

# VAMP

## Arc Protection Series VAMP 121 VAMP 221





## Secure your assets and staff safety

An arc protection relay is a protective device used to **maximize the personnel 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.

On detection of a fault 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.

- **Personnel safety**

A fast and reliable arc protection system may save human lives in case of an arc fault arising in a switchgear during work in or near the installation.

- **Reduces loss of production**

The shorter the operating 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. **No nuisance trippings!**

- **Vast Experience**

Vamp Ltd. is the pioneer in the field of arc protection with more than 6000 arc protection systems in service world-wide.

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.

VAMP arc protection is an extremely fast protection system for LV and MV switchgear and controlgear. It is especially designed to maximize the personnel safety and to minimize material damage caused by arc faults. Minimized damage also means limited need for repair work and enables a rapid restoration of the power supply.

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



# Why arc protection?

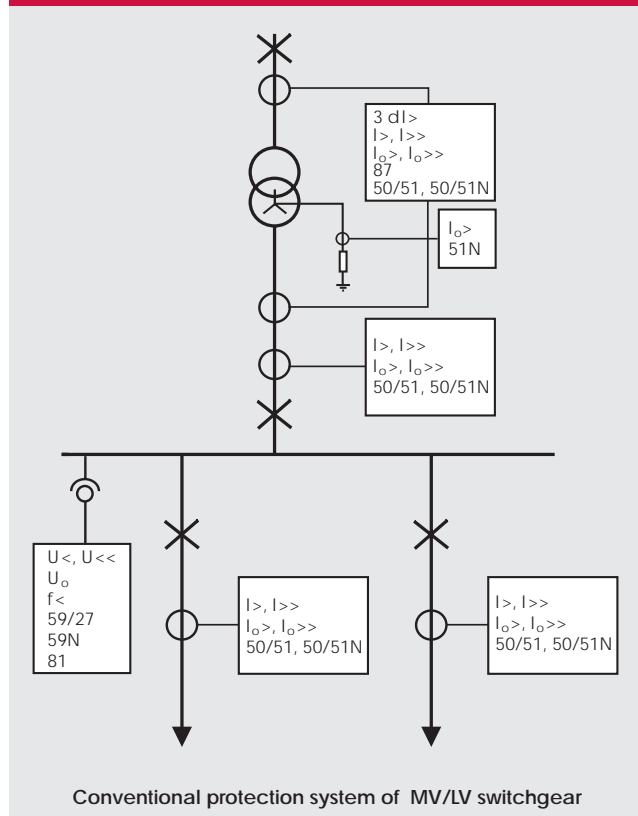
When the traditional time-grading or blocking based protection coordination principle is used, the traditional protection systems may not provide fast enough protection of substation faults. Further, high-impedance type of earth-faults may cause prolonged operation times of earth-fault relays leading to the significant release of the arcing energy. These facts pose a considerable risk to human beings and economical assets.



Traditional protection relay systems do not provide fast enough protection in an arc-fault situations.



## Conventional protection system



### Total fault clearing time typically:

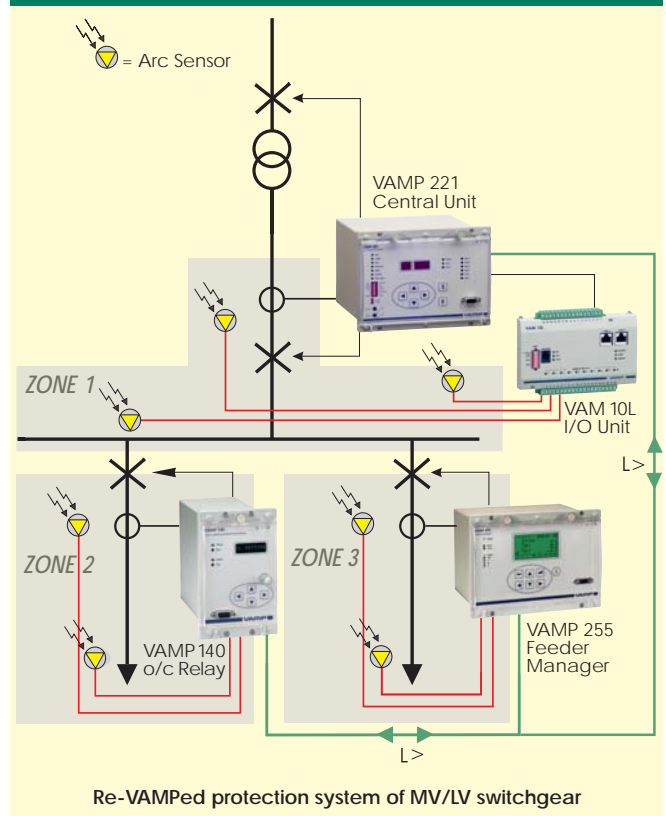
- Outgoing feeder 50 (relay) + 50 (CB) = **100 ms (+ Auto-reclosing)**
- Incoming feeder 350 (relay) + 50 (CB) = **400 ms**

### 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!**

## Conventional protection system enhanced with VAMP arc protection



### Total fault clearing time typically:

- Outgoing feeder 14 (relay) + 50 (CB) = **64ms**
- Incoming feeder 7 (relay) + 50 (CB) = **57ms**

### Resistance earthed network

- **Fault clearance in 64 - 57 ms**

**The operation times in critical arc situations are significantly reduced by implementing VAMP arc protection system.**

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 interlocks are slow, minimum operating 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.



# Vamp Arc Protection has a solution for every

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. Vamp has designed the arc protection family keeping the requirements of every customer segment in mind.



## Panel builders

- 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
- Choice and mixture of sensor technologies (point sensor, fiber sensor) supported
- Robust construction of sensors
- Complete functional testing before delivery possible
- Quick installation



## Industrial customers

- Quick retrofit installation and testing
- Sensors installable even in the partly energized switchgear
- Informative user-friendly Human Machine Interface (HMI)
- 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.



## Utilities

- Easy extension of current measurement locations
- Interface with the SCADA systems
- 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.





# customer segment all over the power system



## 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

## Wind power

- Basic arc protection
- Integrated smoke and arc detection with the same unit
- Cost effectiveness
- High environmental immunity



## System integrators

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

## Distributors

- Use of standard components
- Completion of arc protection systems with building blocks
- Further up-grading possibility

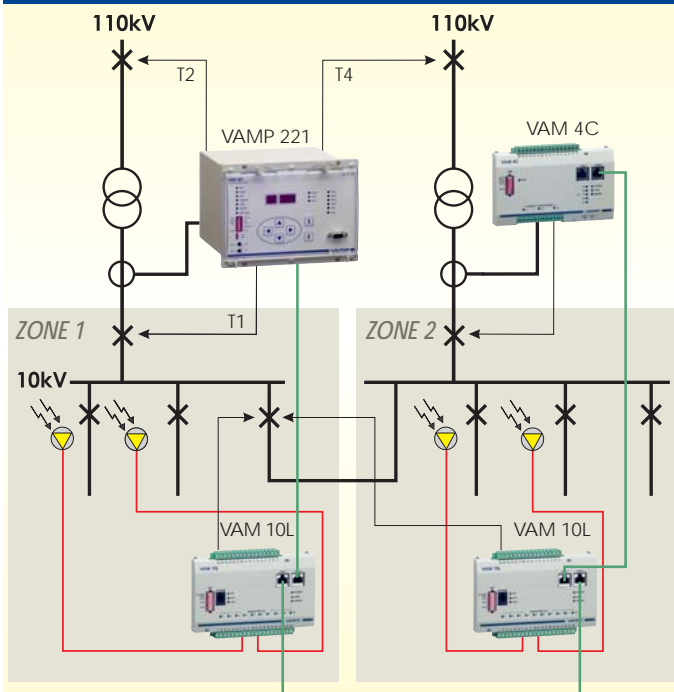


## Marine

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

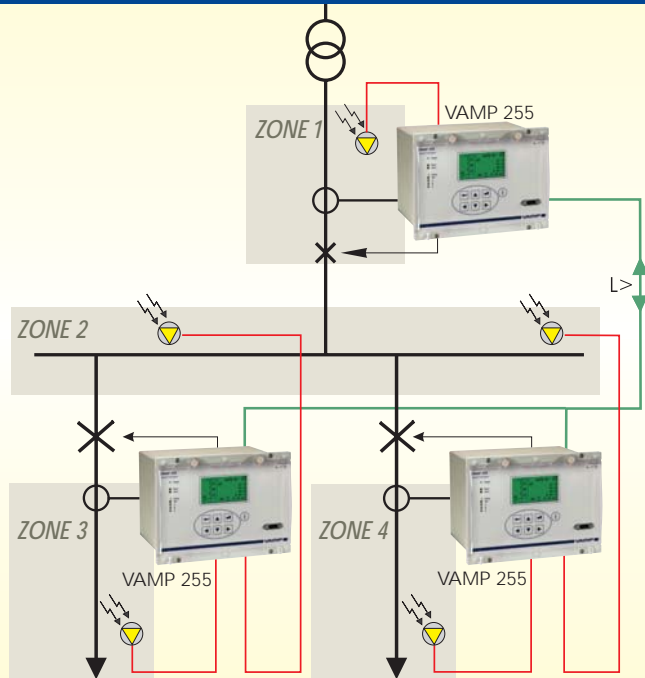
## Scalable and flexible arc protection solution

### 1. Central unit based system



- Arc protection operating independently from conventional protection
- Full two zone selectivity achieved with current measurements at incomers only

### 2. Arc protection system implemented with protection relays



- Novel substations (two-in-one)
- New or retrofit installations
- Cost-effective busbar protection
- Arc protection connectivity with SCADA

### Various solutions for any medium or low voltage arc protection application

The VAMP arc protection system can be built using various components of the VAMP relay family.

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.

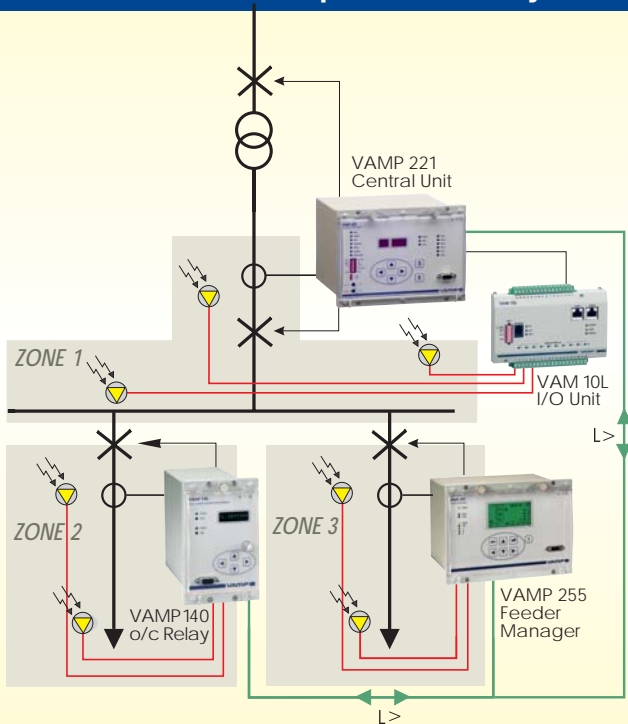


*I/O units are mounted in the apparatus compartment. Connection to central unit is made with a modular cable.*



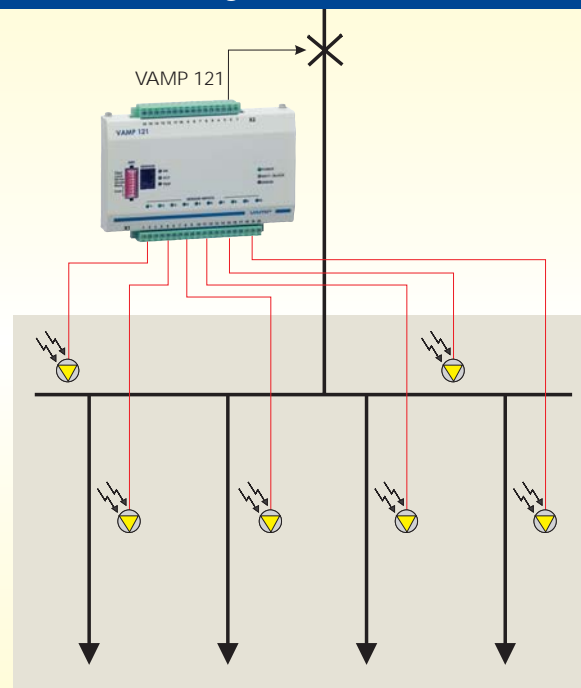
*The arc sensor I/O units incorporate a snap-in connector for the portable sensor. The activated arc sensor channel is indicated with a led.*

### 3. Arc protection system with combination of central units and protection relays



- More monitoring points implemented due to combined arc and relay protection scheme.

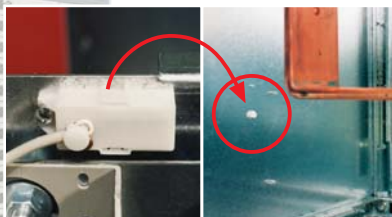
### 4. System based solely on light detection



- The most simple, straight-forward and economical solution, designed mainly for MCC and wind power applications where the current criterion is not needed.



The fiber arc sensor monitors various compartments.



The point sensor monitors the protected compartments through the hole in the compartment wall.



A detailed address code of the fault location is displayed on the central unit.





## Product Characteristics and Highlights

### VAMP 221 system with VAM 4C, VAM 10L and VAM3L I/O units



#### VAMP 221 arc protection system central unit

- 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



#### VAM 4C current I/O unit

- 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, current unbalance and trip relay activation
- One heavy duty trip relay
- Two communication ports for central unit and I/O unit interconnection



#### VAM 10L point sensor I/O unit

- 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



#### VAM 3L, VAM 3LX fiber sensor I/O unit (VAM 3LX with sensor sensitivity adjustment)

- Auxiliary supply and communication via modular cable
- Three supervised fiber arc sensor connections
- 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

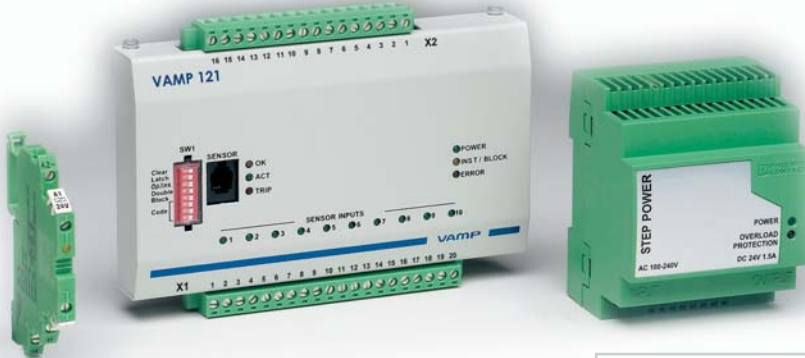


The auxiliary supply, CT wiring, trip and alarm outputs as well as modular cables are connected to the rear side of the relay.





## VAMP 121 system



### VAMP 121 arc protection unit

- Operation on light only
- Supports point or **smoke sensors**
- Up to 10 sensors
- Typically trips the incoming feeder
- Straight-forward installation
- Operation time 9 ms (including the output relay)
- Cost efficient solution
- Self-supervision



Commissioning, measurements and alarm views are activated by pressing the keypad push buttons.



## Sensors and accessories

### Point sensors

- easy installation and replacement (twisted pair connection, handy during switchgear transportation)
- Fault location indication
- Surface mounting
- Pipe mounting
- Continuous self-supervision



Point sensor VA1DA-x (surface)



Point sensor VA1EH-x (pipe)



Fiber sensor ARC1SL-x



Portable sensor VA1DP5



Trip multiplier relay VAMP 4R



Modular cable VX001-x

### Fiber sensor

- Cost effective when plenty of compartments are to be supervised
- Length from 10 to 70 meters
- Continuous self-supervision

### Portable sensor

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

### 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 CB's
- Auxiliary supply wired from the arc protection main unit

### Modular cable VX001-x

- Transfers all information and aux. supply between VAMP 221 and slaves or between slaves, easy wiring with RJ 45 connector

### Sensor mounting plates

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

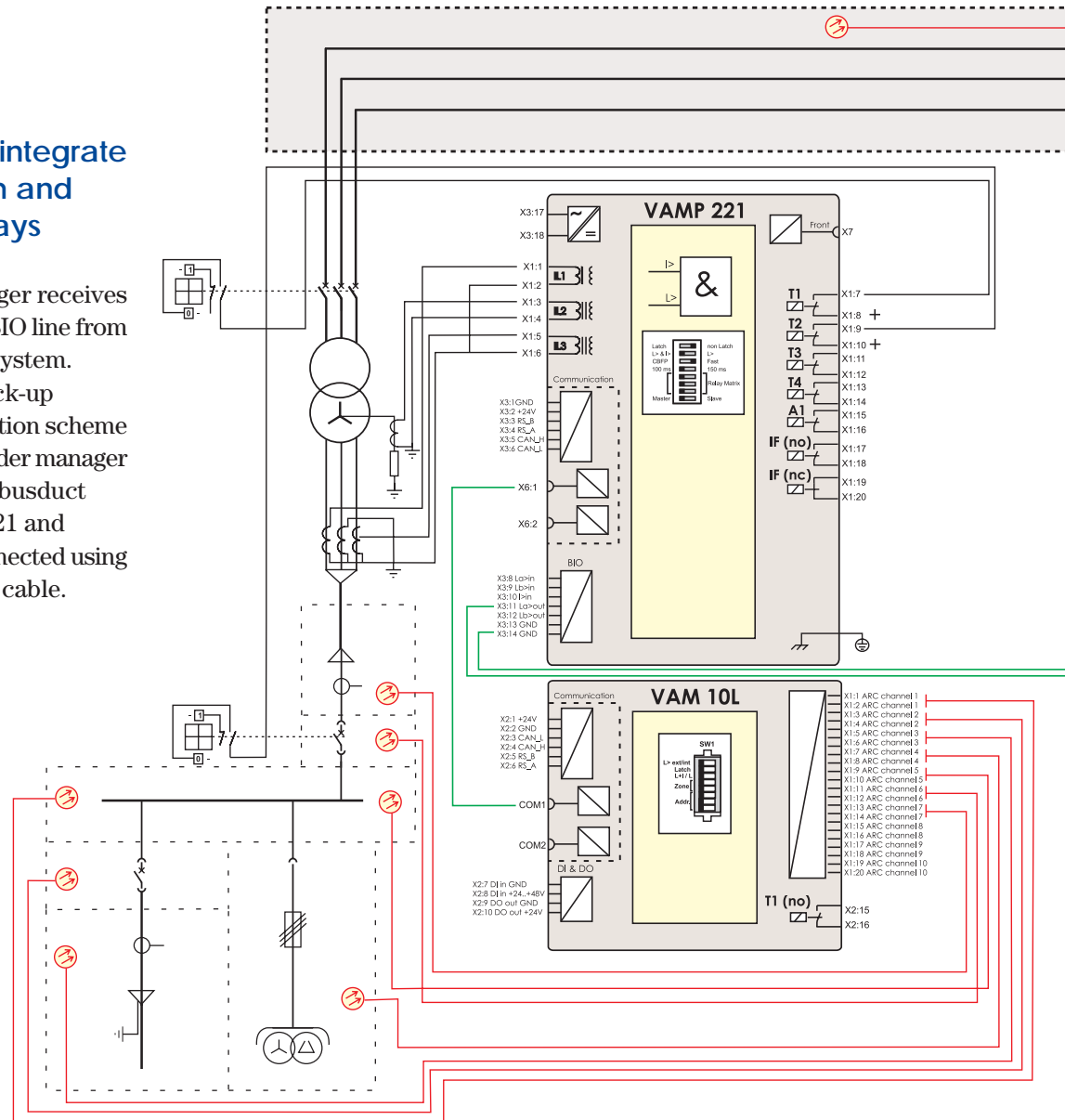


Sensor mounting plates  
VYX002, L-shaped VYX001, Z-shaped

## Connection Diagrams

### A unique concept to integrate arc protection system and feeder protection relays

The VAMP 255 feeder manager receives its light information via the BIO line from the VAMP 221 central unit system. VAMP 255 operates as a back-up protection for the arc protection scheme but in addition to this the feeder manager supervises arc faults in the busduct compartment. The VAMP 221 and VAMP 255 units are interconnected using a standard instrumentation cable.



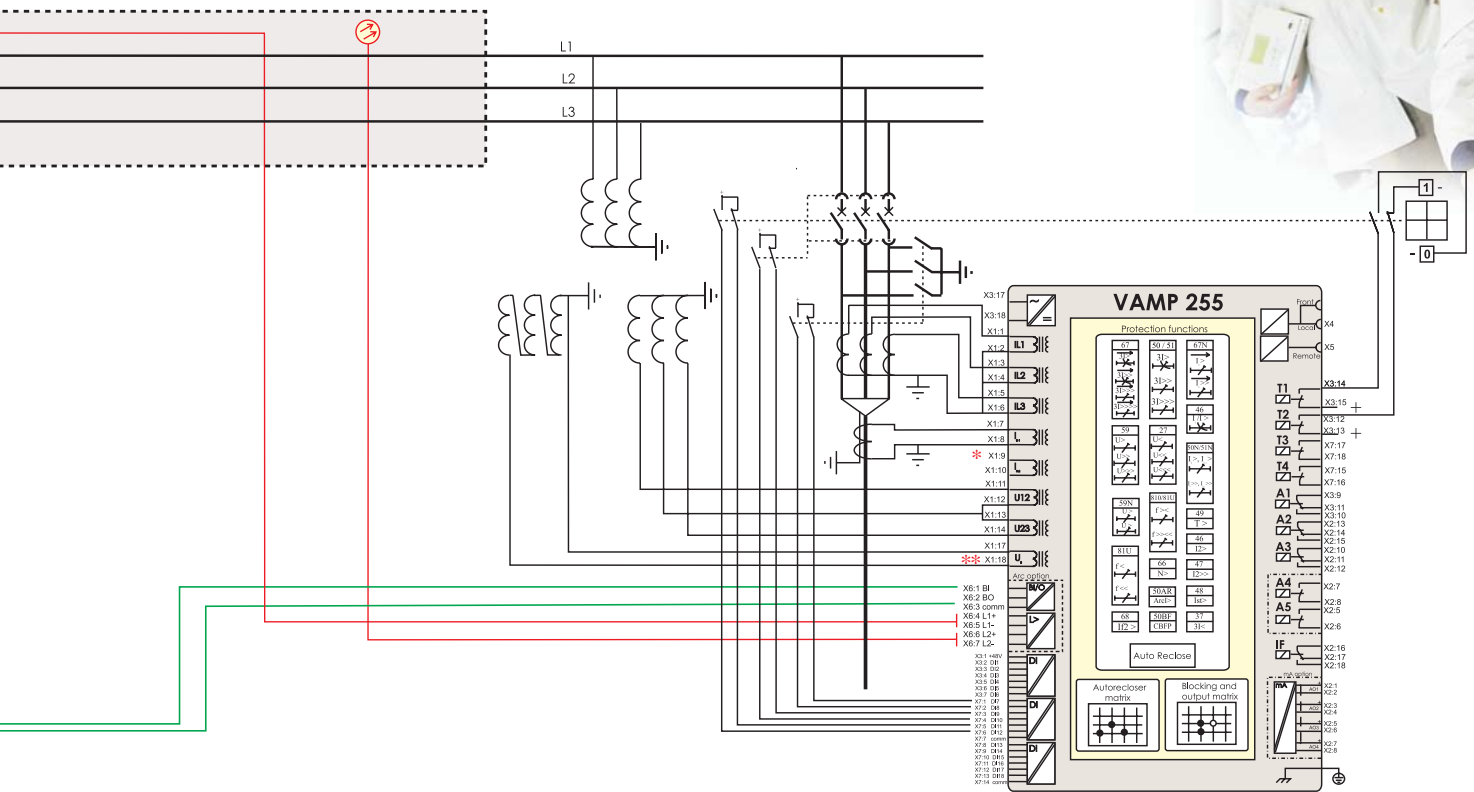
3-phase current measurement or 2-phase current and residual current measurement is used when the simultaneous occurrence of overcurrent and light is used as tripping criteria.

Residual current measurement is recommended especially in high resistance earthed networks. The residual current may be measured by phase current sum connection or an individual core balance CT at the transformer star point.

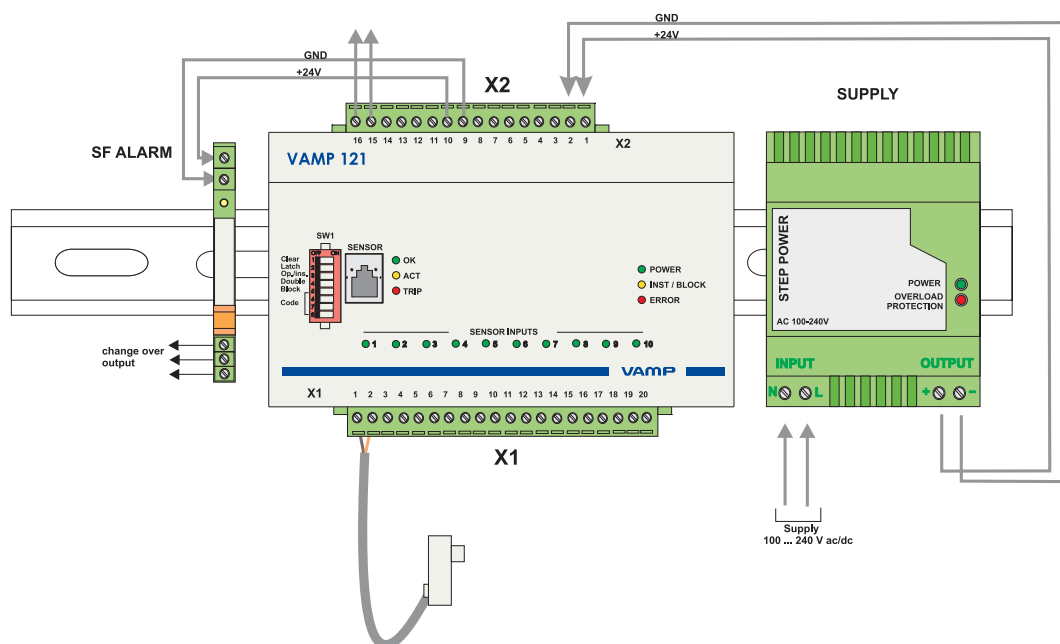
No additional CTs are needed, the arc protection system is connected in series with the conventional protection relays.

A maximum 16 VAM I/O units may be connected to one main VAMP 221 unit. Furthermore, three VAMP 221 central units may be interconnected. The maximum physical distance from the central unit to the last I/O unit is 100 meters.





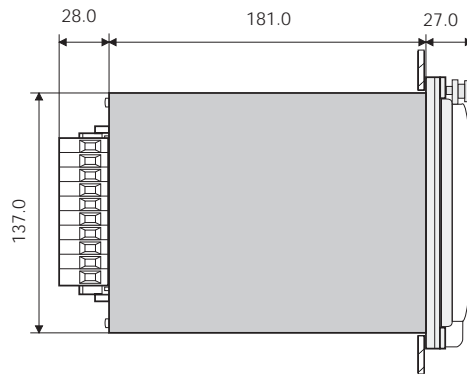
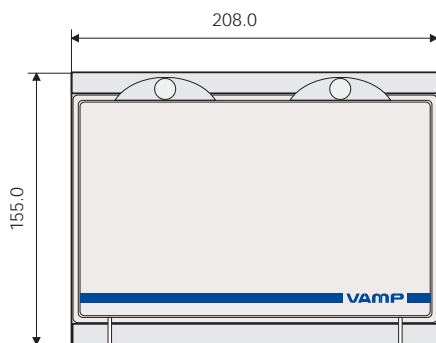
VAMP 121 connection diagram



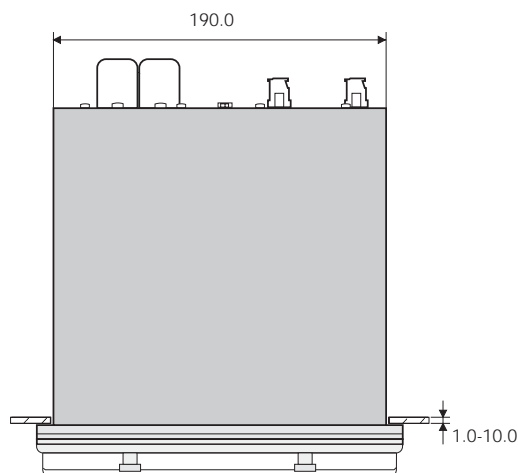
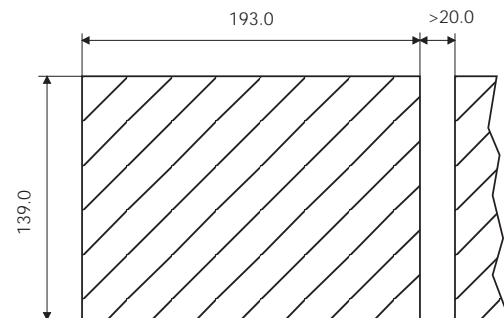
## Dimensional Drawings

All dimensions in mm.

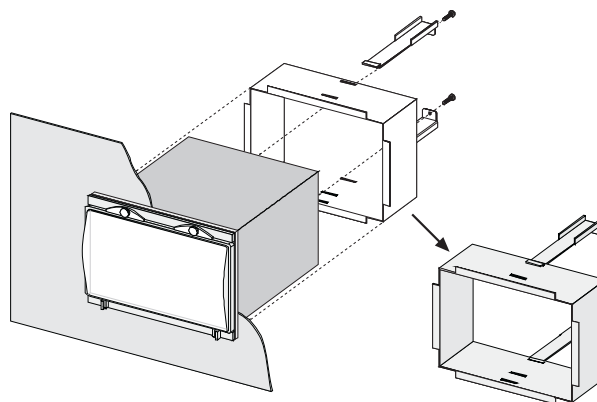
### VAMP 221 system, flush mounting



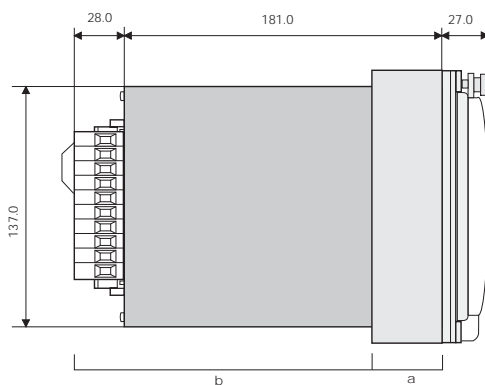
### Panel cut-out



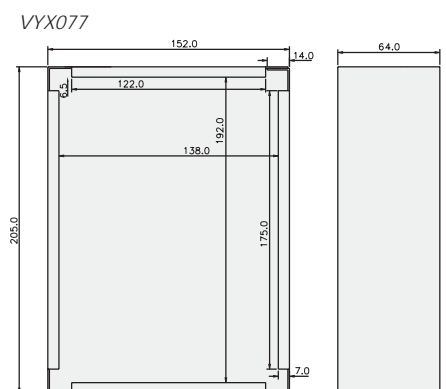
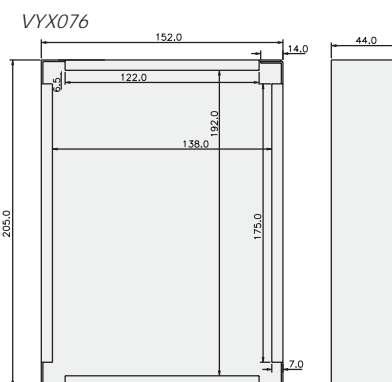
### Mounting technique



### Semi-flush mounting



### Raising frames



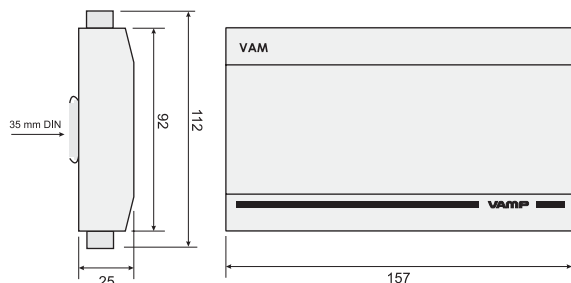
#### Depth with raising frames

Type designation	a	b
VYX 076	40 mm	169 mm
VYX 077	60 mm	149 mm
VYX 233	100 mm	109 mm

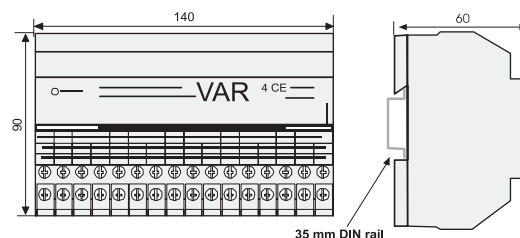




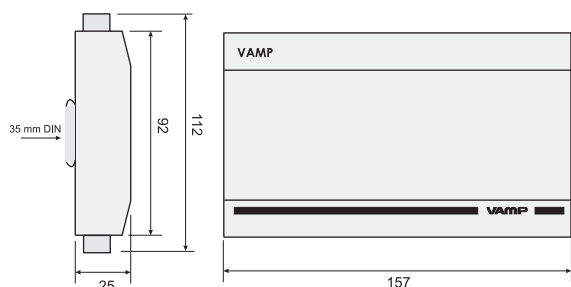
## VAM series (VAM 10L, 3L, 4C)



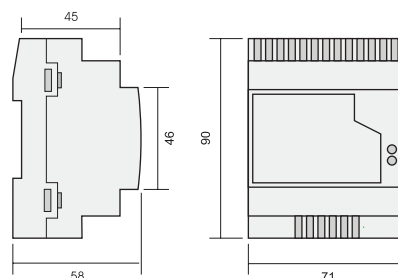
## Trip multiplier unit VAR 4CE



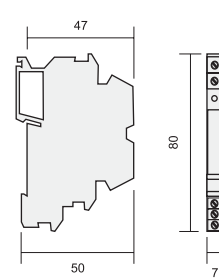
## VAMP 121 system / VAMP 4R



## Supply unit

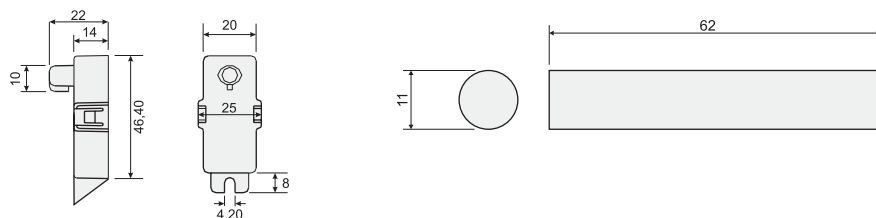


## Alarm relay



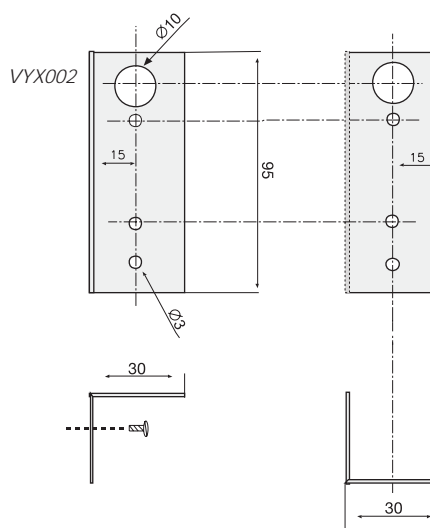
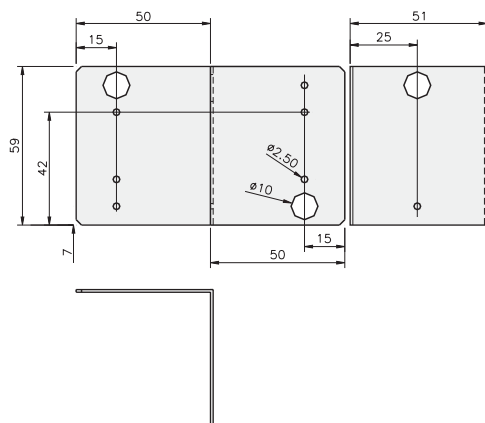
## Arc sensor VA1DA-

## VA1EH



## Mounting plates for VA 1 DA

VYX001



## Order Codes

VAMP 221 - 3 A 3 A A A



VAMP 221 Central Unit

Nominal current [A]  
3 = 1 A / 5 A

Not in use

A

Not in use

3

Supply voltage [V]  
A = 48.. 265Vac/dc

Optional hardware 1  
A = None

Optional hardware 2  
A = None  
B = VAM 3QD Control hardware

### Accessories:

Order Code	Explanation	Note
VAM 3L	Fiber sensor I/O unit (VAMP221)	3 fiber loops
VAM 10L	Point sensor I/O unit (VAMP221)	10 sensor inputs
VAM 4C	Current I/O unit (VAMP221)	3 current inputs
VAM 3LX	Fiber sensor I/O unit (VAMP 221)	3 fiber loops adjustable sensitivity
VAMP 4R	Trip multiplier relay	4xNO and 4xNC
VA1DA-6	Arc sensor	Cable length 6 m
VA1DA-20	Arc sensor	Cable length 20 m
VA1DP-5	Portable arc sensor	Cable length 5 m
VA1EH-6	Arc sensor (pipe type)	Cable length 6 m
VA1EH-20	Arc sensor (pipe type)	Cable length 20 m
ARC-SLX	Arc fiber sensor (> 16,000 Lux)	(x = fiber length)*
ARC-MSLX	Arc fiber sensor (> 8,000 Lux)	(x = fiber length)*
VX001-xx	Modular cable VAM <-> VAM	(xx = cable length)**
VX002-xx	Shielded sensor cable	(xx = cable Length)**

\*\*\*) Cable lengths, xx = 1, 3, 5, 7, 10, 15, 20, 25 & 30 m

\*) Fiber lengths, x = 10, 15, 20, 25, 30, 35, 40, 50 or 70 m

VYX001	Surface mounting plate for sensors	L-shaped
VYX002	Surface mounting plate for sensors	Z-shaped
VYX076	Raising frame	40 mm
VYX077	Raising frame	60 mm
VYX 233	Raising frame	100 mm



Point sensor VA1DA-x



Fiber sensor I/O unit VAM 3L



Portable sensor VA1DP5



Point sensor I/O unit VAM 10L



Point sensor VA1EH-x (pipe)



Current I/O unit VAM 4C



Sensor mounting plate VYX001, Z-shaped



Sensor mounting plate VYX002, L-shaped



Modular cable VX001-x



Fiber sensor ARC1SL-x



Trip multiplier relay VAMP 4R

### VAMP 121

Order code	Explanation
VAMP 121	Arc protection unit
STEP_PS 28 66 446	Supply unit
DEK_REL_ 29 64 500	Alarm relay
VA 1 DA-6	Arc sensor, 6 m cable
VA 1 DA-20	Arc sensor, 20 m cable



VAMP 121 unit



Supply unit



Alarm relay





# Technical Data

## VAMP 221

<b>Power supply</b>	
- Us	48...256 V ac/dc
<b>Measuring circuits</b>	
- Rated current In	1 A / 5 A
- Rated frequency fn	45...65 Hz
- Power consumption	≤0.3 VA
- Thermal withstand	60 x In for 1 s
<b>Operating settings</b>	
- Phase current stage IL>	0.5...6.0 x In
- Earth-fault current Io>	0.05...5.0 x In
- Accuracy	±5%
- Reset ratio	0.95
- t>	7 ms
- t> CBFP	100 ms, 150 ms
<b>Tripping contacts</b>	4 pcs NO
- Rated voltage	250 V ac/dc
- Continuous carry	5 A
- Make and carry for 0.5 s	30 A
- Make and carry for 3 s	15 A
- Contact material	AgCdO <sub>2</sub>
<b>Signal / Alarm contacts</b>	
- SF (error) alarm contact	1 pc change over
- Trip alarm	1 pc NO
- Rated Voltage	250 V ac/dc
- Continuous carry	5 A
- Make and carry for 0.5 s	10 A
- Make and carry for 3 s	8 A
- Contact material	AgCdO <sub>2</sub>
- Operating time	
TRIP 1, 2, 3, 4	7 ms
<b>BIO inputs/outputs</b>	
- Rated voltage	+48 V
- Rated current	20 mA
- Trip alarm	normally open
- L> BI line (IN)	2 pcs
- L> BO lines (OUT)	2 pcs
- L> BIO line (IN/OUT)	1 pcs (L>)
<b>Slave port (RJ45)</b>	
- 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

## VAMP 4R

<b>Tripping contacts</b>	4 pcs NO, 4 pcs NC
- Rated voltage	250V ac/dc
- Continuous carry	5A
- Make and carry for 0.5s	30A
- Make and carry for 3s	15A
- Contact material	AgCdO <sub>2</sub>

## VAM 10L, VAM 3L, VAM 3LX VAM 4C

<b>TRIP contacts</b>	1 pc NO
- Rated voltage	250 V ac/dc
- Continuous carry	5 A
- Make and carry for 0.5 s	30 A
- Make and carry for 3 s	15 A
- t>	7 ms
<b>Digital inputs</b>	1 pc
- Rated voltage	24 V dc
- Rated current	5 mA
<b>Digital outputs</b>	1 pc
- Rated voltage	24 V dc
- Rated current	20 mA ( max )
<b>VAM 10 L</b>	
No. of arc sensor channels	10
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 sens Act )*
<b>VAM 3 L, VAM 3 LX</b>	
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 sens Act )*
<b>VAM 4C</b>	
<b>Measuring circuits</b>	
- Rated current In	1 A / 5 A
- Rated frequency fn	45...65 Hz
- Power consumption	≤0.3 VA
- Thermal withstand	60 x In for 1 s
<b>Operating settings</b>	
- Phase current stage IL>	0.5...6.0 x In
- Earth-fault current Io>	0.05...5.0 x In
- Accuracy	±5%
- Reset ratio	0.95

## VAMP 121

<b>Power supply</b>	
- Us	24 Vdc
- In (stand-by)	30 mA
- I sensAct	20 mA
- Iarc	120 mA (IsensAct x n) *
<b>Tripping contacts</b>	1 pc NO
- Rated voltage	250 V ac/dc
- Continuous carry	5 A
- Make and carry for 0.5 s	30 A
- Make and carry for 3 s	15 A
- Breaking capacity DC, when time constant L/R=40 ms	50 W
- Contact material	AgCdO <sub>2</sub>
- t>	9 ms
<b>BIO inputs/outputs</b>	
- Rated voltage	+24 V
- Rated current / output	20 mA (max)
- Rated current / input	5 mA
- Number of inputs	1
- Number of outputs	1

\* n = number of active sensors

## Casing

<b>VAMP 221</b>	
Dimensions (W x H x D)	208 x 155 x 223 mm
Weight	4.2 kg
<b>VAMP 121</b>	
Dimensions (W x H x D)	157 x 92 x 25 mm
Weight	0.52 kg

## Disturbance tests

<b>Emission</b>	EN 61000-6-4
- Conducted	EN 55011, 0.15 - 30 MHz
- Emitted	EN 55011, 30 - 1 000 MHz
<b>Immunity</b>	EN 61000-6-2
- Static discharge (ESD)	EN 61000-4-2, class III
	6 kV contact discharge
	8 kV air discharge
- Fast transients (EFT)	EN 61000-4-4, class III
	2/1 kV, 5/50 ns, 5 kHz, +/-
- Surge	EN 61000-4-5, class III
	2 kV, common mode
	1 kV, differential mode
- Conducted HF field	EN 61000-4-6
	0.15 - 80 MHz, 10 V
- Emitted HF field	EN 61000-4-3
	80 - 2000 MHz, 10 V/m

## Test voltages

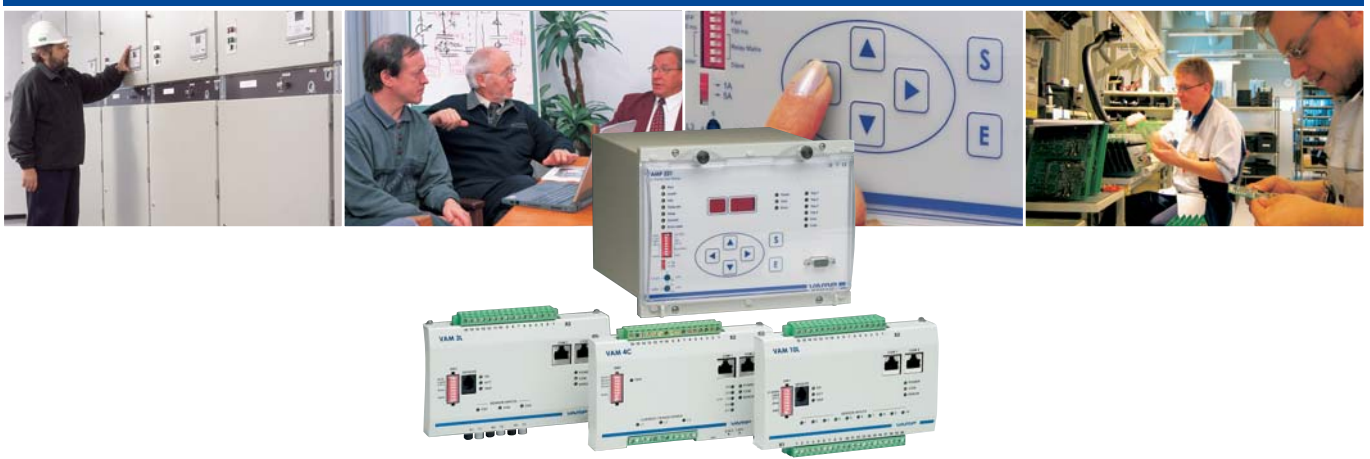
<b>Insulation test voltage</b>	IEC 60255-5
	2 kV, 50 Hz, 1 min
<b>Impulse test</b>	IEC 60255-5
	5 kV, 1.2/50 µs, 0.5 J

## Mechanical tests

<b>Shock response</b>	IEC 60255-21-2, class I
	half sine 11 ms,
	Acceleration 5 g
	6 directions, 3 pulse each dir.
<b>Shock withstand</b>	IEC 60255-21-2, class I
	half sine 11 ms,
	Acceleration 15 g
	6 directions, 3 pulse each dir.
<b>Bump test</b>	IEC 60255-21-2, class I
	half sine 16 ms,
	Acceleration 10 g
	6 directions, 1000 pulse each dir.
<b>Vibration</b>	
Sinusoidal response	IEC 60255-21-1, class I
	Amplitude 0.035 mm
	Frequency 10...150 Hz
	Acceleration 0.5 g
	3 directions, 1 sweep, rate 1 oct/min
Sinusoidal endurance	IEC 60255-21-1, class I
	Frequency 10...150 Hz
	Acceleration 1 g
	3 directions, 20 sweeps, rate 1 oct/min

## Environmental conditions

<b>Operating temperature</b>	-10...+55°C
<b>Transport and storage temperature</b>	-40...+70°C
<b>Relative humidity</b>	< 75% (1 year, average value)
	<90% (30 days per year,
	no condensation permitted)



Vamp Ltd is a Finnish company specialized in developing and manufacturing of protection relays needed for the electrical power generation and distribution system. Vamp Ltd offers complete MV protection, arc flash protection as well as measuring and monitoring units.

Our success is based on competitive standard products, constant development by our designers possessing experience from three protection relay generations, our long-term partnerships, flexibility and 24 hour care of the customers.

Our organization has been audited and found to be in accordance with the requirements of the ISO 9001:2000 management system.

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