VAMP 221
Selective arc flash protection for low and medium voltage power systems

VAMP 221 is an extremely fast arc flash protection system for LV and MV switchgear and controlgear.

Modern society heavily depends on an uninterrupted supply of electric power. Prolonged power outages cause loss of business to the power supplier and loss of production to the power consumer.

Regardless how safe a power system is, faults do occur. This being the case the damage caused by power system faults must be kept to a minimum level. The ultimate solution is to selectively isolate the fault as fast as possible, while maintaining the operation of the healthy network parts.

A VAMP arc protection system can principally be implemented in three different ways, as a autonomous master unit system, as a part of the Schneider Electric protection relay system or as an integration between a master unit system and the Schneider Electric protection relay system.

Customer benefits

- **Reduces loss of production**
The shorter the operate time of the arc protection system the smaller the damage caused by the arc fault will be and the shorter the possible outage of the power supply.

- **Prolonged switchgear life cycle**
A modern arc protection systems increases the life-cycle expectancy of switchgear installations, investment decisions in new switchgear installations can be postponed and money can be saved by re-vamping existing switchgear systems.

- **Reduced insurance costs**
The faster and better the protection system of a power installation is, the more generous the insurance terms and costs will be.

- **Low investment costs and fast installation**
A comprehensive arc protection is characterized by low investment costs and a fast installation and commissioning time. One successful operation of the arc protection system provides immediate investment pay off.

- **Reliable operation**
Function based on the simultaneous appearance of light and current or alternatively on the appearance of light alone, depending on the application. Designed according to IEC-60255 standard for protective relays.

- **Vast experience**
Schneider Electric is the pioneer in the field of arc flash protection with more than 10,000 VAMP arc flash protection systems and units with over 150,000 arc detection sensors in service world-wide.
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Summary

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Secure your assets and staff safety

An arc protection relay is a protective device used to enhance safety and minimize the material damage of the installation in the most hazardous power system fault situations. The arc protection system detects an arc in an installation and measures the fault current. In an arc flash situation, the arc protection relay immediately trips the concerned circuit breaker(s) to isolate the fault. An arc protection system operates much faster than conventional protection relays and thus damage caused by an arc short circuit can be kept to a minimum level.

Why arc flash protection?

When the traditional time-grading or blocking based protection coordination principle is used, the traditional protection systems may not provide fast enough protection of substation faults. Further, high-impedance type of earth-faults may cause prolonged operation times of earth-fault relays leading to the significant release of the arcing energy.

These facts pose a considerable risk to human beings and economical assets. The type of the protection is different from the function selected by the customer.

Conventional protection system of MV/LV switchgear

- Conventional protection system
- Resistance earthed network
- Outgoing feeder 50 (relay) + 60 (CB) = 110 ms (+ Auto-reclosing)
  - Incoming feeder 350 (relay)+ 60 (CB) = 410 ms

Re-VAMPed arc flash protection system for MV/LV switchgear

- Re-VAMPed arc flash protection system
- Advanced Multizone Arc Flash Protection System
- Total fault clearing time typically:
  - Outgoing/ingoing feeders 7 ms (relay) + 60 ms (CB) = 67 ms

Resistance earthed network

- Earth-fault relay operation times are typically set high, thus burning times of high-impedance type arc faults are prolonged.
  - Typically the burning time of an arc fault should be limited to less than 100 ms in order to avoid major damage
  - Burning times of nearly half a second will most certainly cause considerable damage in the switchgear installation.

- Fault clearance in 57 - 67 ms

The conventional MV protection schemes have traditionally been complemented by implementing busbar differential schemes. The differential scheme implementations are typically expensive due to extra CT’s needed and complicated engineering and wiring. Busbar protection systems based on interlockings are slow, minimum operate time usually being 100 ms + CB time. A modern arc protection system provides though a very cost effective high-speed busbar protection for air insulated MV switchgears.
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Solutions for arc flash protection

VAMP arc protection has a solution for every customer segment all over the power system

Panel builders
- Complement to arc resistant panel
- Enhanced operator protection even in the door open condition
- Protects also switchgear itself
- Cost effectiveness from basic to demanding applications
- The system shall be adaptive to changes during the execution of the switchgear construction project
- Arc sensors mountable in stages. Quick installation.
- Choice and mixture of sensor technologies (point sensor, fiber sensor) supported
- Robust construction of sensors
- Complete functional testing before delivery possible

Power generation
- Precise quick operation as the currents are high
- Alternative implementation of the bus bar protection using arc protection systems.
- High immunity against interference

Industrial customers
- Quick retrofit installation and testing
- Sensors installable even in the partly energized switchgear
- Quick location of the arc fault
- Practical current measurement from various locations, multi-zone operation.
- Integration to existing arc protection systems, interconnection between various systems even over different system voltage levels.

Wind power
- Protection of generator, transformer, converter cabinet, cable joints and circuit breaker compartment
- Integrated smoke and arc detection with the same unit
- Cost effectiveness
- Generator set emergency trip
- Basic protection with full self-supervision
- Safety loop support

Utilities
- Easy extension of current measurement locations
- Interface with the SCADA systems over DO
- Simple installation as the commissioning is often completed by the utility electricians themselves.
- During the re-vamping of protection relaying it is possible to integrate arc protection to the protection scheme.

System integrators
- Preparation and pre-installation in live switchgear
- Quick installation and straight-forward testing
- Adaptation to changes during the commissioning project and in the future

Distributors
- Use of standard components
- Completion with building blocks
- Further upgrading possibility

Marine
- Small and compact in size, easy commissioning
- Selective operation
- ABS, GL, BV and Lloyds approvals for relay based arc protection

The comprehensiveness of an arc protection system depends on the requirements of the customer segment. Each segment prefers using an appropriate protection scheme and the scheme is naturally optimised for the power system.
Selective and flexible arc flash protection solutions for low and medium voltage systems

The modern motor control centers (MCC) equipped with an arc flash protection gives an ultra-fast arc protection for the switchgear limiting the possible arc flash fault to a minimum. The point sensors give an accurate location of the fault thus the required repair for the MCC’s is fast and the power can be restored without fault location time delay. Central unit trips both the incoming LV circuit breaker and the circuit breaker up-stream. The nature for an arc flash fault can be fuse, cable termination, contactor or circuit breaker feeding the motor in the MCC.

I/O units are mounted in the apparatus compartment. Connection to central unit is made with a modular cable. In case the central unit with the needed user interface information is located close to the I/O units, the I/O units can be placed in the secondary equipment compartment.

The arc sensor I/O units incorporate a snap-in connector for the portable sensor. The activated arc sensor channel is indicated with a led.
Selectivity
The selectivity requirement of the arc flash protection is dependent on the switchgear construction and on importance of the power distribution.
The more important the supplied power distribution process is the more selective arc flash protection scheme is implemented.
The left side of the medium voltage switchgear, as seen in the picture, has various protection zones. Cable termination has its own zone and is tripped should the fault happen in the cable compartment.

One system extension module VAM 12LD unit is able to trip up to three sub-zones selectively. The circuit breaker and busbar compartments belongs to another zone supervised by the same VAM 12LD units.
As the distribution system does not have current measurement on the high voltage side of the power transformer the arc flash protection system use the current status from low voltage side. In this case the zone 1 selectivity is set up by light only criteria and the zone is fully isolated should the fault happen.
The right side of the switchgear has universal one zone scheme for the cable, circuit breaker and bus bar compartments using three fiber sensor loops. The incoming cable termination compartment is based on the light only protection principle.

Various solutions for any medium or low voltage arc protection application

• The VAMP arc protection system can be built using various components of the Schneider-Electric Easergy P3 and VAMP relays.
• The system has been designed to cover basic level and demanding applications of the low and medium voltage power distribution system.
• VAMP arc protection system and relay products can be combined to obtain an arc protection scheme for any application.
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Characteristics and highlights

Central unit - VAMP 221 arc protection system

- 3-phase current measurement or 2-phase and earth-fault current measurement
- Circuit-breaker failure protection (CBFP)
- Operation on simultaneous current and light or on light only
- Informative display
- Four normally open trip contacts
- One normally open and one change over alarm contact
- 7 ms operation time (including the output relay)
- Programmable operation zones
- Continuous system self-supervision

The auxiliary supply, CT wiring, trip and alarm outputs as well as modular cables are connected to the rear side of the central Unit.

System extension module
- VAM 4C, VAM 4CRL, VAM 4CD current I/O units

- Auxiliary supply and communication via modular cable
- 3-phase current measurement or 2-phase and earth-fault current measurement
- Current pick-up setting by potentiometer and led display
- Indication of the current channel pick-up, current unbalance and trip relay activation
- One heavy duty trip relay
- Two communication ports for central unit and I/O unit interconnection

Additional feature to VAM 4CRL
- Ringlug connectors for current inputs (X1)

Additional features to VAM 4CD
- Customized arc sensor channel text pocket info
- Flush mounting
- HMI indication available on door closed position

System extension module
- VAM 3L, VAM 3LX fiber sensor I/O units

- Auxiliary supply and communication via modular cable
- Three supervised fiber loop arc sensor connection
- Connection of portable arc sensor
- Indication of the sensor channel and trip relay activation
- One heavy duty trip relay
- Two communication ports for central unit and I/O unit interconnection

Additional feature to VAM 3LX
- Fiber arc sensor sensitivity adjustment

System overview

- Auxiliary supply and communication via modular cable
- Continuous supervision of sensors
- Connection of portable arc sensor, except VAM 4C and VAM 4CD
- Indication of arc sensor / current channel and trip relay activation
VAMP 221
Characteristics and highlights

System extension module
- VAM 10L, VAM 10 LD point sensor I/O units

- Auxiliary supply and communication via modular cable
- Ten (10) point arc sensor connections
- Continuous supervision of sensors
- Connection of portable arc sensor
- Indication of the sensor channel and trip relay activation
- One heavy duty trip relay
- Two communication ports for central unit and I/O unit interconnection

Additional features to VAM 10LD
- Customized arc sensor channel text pocket info
- Flush mounting
- HMI indication available on door closed position

System extension module
- VAM 12L, VAM 12LD point sensor I/O units

- Three selective trip output contacts for dedicated sensors
- Auxiliary supply and communication via modular cable
- Ten (10) point arc sensor connections
- Continuous supervision of sensors
- Connection of portable arc sensor
- Indication of the sensor channel and trip relay activation
- Two communication ports for central unit and I/O unit interconnection

Additional features to VAM 12LD
- Flush mounted unit
- HMI indication available on door closed position
- Customized arc sensor channel text pocket info

Selection table for VAM I/O units

<table>
<thead>
<tr>
<th></th>
<th>VAM 3L</th>
<th>VAM 10L</th>
<th>VAM 10LD</th>
<th>VAM 12L</th>
<th>VAM 12LD</th>
<th>VAM 4C</th>
<th>VAM 4CRL</th>
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<tr>
<td>Mounting</td>
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<td>No. of alarm contacts</td>
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<td>No. of BI (24-48Vdc)*</td>
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<td>No. of sensor channel indication (LED)</td>
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<td>Other</td>
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<td>Text pocket for setting values</td>
<td>Text pocket for setting values</td>
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</table>

* Used for zone shift 1 < --- > 2 and 3 < --- > 4

VAMP 4R trip multiplier relay

- 4 + 4 trip outputs (4 x NO and 4 x NC)
- Two separate tripping groups
- Enables a 7 ms total operation time to a large number of CBs (controlled by binary output (BO) of VAMP 121 unit)
- External auxiliary power supply
VAMP 221

Accessories

Point sensors
- Easy installation and replacement
- Enables fault location indication
- Surface mounting
- Tube mounting
- Continuous self-supervision

Point sensor VA1EH-x
(pipe)

Point sensor VA1DA-x
(surface)

Point sensor VA1GIS

Fiber sensor ARC SLM-x
- Standard fiber
- Length from 1 to 70 meters
- Self-supervision
- Cost effective when plenty of compartments
- Activation 8,000 lx
- Multicore cable
- 10 mm bending radius minimum

Extension cable VX031-5
- Extension cable and door socket for VA1DP-5D
- Diplexer for two portable sensors

Modular cable VX001-x
- Transfers all information and aux. supply between VAMP 221 and I/O unit or between I/O units, easy wiring with RJ 45 connector

Fiber joint SLS-1
- Conveniently connects two fibers together
- Used for switchgear shipping splits, maximum one joint per fiber

Portable sensors VA1DP
- Provides extra personal safety while working on live switchgear
- Quick connection with snap-in socket

Portable sensor VA1DP-5
- Snap-in socket connection to sensor I/O unit

Portable sensor VA1DP-5D
- Snap-in socket connection to sensor I/O unit via VX031-5 cable

Sensor mounting plates
- Z- or L-shaped
- Wall mounting to VA1DA-x sensors (no extra holes in the switchgear)

Sensor mounting plate VYX001, Z-shaped

Sensor mounting plate VYX002, L-shaped

Fiber sensor ARC SLM-x
- Standard fiber
- Length from 1 to 70 meters
- Self-supervision
- Cost effective when plenty of compartments
- Activation 8,000 lx
- Multicore cable
- 10 mm bending radius minimum

Power supply unit 3P004
- Primary-switched MINI POWER power supply for DIN rail mounting
- Input: 1-phase, output: 24 V DC/1.3 A

Line amplifier 3P001
- Flare, solid state relay with 6.2 mm overall width
- Output, transistor module, spring clamp terminal, jumper at negative pole at the control side

Project mounting frames VYX076, VYX 077 and VYX 233

More information about note 1 and 2, please see "Accessories" on page 10.
## Accessories

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<thead>
<tr>
<th>Order Code</th>
<th>Explanation</th>
<th>Note</th>
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<tr>
<td>VAM 3LSE</td>
<td>Fiber sensor I/O unit (VAMP221 &amp; 321)</td>
<td>3 fiber loops, 1 trip relay</td>
</tr>
<tr>
<td>VAM 3LXSE</td>
<td>Fiber sensor I/O unit (VAMP221 &amp; 321)</td>
<td>3 fiber loops, 1 trip relay, adjustable sensitivity</td>
</tr>
<tr>
<td>VAM 4CSE</td>
<td>Current I/O unit (VAMP221 &amp; 321)</td>
<td>3 current inputs, 1 trip relay, clamp connector</td>
</tr>
<tr>
<td>VAM 4CSE-RL</td>
<td>Current I/O unit (VAMP221 &amp; 321)</td>
<td>3 current inputs, 1 trip relay, ring-lug connector</td>
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<tr>
<td>VAM 4CDSE</td>
<td>Current I/O unit (VAMP221 &amp; 321)</td>
<td>3 current inputs, 1 trip relay, flush mounting</td>
</tr>
<tr>
<td>VAM 10LSE</td>
<td>Point sensor I/O unit (VAMP221 &amp; 321)</td>
<td>10 sensor inputs, 1 trip relay</td>
</tr>
<tr>
<td>VAM 10LDSE</td>
<td>Point sensor I/O unit (VAMP221 &amp; 321)</td>
<td>10 sensor inputs, 1 trip relay, flush mounting</td>
</tr>
<tr>
<td>VAM 12LSE</td>
<td>Point sensor I/O unit (VAMP221 &amp; 321)</td>
<td>10 sensor inputs, 3 trip relays</td>
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<tr>
<td>VAM 12LDSE</td>
<td>Point sensor I/O unit (VAMP221 &amp; 321)</td>
<td>10 sensor inputs, 3 trip relays, flush mounting</td>
</tr>
<tr>
<td>VAMP 4R</td>
<td>Interface Unit (use vx002 cable)</td>
<td>4 x NO, 4 x NC, 2 groups</td>
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<tr>
<td>VA 1 DA-6</td>
<td>Arc Sensor</td>
<td>Cable length 6 m</td>
</tr>
<tr>
<td>VA 1 DA-20</td>
<td>Arc Sensor</td>
<td>Cable length 20 m</td>
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<tr>
<td>VA 1 EH-6</td>
<td>Arc Sensor (Pipe type)</td>
<td>Cable length 6 m</td>
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<td>VA 1 EH-20</td>
<td>Arc Sensor (Pipe type)</td>
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<td>VA 1 EH-6S-IP</td>
<td>Arc Sensor, shielded (Pipe type, IP65)</td>
<td>Cable length 6 m</td>
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<tr>
<td>VA 1 EH-20S-IP</td>
<td>Arc Sensor, shielded (Pipe type, IP65)</td>
<td>Cable length 20 m</td>
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<td>VA 1 DP-6</td>
<td>Portable Arc Sensor</td>
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<td>VA 1 DP-5</td>
<td>Portable Arc Sensor</td>
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<td>VA 1 GIS-1.5</td>
<td>Arc Sensor, shielded with GIS adapter</td>
<td>Cable length 1.5 m</td>
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<td>VA 1 GIS-3</td>
<td>Arc Sensor, shielded with GIS adapter</td>
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<td>VA 1 GIS-5</td>
<td>Arc Sensor, shielded with GIS adapter</td>
<td>Cable length 5 m</td>
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<td>VA 1 GIS-10</td>
<td>Arc Sensor, shielded with GIS adapter</td>
<td>Cable length 10 m</td>
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<td>ARC SLM-x</td>
<td>Fiber sensor, 8 000 lx</td>
<td>x = fiber length (1)</td>
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<td>SLS-1</td>
<td>Fiber joint SLS-1</td>
<td>Max one joint per fibre</td>
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<tr>
<td>VX001-xx</td>
<td>Modular Cable VAM &lt;-&gt; VAM (xx = Cable length [m])</td>
<td>Preferred Cable Lengths (2)</td>
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<tr>
<td>VX031-5</td>
<td>Extension cable for VAMP-5D</td>
<td>Cable length 5 m</td>
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<tr>
<td>VYX001</td>
<td>Surface Mounting Plate for Sensors</td>
<td>Z-shaped</td>
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<tr>
<td>VYX002</td>
<td>Surface Mounting Plate for Sensors</td>
<td>L-shaped</td>
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<tr>
<td>VYX076</td>
<td>Projection</td>
<td>Height 40 mm</td>
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<tr>
<td>VYX077</td>
<td>Projection</td>
<td>Height 60 mm</td>
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<tr>
<td>VYX233</td>
<td>Projection</td>
<td>Height 100 mm</td>
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<tr>
<td>VYX 628</td>
<td>Surface Mounting Plate for VAMP-10 Sensor</td>
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<tr>
<td>3P001</td>
<td>Line amplifier for arc protection BI/O channels</td>
<td>DIN rail mount</td>
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<tr>
<td>3P004</td>
<td>Supply unit, 100-240AC/24DC/1.3A</td>
<td>Supply unit</td>
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</table>

Note 1. Fibre lengths 1, 5, 10, 15, 20, 25, 30, 35, 40 or 50 m
Note 2. Cable lengths 1, 3, 5, 7, 10, 15, 20, 25 & 30
VAMP 221

Technical data

VAMP 221 system

Power supply
- Us: 48 - 265 V ac/dc
- Measuring circuits: 1 A / 5 A
- Rated frequency: 45 - 65 Hz
- Power consumption: 0.3 VA
- Thermal withstand: 60 x I_n for 1 s

Operating settings
- Phase current stage I_L: 0.5 - 6.0 x I_n
- Earth-fault current I_o: 0.05 - 5.0 x I_n
- Accuracy: ± 10%
- Reset ratio: 0.95
- t> CBFP: 100 ms, 150 ms

Tripping contacts
- Rated voltage: 250 V ac/dc
- Continuous current: 5 A
- Make and carry: for 0.5 s: 30 A; for 3 s: 15 A
- Contact material: AgNi

Signal / Alarm contacts
- SF (error) alarm contact: 1 pc change over
- Trip alarm: 1 pc NO
- Rated Voltage: 250 V ac/dc
- Continuous current: 5 A
- Make and carry: for 0.5 s: 10 A; for 3 s: 8 A
- Contact material: AgNi
- Operate time - TRIP 1, 2, 3, 4: 7 ms

BIO inputs/outputs
- Rated voltage: +48 V
- Rated current: 20 mA
- Trip alarm: normally open
- L> BI line (IN): 2 pcs
- L> BO lines (OUT): 2 pcs
- I> BIO line (IN/OUT): 1 pcs (I>)

Slave port (RJ45)
- Multi drop: Max 16 slaves and 3 masters
- Supply to slaves: Isolated 24 V dc
- Communication (master-slave): RS485 (15 kV) information / self supervision
- ARC / OC signal master-slave: 4 zone ARC and 1 zone OC line

VAM I/O units, common characteristics

TRIP contacts
- Rated voltage: 250 V ac/dc
- Continuous carry: 5 A
- Make and carry: for 0.5 s: 30 A; for 3 s: 15 A
- t>: 7 ms

Digital inputs
- Rated voltage: 24 V dc
- Rated current: 5 mA

Digital outputs
- Rated voltage: 24 V dc
- Rated current: 20 mA (max)

VAM 3L / 3LX
- No. of trip contacts: 1
- No. of digital inputs: 1
- No. of digital outputs: 1
- No. of fiber loops: 3 pcs
- Power supply: +24 V dc via modular cable or terminals
- Power consumption, In (stand-by): 45 mA
- Power consumption per activated channel I_sensAct: 20 mA
- Total power consumption: 45 mA + ( n x I_sensAct) *

VAM 4C / 4CD / 4CRL
- No. of trip contacts: 1
- No. of digital inputs: 1
- No. of digital outputs: 1

VAM 10L / 10LD / 12L / 12LD

VAM 10L / LD
- No. of trip contacts: 1
- No. of digital inputs: 1
- No. of digital outputs: 1
- No. of arc sensor channels: 10 pcs
- Power supply: +24 V dc via modular cable or terminals
- Power consumption, In (stand-by): 45 mA
- Power consumption per activated channel I_sensAct: 20 mA
- Total power consumption: 45 mA + ( n x I_sensAct) *

VAM 12L / LD
- No. of trip contacts: 3
- No. of digital inputs: 1
- No. of digital outputs: 1
- No. of arc sensor channels: 10 pcs
- Power supply: +24 V dc via modular cable or terminals
- Power consumption, In (stand-by): 45 mA
- Power consumption per activated channel I_sensAct: 20 mA
- Total power consumption: 45 mA + ( n x I_sensAct) *

* n= number of active sensors
### VAMP 4R trip multiplier relay

<table>
<thead>
<tr>
<th>Technical data</th>
<th>Value</th>
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<tbody>
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<td>Number of groups</td>
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<td>Power supply</td>
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<td>Control signal</td>
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<td>Tripping contacts</td>
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<tr>
<td>Contact material</td>
<td>AgNi</td>
</tr>
</tbody>
</table>

#### Disturbance tests

<table>
<thead>
<tr>
<th>Test type</th>
<th>Standard/Class</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission</td>
<td>EN 61000-6-4</td>
<td></td>
</tr>
<tr>
<td>Conducted</td>
<td>EN 55011, 0.15-30 MHz</td>
<td></td>
</tr>
<tr>
<td>Emitted</td>
<td>EN 55011, 30-1000 MHz</td>
<td></td>
</tr>
<tr>
<td>Static discharge (ESD)</td>
<td>EN 61000-4-2, class IV</td>
<td>8 kV contact discharge/15 kV air discharge</td>
</tr>
<tr>
<td>Fast transients (EFT)</td>
<td>EN 61000-4-4, class IV</td>
<td>4 kV, 5/50 ns, 5 kHz, +/-</td>
</tr>
<tr>
<td>Surge</td>
<td>EN 61000-4-5, class III</td>
<td>2 kV, common mode/1 kV, differential mode</td>
</tr>
<tr>
<td>Conducted HF field</td>
<td>EN 61000-4-6</td>
<td>0.15 - 80 MHz, 10 V</td>
</tr>
<tr>
<td>Emitted HF field</td>
<td>EN 61000-4-3</td>
<td>80 - 2700 MHz, 10 V / m</td>
</tr>
</tbody>
</table>

#### Test voltages

<table>
<thead>
<tr>
<th>Test type</th>
<th>Standard/Class</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation test voltage</td>
<td>IEC 60255-5</td>
<td>2 kV, 50 Hz, 1 min</td>
</tr>
<tr>
<td>Impulse test</td>
<td>IEC 60255-5</td>
<td>5 kV, 1.2/50 ms, 0.5 J</td>
</tr>
</tbody>
</table>

### Mechanical tests

<table>
<thead>
<tr>
<th>Type</th>
<th>Standard/Class</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock response</td>
<td>IEC 60255-21-2, class I</td>
<td>half sine 11 ms, Acceleration 5 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 directions, 3 pulse each direction</td>
</tr>
<tr>
<td>Shock withstand</td>
<td>IEC 60255-21-2, class I</td>
<td>half sine 11 ms, Acceleration 15 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 directions, 3 pulse each direction</td>
</tr>
<tr>
<td>Bump test</td>
<td>IEC 60255-21-2, class I</td>
<td>half sine 16 ms, Acceleration 10 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 directions, 1000 pulse each direction</td>
</tr>
</tbody>
</table>

#### Vibration

<table>
<thead>
<tr>
<th>Response</th>
<th>Standard/Class</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static response</td>
<td>EN 61000-6-2</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>10 - 150 Hz</td>
<td></td>
</tr>
<tr>
<td>Acceleration</td>
<td>0.5 g</td>
<td></td>
</tr>
<tr>
<td>Directions</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sweep rate</td>
<td>1 oct/min</td>
<td></td>
</tr>
<tr>
<td>Sinusoidal response</td>
<td>EN 60255-21-1, class I</td>
<td>Frequency 10 - 150 Hz, Acceleration 1 g, 3 directions, 20 sweeps, rate 1 oct/min</td>
</tr>
</tbody>
</table>

### Environmental conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-10 - +65°C</td>
</tr>
<tr>
<td>Transport and storage temperature</td>
<td>-40 - +70°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>&lt; 75% (1 year, average value)</td>
</tr>
<tr>
<td></td>
<td>&lt; 90% (30 days per year, no condensation permitted)</td>
</tr>
<tr>
<td></td>
<td>&lt; 90% (30 days per year, no condensation permitted)</td>
</tr>
</tbody>
</table>

### Device track record

- Schneider Electric specializes in protection relays, arc flash protection and measuring and monitoring units for power systems.
- Schneider Electric’s medium-voltage and sub-transmission protection relays are used in numerous applications, from overhead line feeders and substations to power plants and industrial power systems. Schneider Electric’s optical arc flash system provides fast trip times and may reduce equipment damage. Schneider Electric is a leader in arc flash protection worldwide.