

VAMP 221

Selective Arc Flash Protection for Low and Medium Voltage Power Systems



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

- **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.

- **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 detecting sensors in service world-wide.

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.

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.



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

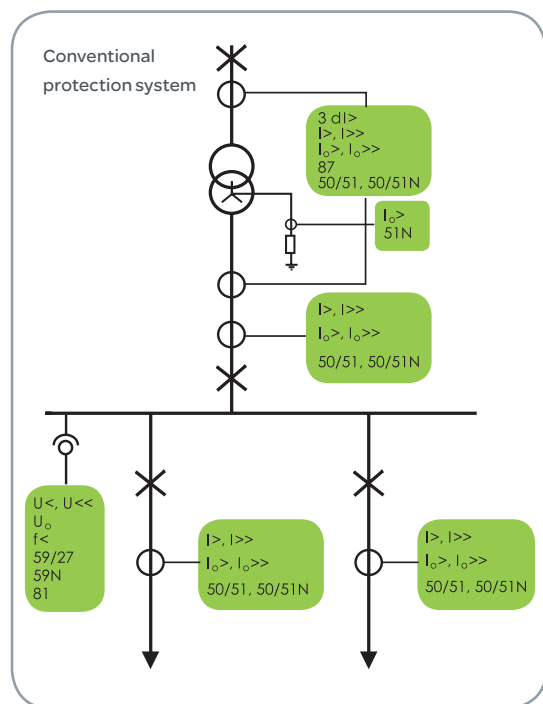


VAMP arc flash protection is an extremely fast protection system for LV and MV switchgear and controlgear.

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.

CONVENTIONAL PROTECTION SYSTEM OF MV/LV SWITCHGEAR



Total fault clearing time typically

- Outgoing feeder 50 (relay) + 60 (CB)
= 110 ms (+ Auto-reclosing)
- Incoming feeder 350 (relay) + 60 (CB)
= 410 ms

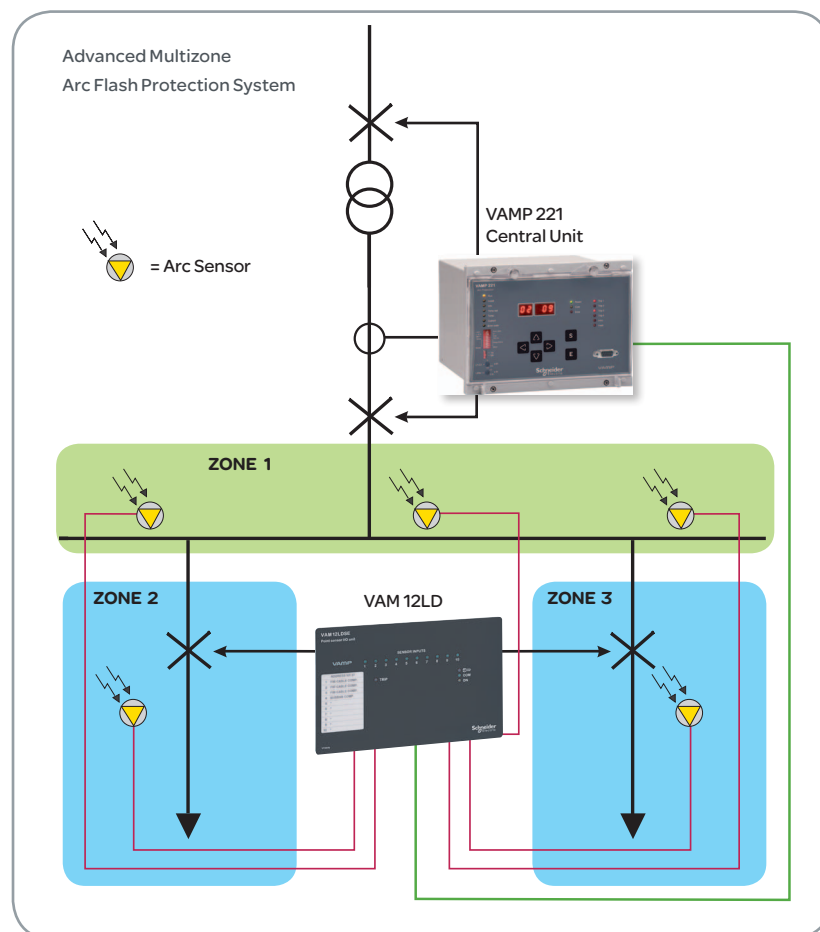
Resistance earthed network

- 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.

RE-VAMPED ARC FLASH PROTECTION SYSTEM FOR MV/LV SWITCHGEAR



Total fault clearing time typically:

- Outgoing/ingoing feeders 7 ms (relay) + 60 ms (CB)
= 67 ms

Resistance earthed network

- 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 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.



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

VAMP arc protection has a solution for every

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



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.



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.



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.



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

- 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

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



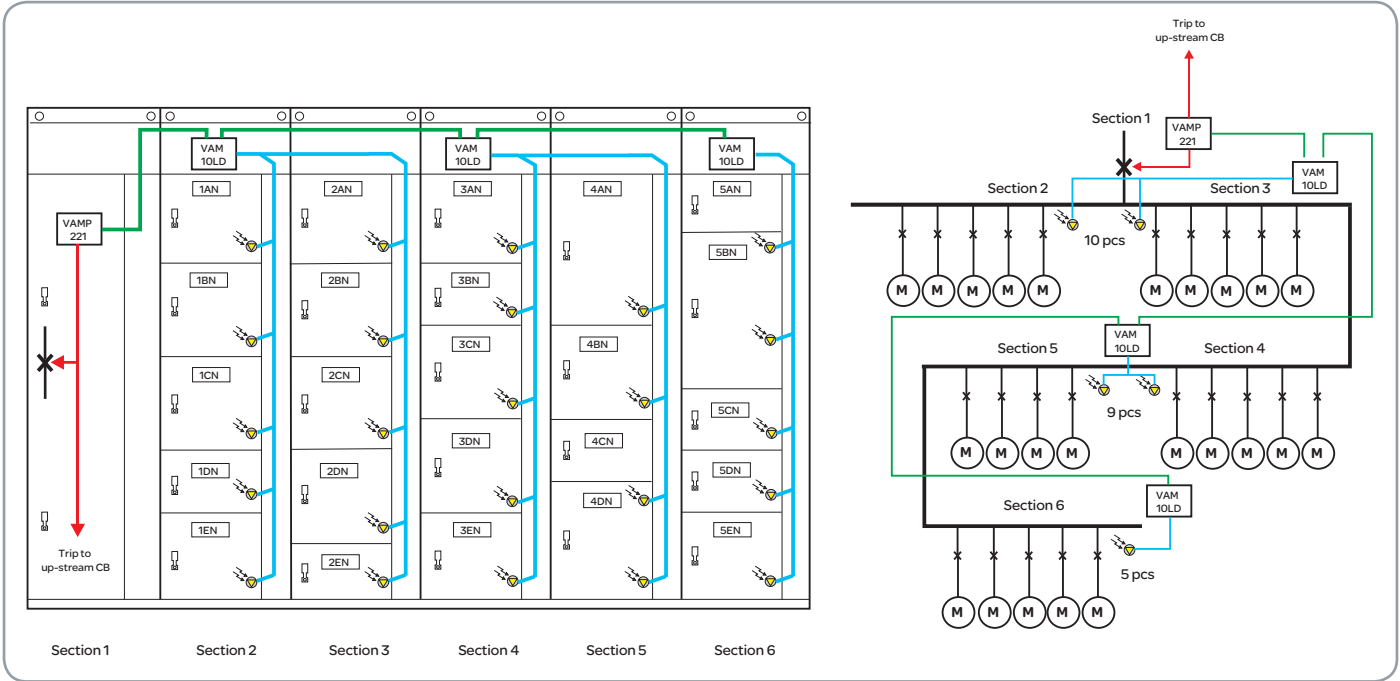
VAMP has designed the arc protection family keeping the requirements of every customer segment in mind



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

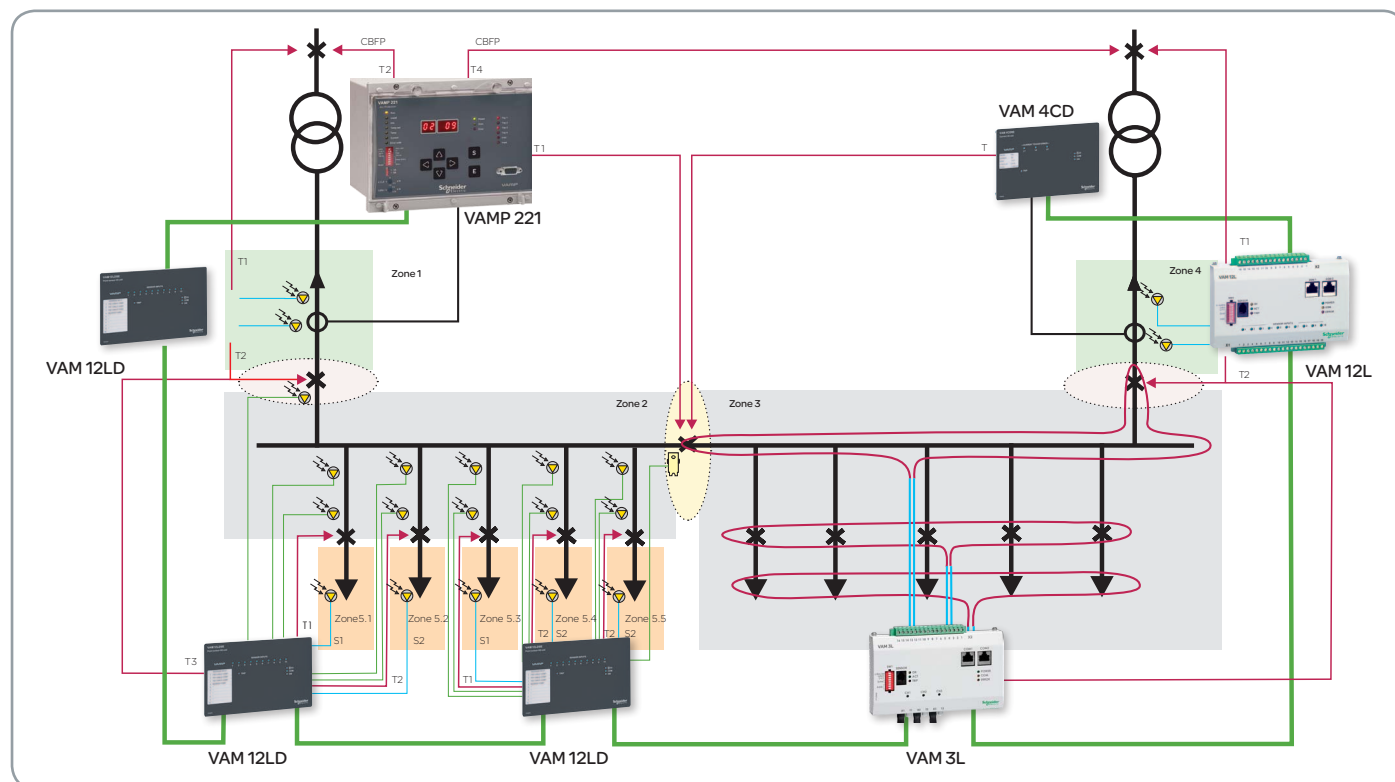


The arc sensor I/O units incorporate a snap-in connector for the portable sensor. The activated arc sensor channel is indicated with a led



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





The selectivity requirement of the arc flash protection is dependent of 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 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 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.



Characteristics and highlights of the VAMP 221 arc protection system

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



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

VAMP 221 ARC PROTECTION SYSTEM

- 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

VAM 4C, VAM 4CD CURRENT I/O UNIT

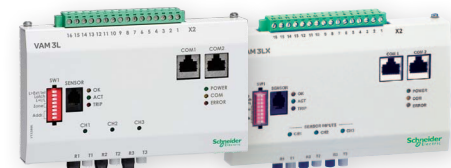


- Auxiliary supply and communication via modular cable
- 3-phase current measurement or 2-phase and earth-fault current measurement
- Current pick-up setting by potentiometer and led display
- Indication of the current channel pick-up, current unbalance and trip relay activation
- One heavy duty trip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

VAM 4CD

- Customized arc sensor channel text pocket info
- Flush mounting
- HMI indication available on door closed position

VAM 3L, VAM 3LX FIBER SENSOR I/O UNIT



- Auxiliary supply and communication via modular cable
- Three supervised fiber loop 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

VAM 3LX

- Fiber arc sensor sensitivity adjustment

VAM 10L, VAM 10 LD
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 10LD

- Customized arc sensor channel text pocket info
- Flush mounting
- HMI indication available on door closed position

SELECTION TABLE FOR VAM I/O UNITS

	VAM 3L	VAM 10L	VAM 10LD	VAM 12 L	VAM 12LD	VAM 4C	VAM 4CD
Mounting	DIN rail	DIN rail	Door	DIN rail	Door	DIN rail	Door
No. of point sensors		10	10	10	10		
No. of loop sensors	3						
No. of protection zones supported	1	1	1	4	4		
No. of trip contacts	1	1	1	3	3	1	1
No. of alarm contacts				1	1		
No. of current inputs						3	3
No. of BI (24-48Vdc)*	1	1	1				
No. of BI (24-48Vdc) L>						1	1
No. of BO (24Vdc) trip	1	1	1			1	1
No. of sensor channel indication (LED)	3	10	10	10	10	3	3
Connection for portable sensor	1	1	1	1	1		
Other			Text pocket for setting values		Text pocket for setting values		Text pocket for setting values

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

VAM 12L, VAM 12LD
POINT SENSOR I/O UNIT



- 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

VAM 12LD

- Flush mounted unit
- HMI indication available on door closed position
- Customized arc sensor channel text pocket info



Door mounted I/O units show arc protection system information without opening the secondary compartment door

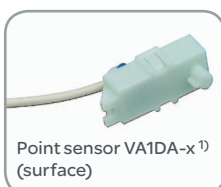
In case the central unit with the needed user interface information is located close to the I/O units, the I/O units can be placed in the secondary equipment compartment.



Sensors and accessories

POINT SENSORS

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



FIBER ARC-SLM SENSORS

- Standard fiber
- Length from 1 to 70 meters
- Self-supervision
- Cost effective when plenty of compartments



- ARC-SLm**
- Activation 8,000 lx
 - Multicore cable
 - 10 mm bending radius minimum

SENSOR MOUNTING PLATES

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



PORTABLE SENSOR 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



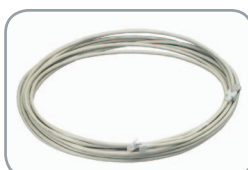
Portable sensor VA1DP-5D

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



VX031-5 Extension cable

- 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

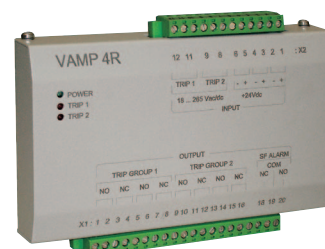


Fiber joint SLS-1

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

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



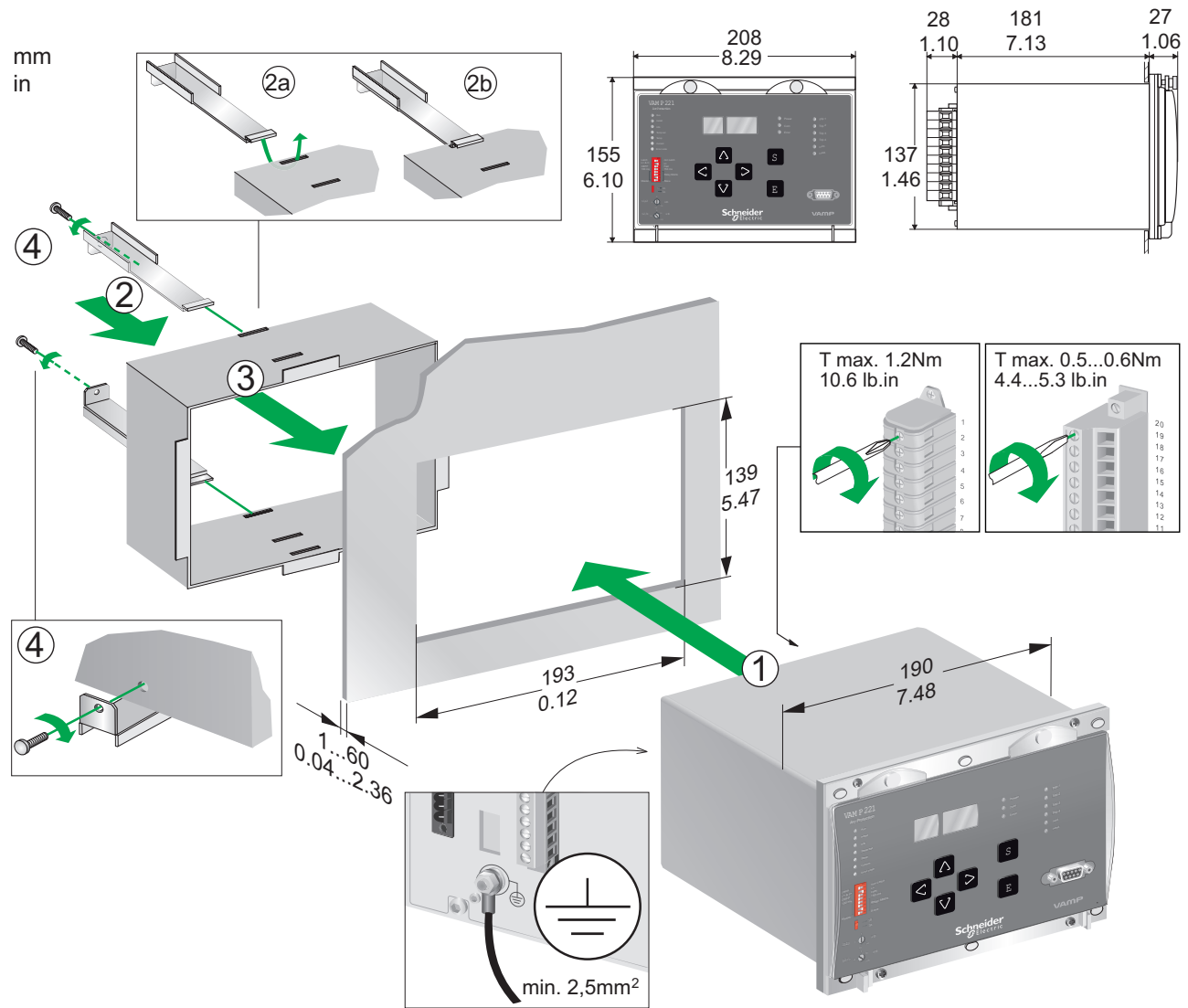
Note 1: X = cable length (m)

Note 2: X = fiber length (m)

For more details, see accessories page 14.

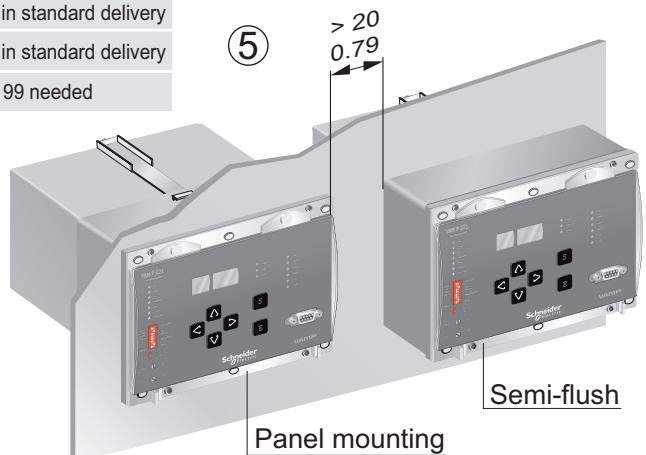
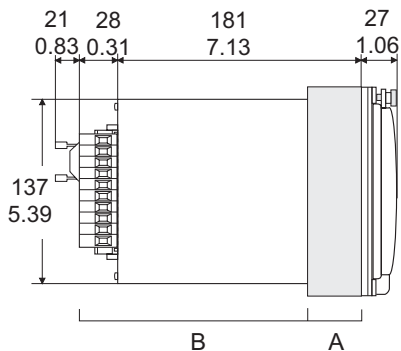
Dimensional drawings

PANEL MOUNTING

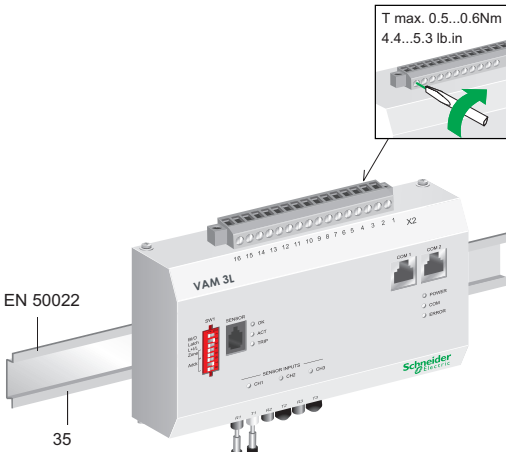
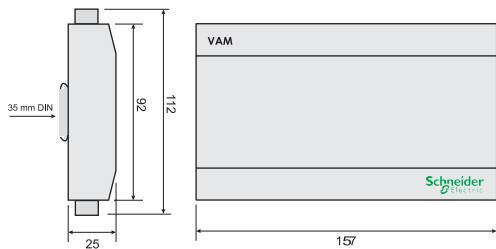


SEMI-FLUSH

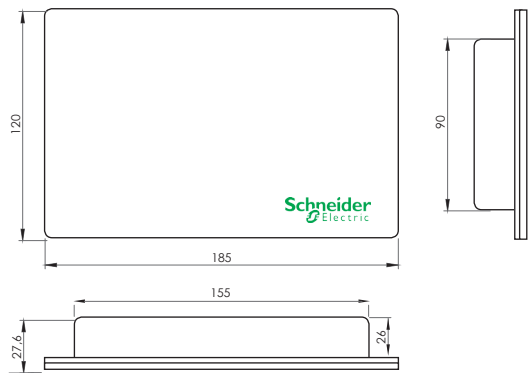
Raising frame	A	B	Fixing bracket
VYX076	40 mm / 1.57"	169 mm / 6.65"	Included in standard delivery
VYX077	60 mm / 2.36"	149 mm / 5.87"	Included in standard delivery
VYX233	100 mm / 3.94"	109 mm / 4.29"	2 x VYX199 needed



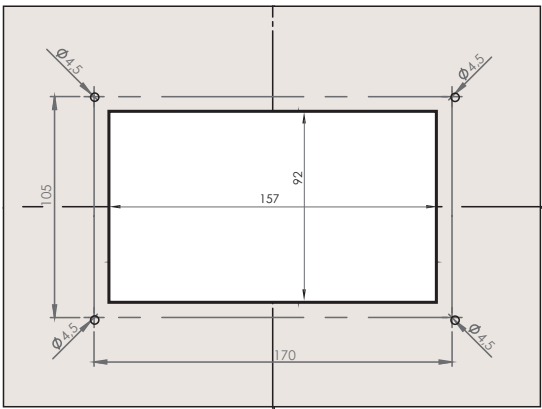
VAM 10L, 3L, 3LX 4C AND VAMP 4R
Unit: mm



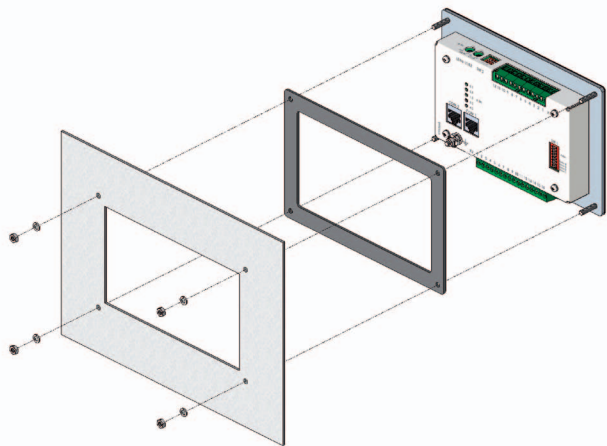
VAM 4CD, 10 LD, 12LD FLUSH MOUNTING



PANEL CUT-OUT

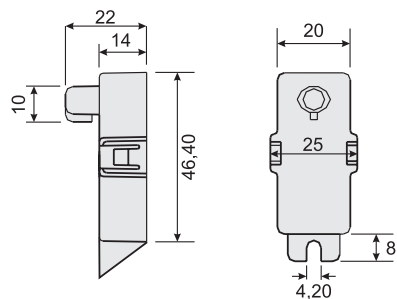


MOUNTING TECHNIQUE

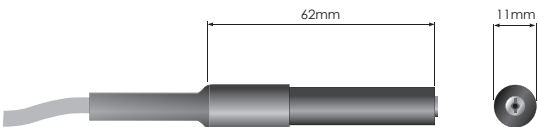


All dimensions in mm.

ARC SENSOR VA1DA-

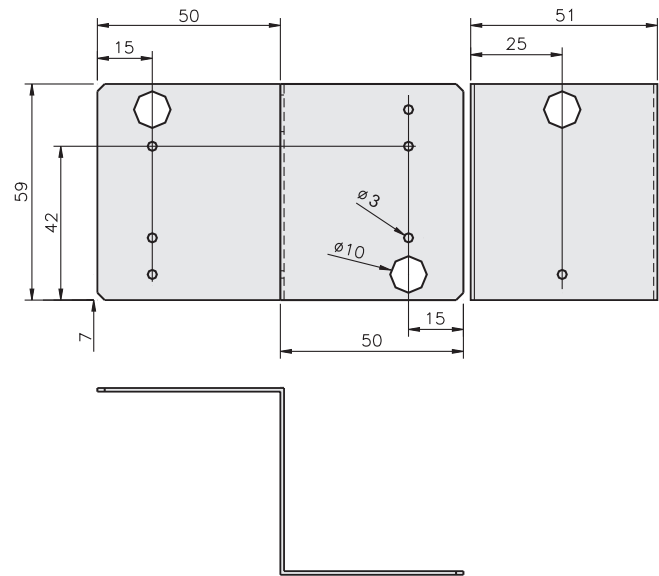


VA1EH

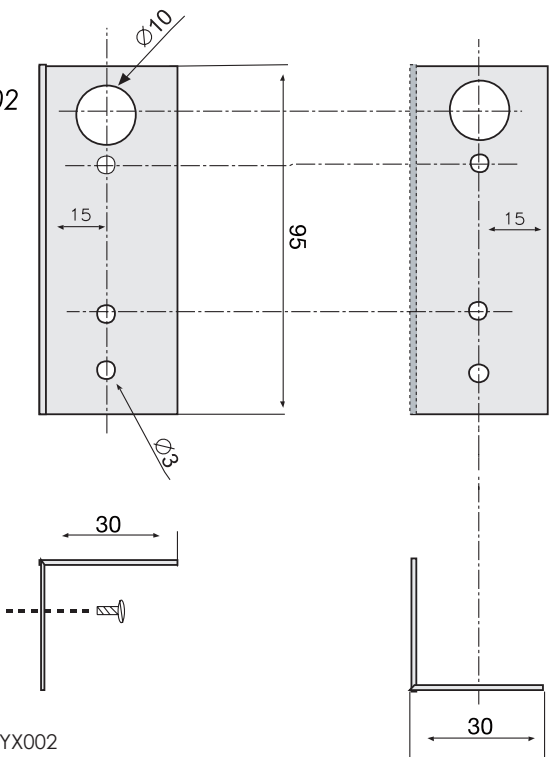


MOUNTING PLATES FOR VA 1 DA

VYX001



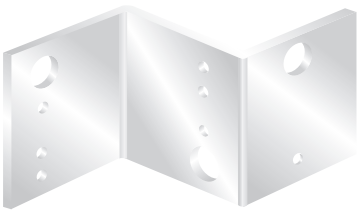
VYX002



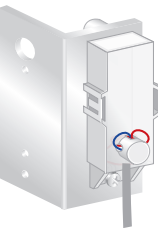
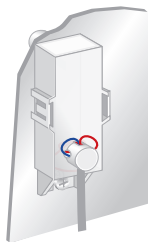
VA1DA-



VYX001



VYX002



All dimensions in mm.

VAMP 221 order codes

CENTRAL UNIT


V221

3

A

A

A



Arc protection

Nominal current [A]

3 = 1A / 5A

4 = Rogowski sensor inputs

Région

A = IEC

B = ANSI

Not in use

3

Supply voltage [V]

A = 48.. 265Vac/dc

Optional hardware 1

A = None

Optional hardware 2

A = None

ACCESSORIES

Order Code	Explanation	Note
VAM 3LSE	Fiber sensor I/O unit	3 fiber loops, 1 trip relay
VAM 3LXSE	Fiber sensor I/O unit	3 fiber loops, 1 trip relay, adjustable sensitivity
VAM 4CSE	Current I/O unit	3 current inputs, 1 trip relay
VAM 4CDSE	Current I/O unit	3 current inputs, 1 trip relay, flush mounting
VAM 10LSE	Point sensor I/O unit	10 sensor inputs, 1 trip relay
VAM 10LDSE	Point sensor I/O unit	10 sensor inputs, 1 trip relay, flush mounting
VAM 12LSE	Point sensor I/O unit	10 sensor inputs, 3 trip relays
VAM 12LDSE	Point sensor I/O unit	10 sensor inputs, 3 trip relays, flush mounting
VAMP 4RSE	Interface Unit (use vx002 cable)	4 x NO, 4 x NC, 2 groups
VA 1 DA-6	Arc Sensor	Cable length 6m
VA 1 DA-20	Arc Sensor	Cable length 20m
VA 1 DT-6	Temperature Sensor	Cable length 6m
VA 1 DP-5	Portable Arc Sensor	Cable length 5m
VA 1 DP-5D	Portable Arc Sensor	Cable length 5m
VA 1 EH-6	Arc Sensor (Pipe type)	Cable length 6m
VA 1 EH-20	Arc Sensor (Pipe type)	Cable length 20m
ARC-SLm-x	Fiber sensor, 8 000 lx	x = fiber lenght [m], see note 1
SLS-1	Fiber joint SLS-1	Max one joint per fibre
VX001-xx	Modular cable between VAMP 221 - VAM and VAM - VAM	xx = Cable length [m], see note 2
VX031-5	Extension cable for VA1DP-5D	Cable length 5cm
VYX001	Surface Mounting Plate for Sensors	Z-shaped
VYX002	Surface Mounting Plate for Sensors	L-shaped
VYX076	Raising Frame	Height 40mm
VYX077	Raising Frame	Height 60mm
VYX223	Raising Frame	Height 100mm
3P001	Line amplifier for arc protection BI/O channels	DIN rail mount
3P004	Supply unit, 100-240AC/24DC/1.3A	Supply unit

Note 1. Fibre lengths 1, 5, 10, 15, 20, 25, 30, 35, 40, 50, 60 or 70 m
Note 2. Cable lengths 1, 3, 5, 7, 10, 15, 20, 25 & 30

Technical data

VAMP 221 system

Power supply		
Us	48...265 V ac/dc	
Measuring circuits		
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	
Operating settings		
Phase current stage IL>	0.5...6.0 x In	
Earth-fault current Io>	0.05...5.0 x In	
Accuracy	± 10%	
Reset ratio	0.95	
t>	7 ms	
t> CBFP	100 ms, 150 ms	
Tripping contacts	4 pcs NO	
Rated voltage	250 V ac/dc	
Continuous carry	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 carry	5 A	
Make and carry	for 0.5 s	10 A
	for 3 s	8 A
Contact material	AgNi	
Operating 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	

* n= number of active sensors

VAM I/O units

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 10L / 10LD / 12L / 12LD	VAM 10L / LD	VAM 12L / LD
No. of trip contacts	1	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 sens Act)*	

VAM 3L, VAM 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 sens Act)*

VAM 4C / VAM 4CD

No. of trip contacts	1
No. of digital inputs	1
No. of digital outputs	1
Measuring circuits	
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
Operating settings	
Phase current stage IL>	0.5...6.0 x In
Earth-fault current Io>	0.05...5.0 x In
Accuracy	15%
Reset ratio	0.95

VAMP 4R trip multiplier relay

Two groups	
Power supply	24Vdc
Control signal	18..265 V ac/dc
Tripping contacts	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	AgNi

Disturbance tests

Emission	EN 61000-6-4
Conducted	EN 55011, 0.15–30 MHz
Emitted	EN 55011, 30–1000 MHz
Immunity	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

Insulation test voltage	IEC 60255-5
	2 kV, 50 Hz, 1 min
Impulse test	IEC 60255-5
	5 kV, 1.2/50 ms, 0.5 J

Mechanical tests

Shock response	IEC 60255-21-2, class I
	half sine 11 ms,
	Acceleration 5 g
	6 directions, 3 pulse each dir.
Shock withstand	IEC 60255-21-2, class I
	half sine 11 ms,
	Acceleration 15 g
	6 directions, 3 pulse each dir.
Bump test	IEC 60255-21-2, class I
	half sine 16 ms,
	Acceleration 10 g
	6 dir., 1000 pulse each dir.
Vibration	
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

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

DEVICE TRACK RECORD

- Schneider Electric's VAMP Range specializes in arc flash protection relays for power system.
- Schneider Electric VAMP's arc flash fault protection functionality enhances the safety of both people and property and has made Schneider Electric VAMP a pioneer in the field of arc flash protection with more than 10.000 VAMP arc flash systems and units with over 150.000 arc detecting sensors in service worldwide.
- All Schneider Electric VAMP products meet the latest international standards and regulations.
- Our success is based on competitive standard products, constant development by our designers possessing experience from arc flash relay generations

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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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