mobile cables such as those of travelling cranes, robots and automatic machines are frequently affected by short-circuits resulting from crushing or tearing or from ageing of the electrical conductor insulator. During earthwork, excavators and mechanical machinery can sever all types of electrical power supplies.

2.2. The overload

The causes of tripping of protection devices due to overloads in an electrical installation are many. However two main causes can be identified:
- the electrical installation changes over time and nominal current is exceeded when the number of loads increases. This is for example the case of an increase in machine installed base, number of workstations, terminals, amount of traffic, etc.
- loads consume more current than normal due to a malfunction, for example: clogged lifting pumps, obstructed ventilation systems, overloaded or incorrectly serviced traversers, improperly adjusted or maladjusted systems, deterioration over time of parameters leading to reduced efficiency generating increased power, etc.

2.3. The leakage currents

Leakage currents can have several origins:
- leakage currents resulting from an insulation fault (excluding phase-to-earth short-circuit faults).
They are normally caused by breaking of phase-to-earth insulation (of cables) and are forerunners of a fault leading to a short-circuit. The most well known is the motor winding, but the phenomenon is similar when a deposit of residue, in most cases damp, is gradually accumulated on live parts to join a component that is earthed. Electrical coffee-makers and other devices using water and electricity are frequently sources of earth faults. The water resulting from condensation and the air coming from the machine ventilation systems can convey particles of matter used in this load and be deposited between a live conductor and the frame, normally along the insulator.
Faults and disturbances in low voltage networks

The role of the protection devices is then to eliminate all faults likely to result in risk either for people or equipment.

- leakage currents due to the capacitances of cables and electronic equipment filters.

The phenomenon is linked to equipment incorporating electronic components which, in order to respect the European Directive or other directives worldwide on electromagnetic compatibility, use filters with earthed capacitances.

These capacitances are connected between the phase and neutral power conductors and the earth (see diagram below). Consequently, they are responsible for high transient currents particularly on energisation or de-energisation of circuits (see SI earth leakage protection guide). These currents flowing off to earth are specific to interference-suppression filters. Today, these phenomena are very familiar to electricians: their extremely random nature, often correlated with other phenomena, makes them hard to diagnose.

For very long cables, power conductors behave like mains filters and produce the same effects. 100 metres of cable have more or less the same capacitance as a computer workstation.
2.4. Disturbances due to surges

There are two types of surge: those generated by a lightning impact and those resulting from electrical switchgear switching operations.

- surges resulting from lightning strokes (see figure below) can affect all electrical installations. Consequently, they are without doubt the main source of nuisance tripping of electrical protection devices. In most cases an earth leakage protection device will trip. The incomer circuit-breaker, if it is of the residual current kind, is the first concerned as it affects the entire electrical installation.

Should lightning fall on a line or an electrical installation, it will cause a potential build-up that will lead to arcing to the earth resulting in tripping of earth leakage and/or thermal magnetic protection devices.

- operating overvoltage (see figure below) result from opening or closing of switchgear on the electrical network (current switching on a high power network). The phenomenon that creates most disturbance is that generated by surges occurring on the network when a protection device cuts an electric current.

The electrical power transmitted by this second surge category is markedly less energetic than that transmitted by a lightning stroke occurring close-by.

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**Lightning surge.**

**Operating overvoltage.**

- surges resulting from breaking of the neutral conductor.

In three-phase systems, breaking of the earthed neutral conductor connection results in a potential rise of the neutral (according to load unbalance).

Phase-to-neutral voltage is also affected and can increase by $70\% \left( U_0 / \sqrt{3} \right)$.

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**Displacement of the neutral point in event of breaking (case $Z_i \gg Z_j$ and $Z_j$).**
The main cause of harmonic currents are loads incorporating rectifiers such as mains switch-mode power supplies and, in particular, those currently used in office computers. These loads, normally single-phase, can be numerous and generate a 3rd order harmonic load at 150 Hz in three-phase power circuits. Harmonic currents can be greater than nominal current and attain in the neutral conductor 1.7 times the value of the root mean square current flowing in the phase conductors.

These currents **are not likely to cause earth leakage protection devices to trip**, but, on the other hand, they can lead to tripping of the neutral conductor protection device if it has been calculated in the phase image. A badly protected reduced cross-section of the neutral conductor may result in deterioration of the latter. In most cases it is office buildings, where microcomputers are omnipresent, that suffer most from harmonic currents ($IN > 130\% \text{ lphase}$).
The basic principles for improving continuity of supply

3.1. A sound electrical installation

Installation standards such as NF C15-100 or IEC 60364 lay down rules in order to guarantee safety of people and equipment. Consideration of requirements concerning continuity of supply is based on solutions adapted to each individual case.

First and foremost it should be borne in mind that an electrical installation in which continuity of supply is essential must be properly designed.

All too often protection devices are removed to prevent nuisance tripping. This tendency is particularly obvious in the case of nuisance tripping of earth leakage protection devices. In this case the risk of serious damage is great both for safety of people and equipment. However continuity of supply is not increased as a result, since even if nuisance tripping is eliminated, it is replaced by incidents or accidents whose consequences are generally far more serious (opening of upstream protection devices).

3.2. The standards

Protection of “unsupervised installations” depends on the installation standards specific to each country.

- IEC 60364 authorises use of resetting devices even for domestic use
- for instance, in France, for installations generating their own power, NF C 15-100 considers:
  - for domestic type installations, use of automatic resetting devices is forbidden
  - for non-domestic type installations, use of resetting devices, is authorised, provided that (paragraph 471.2.5):
    - their presence is signalled in the vicinity of the resetting device
    - automatic operation can be locked
- urban lighting satisfies specific requirements, for instance, in France:
  - NF C 17-200 deals with urban lighting
  - the UTE C 17 205 guide illustrates the main application rules of NF C 17-200
- the UTE C 17 202 guide illustrates the main application rules concerning installation of light garlands
- the UTE C 17 210 practical guide is dedicated to electronic earth protection devices for public lighting.

Automatic resetting devices are authorised by these standards.

In short

Basic principles:
- a sound electrical installation with suitable protection devices
- elimination of protection devices normally results in reduced availability.

For installations:
- non-supervised
- non-domestic

Installation standards authorise automatic resetting.
### The basic principles
for improving continuity of supply

#### 3.3. Choosing the most suitable protection devices

#### 3.3.1. Shorts-circuits

This is certainly one of the most tricky issues for electricians designing electrical installations. For this purpose, he must ensure good co-ordination of protection devices (see expert guide no. 5).

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**In short**

Confronted with the risk of faults, co-ordination of protection devices and a properly designed wiring diagram optimise continuity of supply.

Confronted with the risk of disturbance: 3 requirements, 3 solutions, 3 products:
- **the surge arrester** protects electrical equipment from destruction caused by excessive surges
- **the immunised earth leakage device** guards against nuisance tripping caused by high frequency stray currents
- **the resetting device** allows re-supplying on various types of faults or disturbances.

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The short-circuit current is seen by all circuit-breakers upstream of the fault: **only good discrimination** (total) of the protection devices can guarantee only the opening of the lower rating circuit-breaker.

To increase availability of a feeder, we recommend that you supply it as far upstream as possible (near the source) to prevent tripping a protection device for another item of equipment.

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On networks with high availability, use of an automatic resetting device may be justified if discrimination is partial or if a short-circuit can be eliminated naturally (this is rare). This technique is used in high voltage but seldom in low voltage: a rodent or crawling animal causing a fault leads in most cases to a permanent short-circuit fault.

**In all cases resetting must be considered to be exceptional**, and the number of reset attempts limited.
3.3.2. Overloads

The overload current is seen by the circuit-breakers upstream of the faulty load. To prevent tripping of these protection devices, it is necessary:

- either to size them without taking a lamination factor (solution 1)
- or to individually protect each sensitive feeder by a circuit-breaker (solution 2).

It is always preferable to supply a feeder as far upstream as possible to prevent tripping of a protection device for another item of equipment.

**Use of an automatic resetting device on a sensitive feeder** of a network with high availability allows automatic re-supplying, normally temporary, during the time required for maintenance services to take action.
The basic principles for improving continuity of supply

3.3.3. Earth faults

When the earth leakage protection device is extremely sensitive, less than or equal to 30 mA and has a personal protection role, automatic resetting, except in specific cases (urban equipment, public lighting) is not recommended and in some cases even forbidden for safety reasons (see "standards" paragraph).

- leakage currents resulting from an insulation fault (excepting phase-to-earth short-circuit faults).

To deal with the numerous cases of transient nuisance tripping such as those linked to the presence of water, the resetting device, when sufficiently time-delayed, makes it possible to wait for the fault to disappear before resetting the protection device. This solution is commonly used for outdoor public lighting, urban equipment, light signs, traffic lights as well as in many other cases.

- leakage currents due to the capacitances of cables and electronic equipment filters in the presence of disturbances (interference).

Standard earth leakage protection devices can be disturbed by leakage currents generated by the capacitances of very long cables or filters contained in electronic equipment. These capacitors have an impedance that is reversely proportional to frequency. Since the interference currents are high frequency, they can flow off to earth via these capacitors and can be interpreted as an earth leakage current by the earth leakage protection devices upstream.

Leakage current due to the HF filter on closing of D1.

This phenomenon is responsible for nuisance tripping of standard earth leakage protection devices. To limit the risk of nuisance tripping of such devices, it is essential to use protection that is immunised against this type of wave.

In the case of high amplitude disturbances, the resetting device helps increase the reliability of electrical distribution. Combined with an immunised earth leakage protection device, it ensures maximum availability of electrical power.
3.3.4. Surges

3.3.4.1. Lightning

- a lightning impact occurring far from both the electrical installation and the supply lines has no effect for installations that are properly designed and produced, i.e. with surge arresters and immunised earth leakage devices (see lightning protection guide)
- a lightning impact close by can lead in some cases to tripping of the earth leakage protection devices as well as of the thermal magnetic protection devices.

![Surge arrester diagram]

- a surge arrester to limit surges
- immunised earth leakage protection devices to guard against nuisance tripping
- a resetting device on feeders with high continuity of supply to put the feeder back into operation after a lightning stroke close by. Thus even if opening of the protection devices remains exceptional, for sites where continuity of supply is important, common usage recommends installing a surge arrester to limit surges, immunised earth leakage protection devices to guard against nuisance tripping and a resetting device on feeders requiring high continuity of supply to put the feeder back into operation after a lightning stroke close by.

Note that an electrical installation containing no electronic components (no filters) and no very long cables (no capacitance) could be produced with a surge arrester and standard earth leakage devices combined with resetting devices. However, common usage nevertheless recommends use of immunised earth leakage devices for sensitive sites. This is because resetting devices calculate the number of trippings and resettings and de-energies the feeder after a certain number. If standard earth leakage protection devices are used, the risk is that of several trippings due to far-off lightning impacts in a short period of time. This situation may lead to blocking of the automatic resetting device which interprets this as a permanent fault.

3.3.4.2. Operating overvoltages

Properly designed and produced installations use a surge arrester and immunised earth leakage devices. These measures are sufficient to guard against nuisance tripping caused by operating overvoltages.

3.3.4.3. Harmonic currents

In installations and buildings where electronic components are omnipresent, it is highly recommended to properly evaluate the load in the neutral conductor to assess its cross-section. Use of a half cross-section for the neutral is normally forbidden. The only solution is to respect cable cross-section calculation rules.
The basic principles for improving continuity of supply

3.4. Role and importance of the automatic resetting of supply

The purpose of protection devices is to ensure integrity and safety of electrical installations. If the permissible stress is exceeded, then the protection device will trip. After tripping, the installation must be checked, repaired if necessary and re-energised. In practice, it is often re-energised and it is only if it retrips that the electrical installation is checked. These operations are performed manually. Isolated unmanned sites are often far away, hard to get to and have only limited autonomy.

This is the case of stations controlling railway traffic, weather forecasts, displays, road checks, radio relays for the Gendarmerie or for mobile telephony. These sites normally have an autonomy of roughly twenty minutes and access times of one to twelve hours.

Thus the resetting device prevents interventions consisting of simple manual resetting, leading to quicker re-supplying of the site (no operating losses) and intervention of maintenance personnel at less frequent intervals, later and at the right time.

In many cases, the installation is made up of electronic components (measurement, supervision, telecommunication, etc.) and is able to operate on batteries. Autonomy is normally roughly twenty minutes which enables most mains outages to be covered. The resetting device is ideal for resupplying the installation further to tripping of a protection device on a normally transient fault. In most cases, these faults are linked to the stormy weather in the region, aggravated by geographical situation (at altitude, near metal masts, aerials, stretches of water, etc.). For these same reasons, access is difficult and intervention times long, particularly in winter when snow can make access by road impossible.

For isolated unmanned sites, the resetting device can automatically resupply the site while at the same time ensuring electrical safety (locking on a permanent fault).
How to use a resetting device

4.1 Basic principle

If the fault is transient, the electrician resets the protection device. If the fault is permanent, it repairs then puts it back into operation. The resetting system analyses the nature of the fault and, according to the analysis:

- either de-energises the feeder
- or resets the protection device
- after a time delay
- a limited number of times.

Consequently, after a fault, the resetting device must:

- analyse the behaviour of the protection devices on resetting in order to prevent all resetting on a permanent fault
- allow a certain equilibrium to be restored to the resupplied system by placing a time delay on the resetting orders.

On the first fault, a resetting device delays for a time (T₁) the first resetting order, then checks that the fault has disappeared. If necessary, it locks the automatic resetting device and de-energises the feeder.

For a re-occurring transient fault, it is then possible to reset the protection device by repeating the above operation a certain number (n) of times in succession for a given period of time (T₂), beyond which the system considers that the fault is permanent and de-energises the feeder.

4.2 Operation of a resetting device on a permanent fault

4.2.1. On a short-circuit

A circuit-breaker must only open a limited number of times on a short-circuit. This is because there is a risk of irreversible deterioration and/or fire of the downstream circuits due to repeated thermal overloads.

Resetting followed by immediate opening characterises a fault or a permanent insulation fault. In this case it is essential to prevent other reset attempts.

The feeder in question must be de-energised.
How to use a resetting device

4.2.2. On an earth fault
An earth fault, followed by immediate opening of the protection device, normally indicates an established fault. In this case, just as for the short-circuit, we recommend that the protection device shall be locked.

4.3. Operation of a resetting device in the presence of transient fault risks

4.3.1. Lightning
Lightning is the first risk causing the electrician to install a resetting device which, do not forget, must be combined with a surge arrester to prevent deterioration of electrical equipment.

We recommend that you choose a time (T1) that is sufficiently long to let the storm move away and prevent a number of consecutive resets that would result in resetting device blocking (permanent fault).

In mountain regions and regions exposed to lightning, resetting should be delayed by 3 to 5 minutes (T1), while at the same time authorising more than 3 (n) resets in less than 2 hours (T2) (see risk evaluation software).
4.3.2. Overloads

Tripping of a protection device on a “thermal” overload must be considered to be abnormal insofar as it can conceal a latent fault due to wear, insufficient maintenance, etc. and requires checking by a maintenance operator to inspect the installation.

The time (T1) characterising the period during which the protection device remains open after tripping must be sufficiently long to enable the load to “restore its thermal equilibrium”.

For a motor, this time is normally more than half an hour. As thermal stress increases after several consecutive restarts, it is essential to limit their number (n) during the time (T2). This is particularly important when the start-up phase is long (systems with high inertia).

Motor manufacturers are normally able to supply charts designed to calculate these constants.

The same generally applies for many installations that have strong and long starting currents. When configuring the resetting device, this must be taken into account to determine (n) and the times (T1) and (T2) that must be sufficiently long to prevent damaging the load. Except in rare cases, we recommend against programming a time T1 less than one or two minutes.

In all cases, indication of the number of resets is very useful for evaluating the seriousness of the situation after a fault.

In the case of a compressor (cold, air conditioning, etc.), it is essential to anticipate a time T1 sufficiently long to allow restoration of internal equilibrium of the condenser. Excessively quick restarting may damage the compressor.

As a rule a protection device is installed for this specific risk.

4.3.3. Signalling

The “locking on a fault” information supplied by the resetting device allows maintenance services to take action only on sites with a genuine fault.

This signal is normally transmitted by modem on a private or public telephone line.

Moreover, the resetting counter provides maintenance services with valuable information on evaluation of the risk linked to transient or latent faults.
Schneider has developed an automatic resetting system, ATm, for the C60 and C120 circuit-breakers of the Merlin Gerin M9 ranges, equipped with Tm remote control. The complete system includes the automatic system and all the necessary protection devices (overload, short-circuits, earth leakage protection devices, surge arrester, etc.).

It is used to supply installations without supervision, that are isolated and hard of access, in order to satisfy requirements for availability and high continuity of supply in applications of the type:

- Communication networks (mobile telephony, private radio, cable network, etc.)
- Measurement stations (gas transport, dams, weather forecast)
- Lighting (motorway rest areas, tunnels, car parks)
- Collection and treatment of water
- Signalling (road, railway, air, etc.).

### 5.1 Functions

The system consists of a C60 circuit-breaker, a Vigi C60 module (the "si" type is recommended), a Tm remote control, an SD fault signalling auxiliary and the ATm automatic resetting system.

The ATm controlling the system has the following interfaces on the front face under the sealed transparent cover:

- A switch for selecting the number of resettings authorised or for initialising the ATm
- A potentiometer T2 for setting the period authorising the number of resettings selected
- A potentiometer T1 for setting the time delay before automatic resetting
- An indicator light (yellow) for signalling ATm status

It is also equipped with:

- An input for an external control device (optional) for remotely disabling the ATm
- An output for remote signalling of the presence of a permanent electrical fault

On sites exposed to lightning, it is vital to add:

- A surge arrester
- A surge arrester protection and disconnection circuit-breaker.

### 5.2 Architecture

*Block diagram of an automatic resetting installation.*
Additional technical information

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6.1. Applications with a single feeder

6.1.1. Basic diagram

For small isolated electrical installations: road signalling, car park lighting, lifting pumps.

Principle
- The ATm system ensures automatic resetting after tripping on a fault of the Tm + Vigi 60 remote control residual current device.
- It recognises the type of fault (transient/permanent fault). The automatic system locks the Tm remote control if the fault is permanent, thus de-energising the feeder.

Electrical circuit

Wiring diagram of the installation.

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<th>cat. no.</th>
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<td>1-2P Tm</td>
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<td>ATm</td>
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<td>18316</td>
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<td>SD auxiliary contact</td>
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Description of the ATM

The following are placed on the front face of the ATM, under the sealed transparent cover:

- A switch for selecting the number of resettings authorised (0, 1, 2, 5 or 10), and for stopping and initialising the ATM (off/reset).
- A potentiometer T2 for setting the maximum time (12 to 120 minutes) authorising the number of resettings selected on the switch.
- A potentiometer T1 for setting the time delay (30 to 300 seconds) before automatic resetting.

- An indicator light (yellow) for indicating ATM status:
  - Off: de-energised or off/reset position.
  - Pulsed: normal operation.
  - Flashing: resetting cycle in progress.
  - Permanently on: ATM locked.

Block diagram of the installation.
6.1.2. Remote control diagram

For isolated electrical installations requiring remote supervision: motorway signals, etc.

**Principe**
- The ATm system ensures automatic resetting after tripping on a fault of the Tm + Vigi 60 remote control residual current device.
- It recognises the type of fault (transient/permanent fault). The automatic system locks the Tm remote control if the fault is permanent, thus de-energised the feeder.
- Visual and/or electronic information is remotely available for users.

**Surge protection**
- A disconnection circuit-breaker must be associated with the PRD surge arrester providing protection against atmospheric surges, with a breaking capacity identical to the short-circuit current (Iscc) of the installation.

**Remote supervision**
- A door contact or a key selector switch S1 may be used to remotely disable the ATm. Remote locking of the automatic system is also possible to ensure maximum maintenance safety.
- The indicator light H allows remote signalling of ATm disabling.
- The pulse counter Cl counts the number of "faults".
- Output 28 of the ATm can be used to transfer the information "Tm locked" to the operating centre. This transfer is possible via telephone transmitter.

**Electrical circuit**

![Wiring diagram of the installation.](image)

**Wiring diagram of the installation.**

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<td>2P selector switch</td>
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  - Pulsed: normal operation
  - Flashing: resetting cycle in progress
  - Permanently on: ATM locked.

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*Block diagram of the installation.*
6.2. Multi-feeder applications

6.2.1. Sophisticated diagram with multiple resets

For isolated electrical installations very sensitive to disturbances and with a very high continuity of supply: radio transmitters, etc. The application consists of several HF transmitters each controlling a transmission/reception aerial. The entire assembly is installed in specific electronic bays with class II insulation: each bay has an operating autonomy of 20 minutes. The installation is made in specific shelters that are delocalised in very remote settings.

**Mobile telephony transmitter**

![Diagram of mobile telephony transmitter](image)

**Characteristics of the mobile telephony application**

- In order to “cover” a region correctly, the network of transmitters consists of some hundred extremely delocalised sites. These are characterised by:
  - extreme sensitivity to disturbances: installation on water towers, high unprotected sites, etc.
  - difficult access
  - absolute continuity of supply
  - difficult, costly maintenance (large number of sites, urgency, site very hard to reach, etc.).

**Principle**

Protection is provided by C60 circuit-breakers equipped with Vigi Si. The resetting function is performed by a Tm module controlled by a nano PLC.

**Surge protection**

A disconnection circuit-breaker must be associated with the PRD surge arrester providing protection against atmospheric surges, with a breaking capacity identical to the short-circuit current (Isc) of the installation.
6.3. F.A.Q.

**Question**
With a TT type earthing system, is it essential for the incomer circuit-breaker to be of the residual current type?

➢➢➢➢➢
No, in the case of protection against indirect contact, you should limit potential rise of frames. This function is performed by the incomer circuit-breaker if it is of the residual current type, but also if it is not, provided that all the downstream feeders are equipped with RCDs (see example in 6.2.1. for mobile telephony).

NB: the electrical switchboard and distribution equipment must be class II.

**Question**
I already use a resetting device, do you recommend protecting a computer feeder with a standard 30 mA RCD? (in the event of nuisance faults, it is the resetting device that resets).

➢➢➢➢➢
No, it is necessary to install an Si RCD (super-immunised) to remove all risk of nuisance tripping. This is because several consecutive nuisance trippings would be interpreted as a permanent fault.

**Question**
Can a surge arrester be protected by a resetting device?

➢➢➢➢➢
Yes, if it is of the residual current type, protection must be delayed (of the S type).

**Question**
I have several feeders supplying loads with high starting currents. Can this type of installation be started automatically?

➢➢➢➢➢
Yes, by installing several resetting devices that will be staggered in time (use of an additional time delay).

**Question**
Is it possible to use the ATm for outdoor lighting applications (car parks, gardens, etc.)?

➢➢➢➢➢
Yes, if it is installed in an electrical switchboard, it should preferably be associated with an RCD that may be compulsory (30 mA for urban equipment in France).

**Question**
Can the ATm be used in the TT earthing system, with a NON residual current incomer circuit-breaker?

➢➢➢➢➢
Yes, if the installation is class II, you should use a switchboard also ensuring class II insulation (the ATm and these associated devices have class II insulation with respect to the operator but not to the symmetrical DIN rail, hence the obligation to choose a suitable electrical switchboard).
Notes