

Function

Vigirex relays measure the earth-leakage current in an electrical installation via their associated toroids.

Vigirex relays may be used for:

- residual-current protection (RH10, RH21, RH99)
- earth-leakage monitoring (RMH or RH99)
- residual-current protection and earth-leakage monitoring (RHUs or RHU).

Residual-current protection relay

Protection relays control the interruption of the supply of power to the monitored systems to protect:

- people against indirect contact and, in addition, against direct contact
- property against fire hazards
- motors.

A relay trips the associated circuit breaker when the set residual operating current $I_{\Delta n}$ is overrun.

Depending on the relay, the threshold $I_{\Delta n}$ can be fixed, user-selectable or adjustable and the overrun can be signalled by a digital display of the measured current or a LED.

Circuit-breaker tripping can be either instantaneous or delayed. On some relays, it is possible to adjust the time delay.

The protection relays store the residual-current fault in memory. Once the fault has been cleared and the output contact has been manually reset, the relay can be used again.

Earth-leakage monitoring relays

These relays may be used to monitor drops in electrical insulation due to ageing of cables or extensions in the installation.

Continuous measurement of leakage currents makes it possible to plan preventive maintenance on the faulty circuits. An increase in the leakage currents may lead to a complete shutdown of the installation.

The control signal is issued by the relay when the residual-current operating threshold is overrun.

Depending on the relay, the threshold can be adjustable or user-selectable and the overrun can be signalled via a digital display of the measured current or a LED.

The control signal can be either instantaneous or delayed. On some relays, it is possible to adjust the time delay.

Earth-leakage monitoring relays do not store the residual-current fault in memory and their output contact is automatically reset when the fault is cleared.


When used in conjunction with a Multi 9 ATm3 or ATm7 auto-reclosing controller (Schneider Electric catalogue numbers 18306 and 18307 respectively), they protect against earth faults due to insulation failures. Typical applications include telephone relay and radio repeater stations. In the event of a transient fault, this system can be used to automatically restore the supply of electrical power to an unattended station, thereby increasing availability and continuity of service.

Use

Vigirex relays may be used for protection and maintenance at all levels in the installation. Depending on the relays, they may be used in TT, IT or TNS low-voltage AC installations for voltages up to 1000 V and frequencies from 50/60 Hz up to 400 Hz.

Vigirex protection relays are suitable for use with all electrical switchgear devices available on the market.



The  mark indicates that the product meets both US and Canadian safety requirements.

Compliance with standards

Vigirex relays are designed to comply with the following standards:

- IEC/EN 60755: general rules for residual-current protection devices
- IEC/EN 60947-2: low-voltage switchgear and controlgear, part 2 (circuit breakers)
- IEC/EN 60947-5-1: low-voltage switchgear and controlgear, part 5-1 (electromechanical devices)
- IEC/EN 61000-4-2: electrostatic-discharge immunity test
- IEC/EN 61000-4-3: radiated, radio-frequency, electromagnetic-field immunity test
- IEC/EN 61000-4-4: electrical fast transient/burst immunity test
- IEC/EN 61000-4-5: surge immunity test
- IEC/EN 61000-4-6: immunity to conducted disturbances, induced by radio-frequency fields
- CISPR 11: limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radiofrequency equipment
- mandatory for CE marking:
 - EN 61000-6-2: immunity to industrial environments
 - EN 50081-1: emissions for commercial and residential environments
- IEC/EN 60664-1: insulation coordination for equipment within low-voltage systems, part 1
- EN 50102: degrees of protection provided by electrical enclosures against external mechanical impact
- IEC 60364 and NFC 15-100: installation rules for low-voltage electrical distribution
- UL 1053: relays RH10, RH21 and RH99 up to 220/240 V are designed to comply with standard UL1053.

Ground fault sensing and relaying equipment UL 1053

The basic standard used to investigate products in this category is UL1053 "Ground-Fault Sensing and Relaying Equipment".

The Listing Mark of Underwriters Laboratories Inc. on the products is the only method provided by UL to identify products manufactured under its Listing and Follow Up Service.

The Listing Mark for these products includes the name and/or symbol of Underwriters Laboratories Inc. (as illustrated on the label) together with the word "LISTED", a control number and the following product name "Ground Fault Sensing and Relaying Equipment".

This category covers ground fault current sensing devices, relaying equipment, or combinations of ground fault current sensing devices and relaying equipment which will operate to cause a disconnecting means to function at predetermined values of ground fault current in accordance with the National Electrical Code, ANSI/NFPA70.

The RH99, RH21 and RH10 (M and P) ground fault relays are control powered ground-fault protection devices used to protect an electrical distribution system from ground faults. The relay receives input from sensors, processes the information and if necessary closes output contacts which will cause the associated protection device to trip.

The product is a class 1 combination ground fault current sensor and relay. This equipment is intended to operate devices with shunt trip coils such as moulded case circuit breakers, moulded case switches and the like, which constitute the disconnecting means, by opening all ungrounded conductors at predetermined values of ground fault current.

This product is designed to protect circuits of not more than 600 V AC, 50/60 Hz only.

The relay should be marked with the following electrical ratings, for the two types M and P:

- type M: DIN format (Multi 9 type fast mounting or screw mounting)
- type P: front-panel mount (on panel, door, etc.)
- ratings:
 - fixed $I_{\Delta n}$ threshold (a number of choices) and no time delay (instantaneous) or
 - selectable $I_{\Delta n}$ threshold from 0.03 to 30 A and user-selectable time delay from 0 to 4.5 s (see settings on pages 433E2400.fm/32 to 37)
- input voltages:
 - AC: 20 to 24 V AC, 48 V AC, 110 to 130V AC or 220 to 240 V AC, 50/60 Hz, or
 - DC: 12 to 48 V DC
- maximum consumption: 4 W.



Front-panel mount device.



DIN device.

Environmental withstand capacity

Vigirex relays meet the environmental requirements contained in the following standards:

- IEC/EN 60068-2-30: damp heat, equipment not operating; relative humidity 95 % at 55 °C (hot and humid climate)
- IEC/EN 60068-2-52: salt mist; KB test severity level 2
- IEC/EN 60068-2-56: damp heat, equipment operating; 48 h, environment category C2.

They may consequently be used in all parts of the world.

Degree of pollution

Vigirex relays are suitable for operation in the most severe industrial environments. They meet the requirements of degree of pollution 3 as per standard IEC/EN 60664-1 and IEC/EN 60947-1 for low-voltage switchgear and controlgear.

Ambient temperature

Vigirex relays are designed for use in ambient temperatures from -35 °C to +70 °C. Relays equipped with a digital display are limited to -25 °C to +55 °C. Start-up should be carried out within the temperature range indicated above. The temperature range for device storage, in the original packing, is -55 °C to +85 °C.

Reinforced insulation for direct connection to upstream distribution system

The reinforced insulation of Vigirex relays (overvoltage category IV, the most severe) makes possible, without any additional galvanic isolation:

- direct connection of the relay power supply to the upstream circuit (connection upstream of an LV incoming device such as a Masterpact circuit breaker, for example)
- direct connection to the upstream busbars.

Insulation class

All Vigirex relays, whether DIN or front-panel mount format, have class II insulated fronts as per standards IEC/EN 60664-1 and NFC 15-100. The communication outputs on the RHU and RMH relays are also class II.

Degree of protection

According to standards EN 60529 (IP degree of protection) and EN 50102 (IK external mechanical impact protection), the devices are rated IP40 and IK07 for the front face through a door or on a front plate, IP30 for the other faces and IP20 for connections.

Vigirex relays comply with environmental-protection regulations.

Déconnecter A1-A2 avant test diélectrique

Disconnect A1-A2 before dielectric test

A1 A2

220 / 240 V AC

50 / 60 / 400 Hz

RH..P 380-415 V AC 5100512339

01221

56016

1234607

Information on the case.

Vibration withstand capacity

Vigirex relays meet the requirements of Veritas and Lloyd's (vibration test from 2 to 13.2 Hz \pm 1 mm and from 13.2 to 100 Hz – 0.7 g).

Labels and markings

- UL, CE and as per IEC 60947-2
- Vigirex relay supply voltage
- product part number
- the origin (Schneider Electric) and the connection terminals (see pages 433E2300.fm/24 to 28) are indicated on the product.

Recycling

The packaging is made of recyclable cardboard. Vigirex relays comply with environmental-protection regulations:

- moulded parts are made of thermoplastic materials (10 % fibreglass reinforced polycarbonate – PC10FV)
- the composition is indicated on the parts (e.g. PCFV for fibreglass reinforced polycarbonate)
- when disposed of, these materials do not produce polluting substances, even when burned.

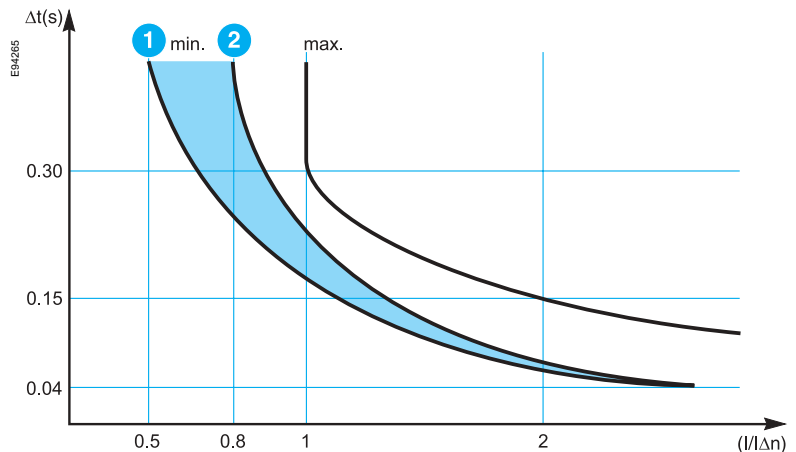
Maximum safety

Protection of persons against direct contact is ensured by an overall breaking time for the faulty circuit of less than 40 milliseconds:

Residual-current relays guarantee the protection of persons against direct contact by acting in less than 40 ms when set to a residual operating current of 30 mA and when used with Merlin Gerin or Telemecanique breakers with a maximum rating of 630 A. The protection of life and property against indirect contact is ensured by optimised measurement of the residual current.

The tolerances on the protection threshold $I\Delta n$ are less than those specified in the residual-current protection standard:

According to standard IEC 60947-2, instantaneous tripping must take place between 0.5 and 1 x $I\Delta n$. Vigirex relays trip between 0.8 and 1 x $I\Delta n$, thus increasing immunity to nuisance tripping by 60 %.



Operating tolerances for the protection threshold $I\Delta n$:

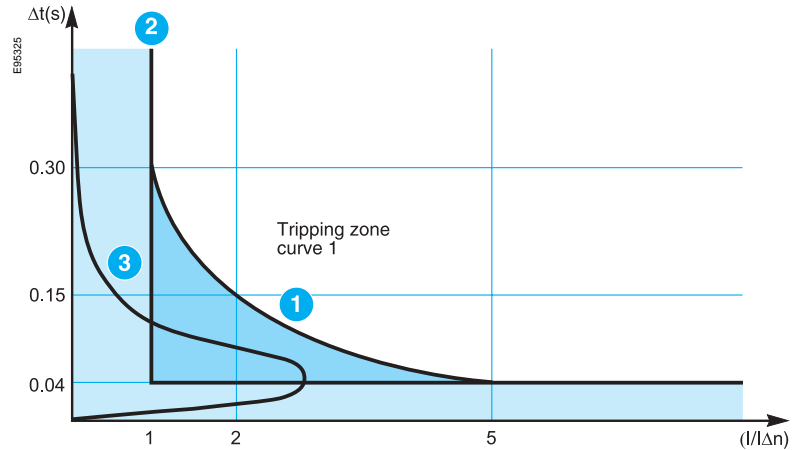
- 1 standards.
- 2 Vigirex.

Gain in immunity to nuisance tripping with Vigirex.

Inverse-time tripping curve:

When circuits are energised, the inverse-time tripping curve avoids nuisance tripping due to short, transient phase-sequence currents, which are caused by:

- the high transient currents caused by certain loads (e.g. motors, LV/LV transformers, etc.)
- the charging of capacitances between live conductors and earth.



- 1 Curve 1: inverse-time tripping curve as per IEC 60947-2.
- 2 Curve 2: tripping curve with fixed threshold $I = I\Delta n$.
- 3 Curve 3: transient zero phase-sequence current upon load energisation.

Zone of optimised continuity of service due to the inverse-time tripping curve.

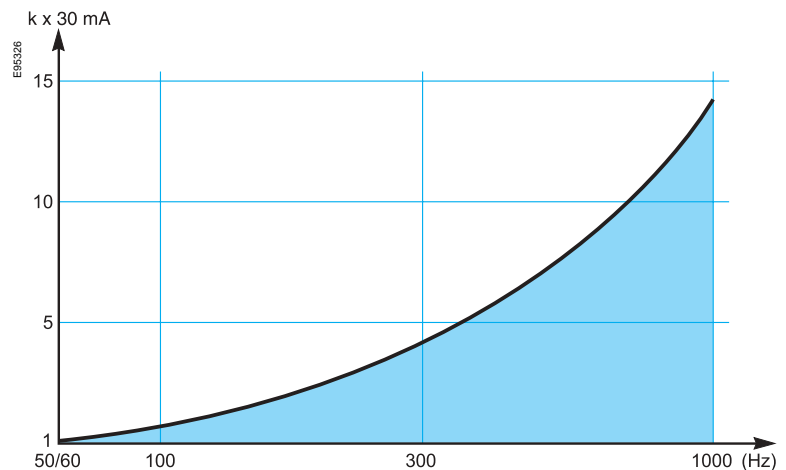
Non-tripping zone (curve 2).

Frequency filtering :

Frequency converters (e.g. variable-speed drives) implementing IGBTs (Insulated Gate Bipolar Transistor) generate significant levels of high-frequency (HF) leakage currents.

During normal operation (no fault), these capacitive HF leakage currents flowing in the installation conductors do not represent a danger for users. In general, residual-current protection relays are sensitive to these HF natural leakage currents.

If an insulation fault occurs downstream of the frequency converter, the fault current comprises a HF-current component. These HF fault currents do not produce the same physiological effects on the human body as 50/60 Hz currents (see IEC 60479).



Variation in the ventricular-fibrillation threshold depending on the frequency from 50/60 Hz up to 1000 Hz..

Gain in immunity to nuisance tripping with Vigirex.

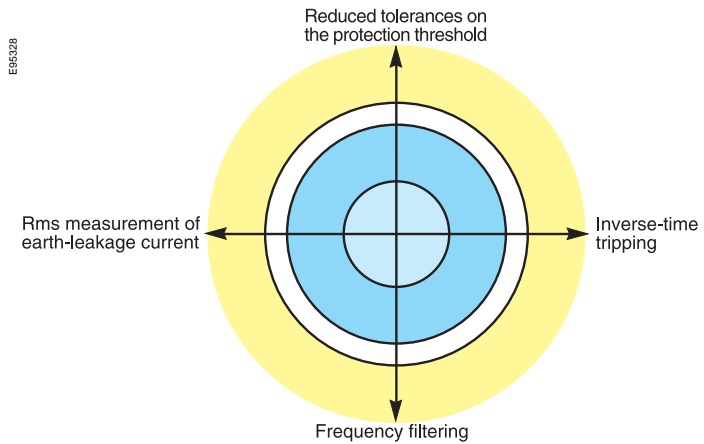
Frequency filtering on the Vigirex range of residual-current protection relays is designed to provide:

- maximum protection if an insulation fault occurs
- continuity of service that has been specially optimised for this type of load.

Rms measurements of earth-leakage currents

Rms measurement of fault currents provides the residual-current protection relays with the means to measure all types of signals and to calculate the weighted true rms value depending on the frequency filtering.

Rms measurement of earth-leakage currents, frequency filtering, the reduced tolerances on the protection threshold and the inverse-time tripping curve built into the Vigirex relays optimise protection of life and property and enhance the continuity of service.



- Non-tripping zone.
- Gain in immunity to nuisance tripping with Vigirex = optimised continuity of service.
- Reduced tolerances zone.
- Mandatory protection zone.

Continuous self-monitoring of Vigirex relays

Vigirex relays carry out continuous monitoring of:

- the relay/toroid link (RH10, RH21, RH99, RHU and RMH)
- the link between the RMH relay and the RM12T multiplexer
- the power supply
- the internal electronics.

In the event of problem, the fault or voltage-presence output contact on the protection relays (RH10, RH21, RH99, RHUs and RHU) is actuated. The cause of the fault must be cleared.

Two wiring techniques for protection relays

Two different wiring techniques are recommended:

- the first places a premium on safety. The voltage-presence contact on the Vigirex residual-current protection relay (RH10, RH21, RH99 or RHUs and RHU) is wired in series with the fault contact. This technique ensures failsafe operation.
- the second technique places a premium on continuity of service if the supply to the residual-current relay is cut.

See the wiring diagrams in chapter 3.

Test and reset

Test

According to standards IEC 60364 and NFC 15-100, a periodic test is required to check correct operation of the residual-current protection system.

The purpose of the test is to check:

- the output contacts:
 - the complete protection system with actuation of the output contacts (this shuts down the installation)
 - the protection system without actuation of the output contacts ("no trip" test) to maintain the installation up and running.
- correct operation of the display (RHUs, RHU and RMH), the LEDs and the internal electronics.

Reset

Whatever the test mode, a reset clears the fault stored in memory and resets the LEDs and the relay status condition.

Test and reset modes

Four possible modes	Actuation of output contacts	
	No	Yes
Local via button in front	■	■
Remote 1 relay	■ (1)	■ (1)
a number of relays	■ (1)	■ (1)
Via communication	■ (RHU/RMH)	■ (RHU/RMH)

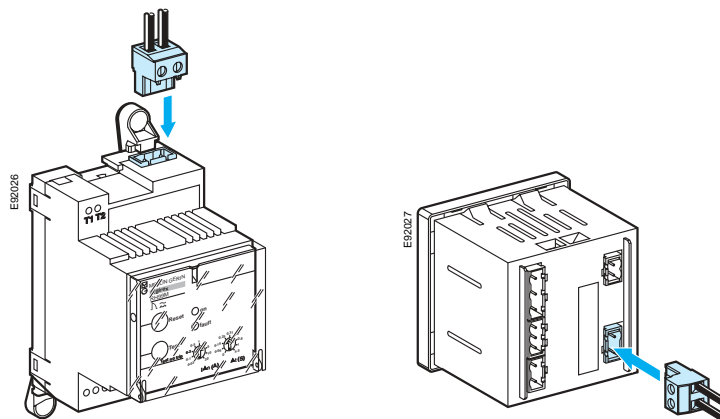
(1) Except for RMH.

Easy switchboard acceptance tests

During acceptance of a switchboard and prior to dielectric testing, isolation of the residual-current relays by disconnecting the supply is mandatory.

Vigirex relays are supplied via a plug-in connector for easy and secure connection and disconnection.

Connections for the front-panel mount relays in the Vigirex range also use plug-in connectors.



Supply connections for the DIN and front-panel mount formats.



DIN device with mounting lugs secured to a mounting plate.

Formats for all installation systems

Vigirex relays are available in two formats:

- front-panel mount format 72 x 72 mm (RH10, RH21, RH99, RHUs, RHU, RMH)
 - DIN format (RH10, RH21, RH99).
- On the DIN-format relays, it is possible to simply clip in:
- the toroids \varnothing 30 mm and \varnothing 50 mm
 - three mounting lugs for relay installation on mounting plates in control cabinets.

Installation system	Suitable format
Main LV switchboard	Front-panel mount
Power distribution switchboard: <ul style="list-style-type: none"> ■ instrumentation zone ■ modular-device zone 	Front-panel mount DIN

Formats for all installation systems (cont.)



DIN device.



DIN device with clip-in toroid.



Front-panel mount device.



Automatic control panel or machine panel.

Power distribution switchboard.

Main LV switchboard.



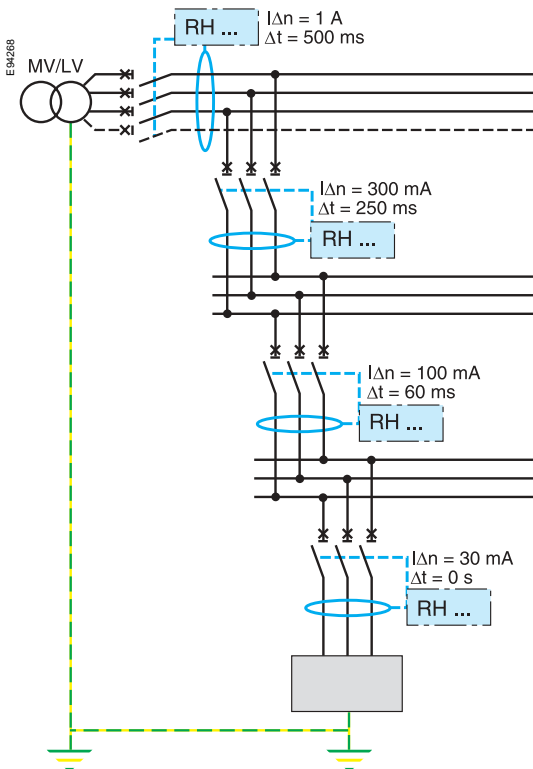
Motor Control Centre (MCC).



Lead-sealable cover.

Covers

All Vigirex relays are equipped with lead-sealable covers to block access to settings while maintaining access to the device test and reset buttons.



It is possible to divide the installation into a number of groups of circuits and to protect each group using the suitable residual-current device. The many fault, alarm and pre-alarm settings and time delays available in the Vigirex range makes it easy to integrate the residual-current relays at all levels in the electrical installation. Coordination between the upstream and downstream devices in an installation makes it possible to cut the supply (by the protection relay) exclusively in the part of the installation where the fault occurred.

Implementing discrimination

Discrimination between upstream and downstream residual-current devices is necessarily of the current and time type. It is ensured by correctly adjusting:

- the operating-current settings
- the non-operating and overall breaking times.

The following general discrimination rules ensure correct operation:

- in terms of the current, the setting for the upstream device must be double that of the downstream device (in accordance with the standardised rules for the operating / non-operating currents)
 - in terms of the time, the non-operating time (time delay) for the upstream device must be greater than the total time (the intentional residual-current device delay and the breaking time of the breaking device) for the downstream device
- These two conditions are summed up here:
- upstream $I_{\Delta n} \geq 2 \times$ downstream $I_{\Delta n}$
 - upstream non-operating time $\Delta T \geq$ downstream total time ΔT

Note: a residual-current device does not limit the fault current. That is why current discrimination alone is not possible.

The time/current curves indicate the operating-current values of the Vigirex devices depending on their standardised characteristics. When superimposed, the curves indicate the protection settings required to ensure total discrimination (see the curves pages 433E2500.fm/42 and 43).

The Vigirex devices, combined with Merlin Gerin and Telemecanique breaking devices (switches, circuit breakers), have successive operating-current and time-delay settings that enhance the discrimination rules mentioned above.

Discrimination rules

System (Schneider Electric breaking device + RCD)		Setting	
Upstream	Downstream	Ratio $I_{\Delta n}$	Time delay
Vigirex	Schneider RCD	1.5	1 setting apart, except ⁽¹⁾
Schneider RCD	Vigirex	2	1 setting apart, except ⁽¹⁾

⁽¹⁾ A difference of two settings is required for the 0.25 s setting (i.e. the 0.5 s and the 0.25 s settings).

Note: for further information, see chapter 4.

The Merlin Gerin residual-current protection ranges (earth-leakage protection function on Masterpact circuit breaker control units, Vigicomact, Multi 9 RCDs, etc.) are internally consistent and designed for combined use to ensure discrimination for insulation faults.

Electromagnetic disturbances

Vigirex relays are immune to:

- overvoltages produced by switching (e.g. lighting circuits)
- overvoltages produced by atmospheric disturbances
- radio-frequency waves emitted by devices such as mobile telephones, radio transmitters, walky-talkies, radar, etc.
- electrostatic discharges produced directly by users.

To guarantee immunity, Vigirex relays are tested in compliance with the following standards:

- IEC/EN 60947-2: low-voltage switchgear and controlgear, part 2 (circuit breakers)
- IEC/EN 61000-4-1: overview of the IEC/EN 61000-4 series
- IEC/EN 61000-4-2: electrostatic-discharge immunity test
- IEC/EN 61000-4-3: radiated, radio-frequency, electromagnetic-field immunity test
- IEC/EN 61000-4-4: electrical fast transient/burst immunity test
- IEC/EN 61000-4-5: surge immunity test
- IEC/EN 61000-4-6: immunity to conducted disturbances, induced by radio-frequency fields
- CISPR 11: limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radiofrequency equipment.

The high immunity levels of Vigirex relays ensure optimum safety without nuisance tripping.

Behaviour during micro-outages in the auxiliary supply

Vigirex relays are not affected by micro-outages lasting less than 60 ms.

The maximum break time during micro-outages complies with standard IEC/EN 60947-2.