VAM 3QD

Low voltage
arc eliminator unit

Technical manual

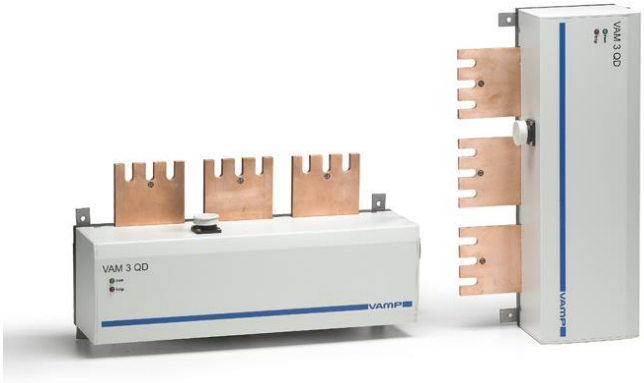


Table of Contents

1. General

1.1. Operation safety

1.1.1. Before commencing the installation

Warning!

Dangerous electrical voltage!

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the Chapter 9 engineering instructions of the device concerned.
- Only suitably qualified personnel to EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or the potential equalization. The installing electrician is responsible for the implementation of this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24-volt supply. Only power supplies which conform to the stipulations of IEC 60364-4-41 or HD 384.4.41 S2 (VDE 0100 Part 410) may be used.

- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlocking the Emergency-stop devices may not initiate a restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Suitable external measures must be implemented at locations where faults in automation devices can cause injury to personnel or material damage to assets. These measures must guarantee or force safe operating conditions during a fault (e.g. using independent limit monitors, mechanical interlocks, etc.).

2. Introduction

According to the EN 60439-1 standard, low-voltage switchgear systems are to be designed to ensure the highest possible levels of protection for personnel and for the system.

The VAMP 221, VAMP 321 arc-fault detection system (without quenching device) or the VAMP 221, VAMP 321 arc-fault protection system (with quenching device) can be used to suit the customers requirements.

2.1. Effects of an arc-fault

The occurrence of an arc-fault in a low-voltage system cannot be completely avoided despite high levels of manufacturing quality and type testing of switchgear combinations, switchgear and sophisticated engineering systems.

The causes which can lead to the occurrence of an arc-fault can be divided into three groups:

- loose connections
- human errors
- foreign bodies and animals (rodents)

Arcing faults present a very high level of danger for personnel and material assets due to the very high energy density involved.

The rise time to destructive levels of pressure and temperature is only 15 ms. The pressure developed in the direct vicinity of the arc fault is up to a maximum of 300 kPa. The temperature develops its maximum value after a further 5 ms.

In enclosed compact switchgear control panels, this pressure will blow the enclosure apart if the pressure cannot be relieved by pressure relief flaps. During this blow-off process, a mixture of poisonous combustion residues and incandescent and molten particles are ejected in the direct vicinity of the switchgear system, which can seriously injure personnel and cause a fire.

The only remedy is to stifle this arc-fault before it has achieved its maximum effect.

2.2. Use of VAMP 221 and VAMP 321

Arc-faults can be detected by the light which is produced and the changes in the current values. The VAMP 221 and VAMP 321 system recognises typical arc-fault light via light sensors and the current value via current transformers, which are installed upstream of the incoming circuit-breaker.

The evaluation of the light and current signals occurs in the evaluation unit. The quenching device and incoming circuit-breaker are only activated when both signals are present.

The detection, evaluation and quenching of the arc is carried within 2 ms. The VAM 3QD quenching device quenches the arc-fault before it can develop its destructive force. The circuit-breaker isolates the system from the mains supply.

The system can be reactivated after a very short delay.

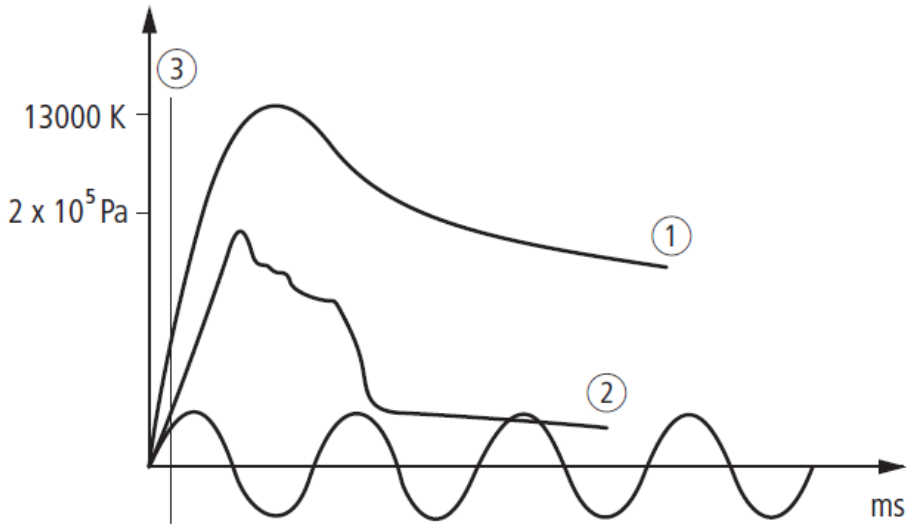


FIGURE 2.2-1 Development of pressure and temperature with an arc-fault
1.Temperature
2.Pressure
3.Arcing time with VAMP 221 arc-fault protection system ~ 2 ms and with VAMP 321 less than 2ms

3. System description

3.1. Function description and arc-fault protection system

The VAMP 221, VAMP 321 arc-fault protection system is comprised of light and current sensors, electronic evaluation units and a quenching device.

The VAM 3QD quenching device short-circuits the arc-fault related busbar system less than 2 ms including detection and deprives the arc of its destructive energy, and the arc fault is quenched.

The 3-phase short-circuit generated by the quenching device is switched off by the incoming circuit-breaker.

3.2. Arc-fault detection system function description

The VAMP 221 and VAMP 321 arc-fault detection system is comprised of light and current sensors and electronic evaluation units.

Both VAM 3L with it's fibre loop sensor and VAM10L with it's point sensors (VA 1 DA) can be used. The detection of the arc-fault current is implemented via a measurement transformer upstream of each incoming circuit-breaker. Secondary currents of 1 A or 5 A can be used. If an arc-fault occurs, the emitted light and the arc current are detected and evaluated by the VAMP 221 arc-fault detection system (see VAMP 221 manual or VAMP 321 manual).

The QD-unit is launched in time fault section of the switchgear, and the circuit breakers tripped. In order to isolate the fault, please see FIGURE 3.2-1

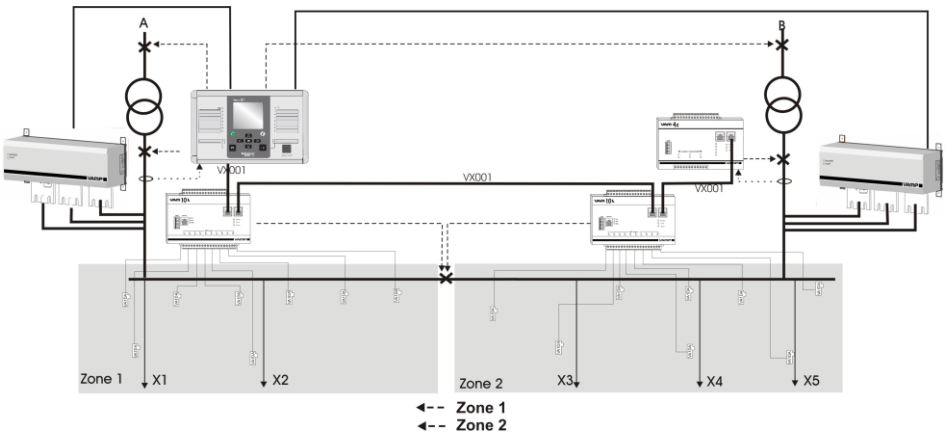


FIGURE 3.2-1 Two- zone application with selective quenching setup.

3.3. Components

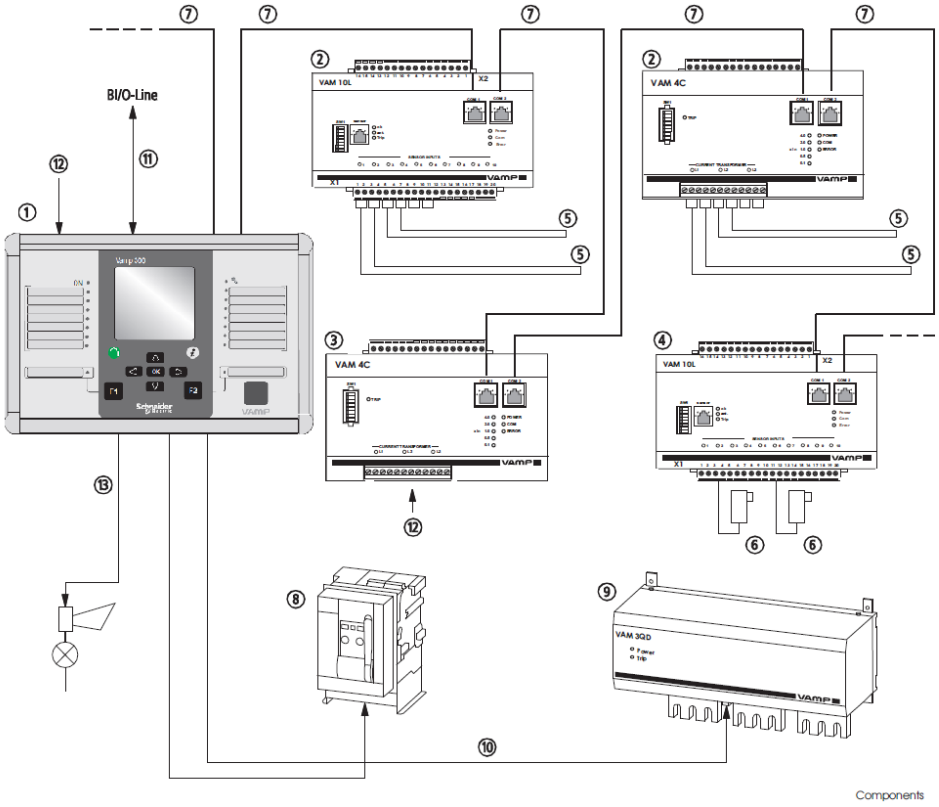


FIGURE 3.3-1 VAMP 321 component overview
1. VAMP 321 master unit
2. VAM 3L slave unit line
3. VAM 4C slave unit current
4. VAM 10L slave unit point
5. Light sensor - ARC-SL…fiber sensor
6. Light sensor – VA 1 DA point sensor
7. VX001-xx connection cable
8. CB circuit-breaker
9. VAM 3QD quenching device
10. ARC-CCAT quenching device connection cable
11. Interconnection between master units
12. Measurement transformer 3 x 1 A/5A
13. Relay outputs

.

4. Commissioning

Warning!
The VAMP 221 or VAMP 321 arc-fault protection system must be put into operation 5 minutes before the power distribution system which is to be protected.

4.1. Procedure before restart

If a system shut-down due to an arc-fault is indicated, proceed in the following manner:

- Document the states of the master units (LEDs, 7 segment displays, LCD display), the slave units and the quenching devices. Use the "System Status" form for this purpose (See Chapter 12 "Appendix",).
- Refer to the power distribution system documentation for the installation location of the slave unit (VAM 3L or VAM 10L) with the displayed address and the place of installation of the displayed sensor.
- If you are using VAMP 221 or VAMP 321 with a quenching device (VAM 3QD), identify the installation location of the actuated quenching device in the project documentation of the power distribution system.
- Remove the actuated quenching device (VAM 3QD), as described in the installation instructions (See Chapter 9).
- Rectify the cause of the fault and, if necessary, clean the point of the fault. Proceed in accordance with the generally accepted rules of electrical engineering.
- Reset the master unit as described in the VAMP 221 or VAMP 321 user manual. The LEDs, displays and relay contacts return to the operational state. If VAMP 221 or VAMP 321 is used without a quenching device (VAM 3QD), ignore the next step.
- Install an un-tripped quenching device (VAM 3QD).

  Replacement devices are available from VAMP Ltd.,. Proceed as described in the installation instructions (See Chapter 9)

Note! **If you do not have an un-tripped quenching device (VAM 3QD) and are unable to wait for the Spare part, it is possible to continue operating the system without a quenching device.**

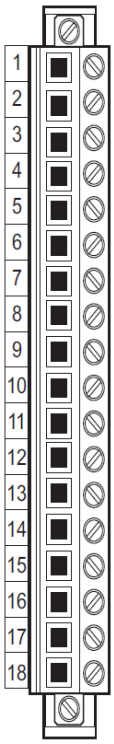
It should be noted however, that this possibility does not provide the highest protection for your switchboard system. If there is a further arc fault, the arc will be cleared by the circuit-breaker. The resulting damage to the switchboard system may then be far more serious.

5. System components

5.1. Master unit connections

VAMP 221 Connections

X2



No.	Designation	Notes	
1	LPWR	Power LED control (Unit 1)	VAM 3QD quenching device connections Zone 1
2	GND	Power + Trip LED GND (Unit 1)	
3	LTRIP	Trip LED control (Unit 1)	
4	Not assigned		
5	1 A+ (+24v)	Semiconductor output A (Trip group 1)	
6	1 A- (GND)		
7	1 B+ (+24v)	Semiconductor output B (Trip group 1)	
8	1 B- (GND)		
9	Not assigned		
10	Not assigned		
11	LPWR	Power LED control (Unit 2)	VAM 3QD quenching device connections Zone 2
12	GND	Power + Trip LED GND (Unit 2)	
13	LTRIP	Trip LED control (Unit 2)	
14	Not assigned		
15	2 A+ (+24v)	Semiconductor output A (Trip group 2)	
16	2 A- (GND)		
17	2 B+ (+24v)	Semiconductor output B (Trip group 2)	
18	2 B- (GND)		

VAMP 321 Connections

5/E/1:1 - 20

No.	Designation	
20	GND	Ground Potential
19	QD-1A	QD output 1A (+)
18	QD-1A	QD output 1A (-)
17	NC	No Connection
16	GND	Ground Potential
15	QD-1B	QD output 1B (+)
14	QD-1B	QD output 1B (-)
13	NC	No Connection
12	GND	Ground Potential
11	QD-2A	QD output 2A (+)
10	QD-2A	QD output 2A (-)
9	NC	No Connection
8	GND	Ground Potential
7	QD-2B	QD output 2B (+)
6	QD-2B	QD Output 2B (-)
5	NC	No Connection
4	GND	Ground Potential
3	BI1	Binary Input 1 (-) (NOTE! not in use)
2	BI1	Binary Input 1 (+) (NOTE! not in use)
1	GND	Ground Potential

5.2. Quenching device VAM 3QD

5.2.1. General

The VAM 3QD quenching device is a 3-pole quick make device. It is intended to quench arc-faults.

The switching drive is operated by two pyrotechnical pressure elements which provide the necessary energy to drive the switch when tripped.

Note! Opening the VAM 3QD quenching device is not permitted for any reason. It contains pyrotechnical elements which can explode and cause serious injury if handled incorrectly.

With a selective busbar system design, one quenching device per busbar section is installed in the power distribution system.

5.2.2. Connections and displays

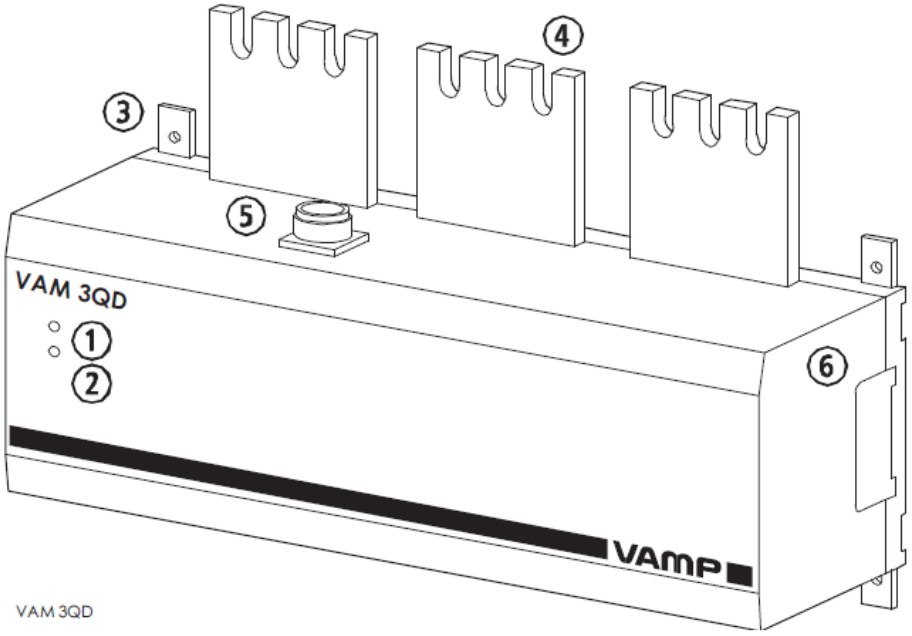


Figure 5.2.2-1 VAM 3QD quenching device view
1. Operational LED display (not used with VAMP 321)
2. Arc-fault shutdown LED display (not used with VAMP 321)
3. Fixing straps
4. Busbar connection
5. ARC-CCAT connection cable connection point
6. Type label

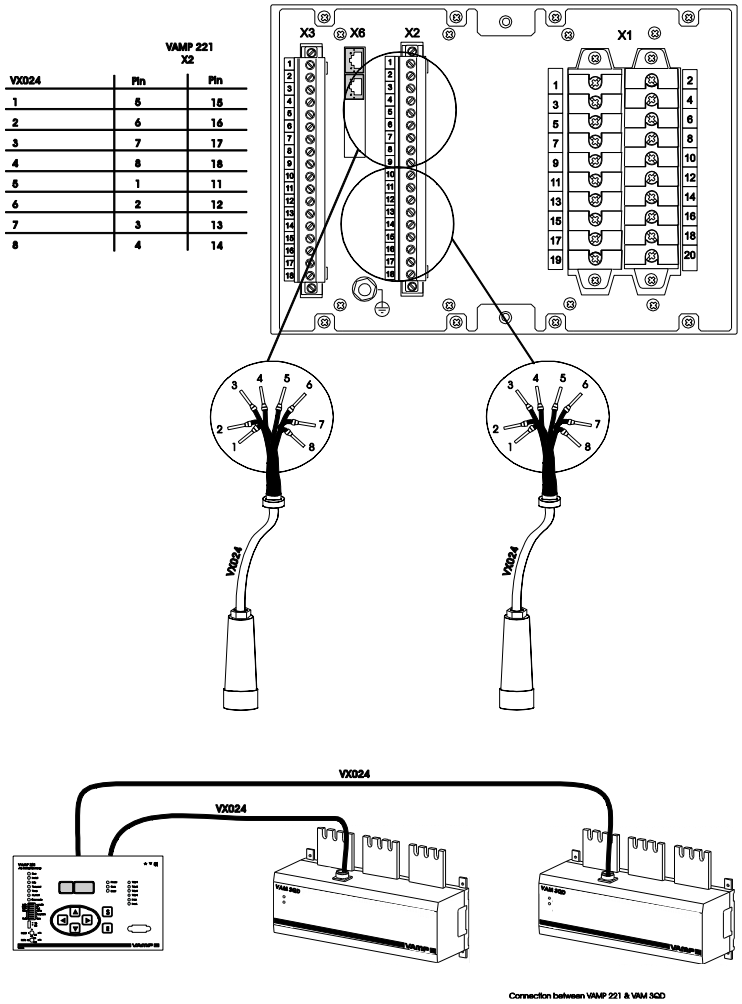


Figure 5.2.2-2 Connection between VAMP 221 and VAM 3QD

Vamp 321
Slot 5

VX077	Pin, QD-1	Pin, QD-2
1	19	11
2	18	10
3	15	7
4	14	6
PE	20	12

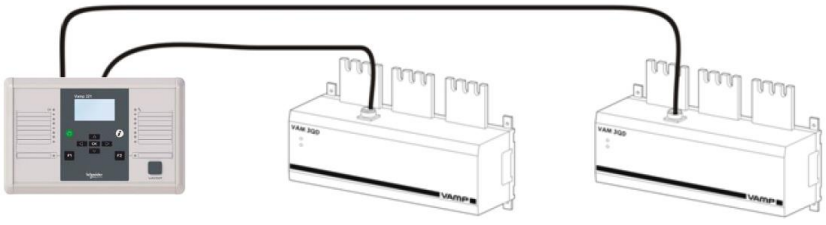


Figure 5.2.2-3 Connection between VAMP 321 and VAM 3QD

5.2.3. Quenching device function description

In the event of an arc-fault, the master unit generates a trip pulse for the quenching device.

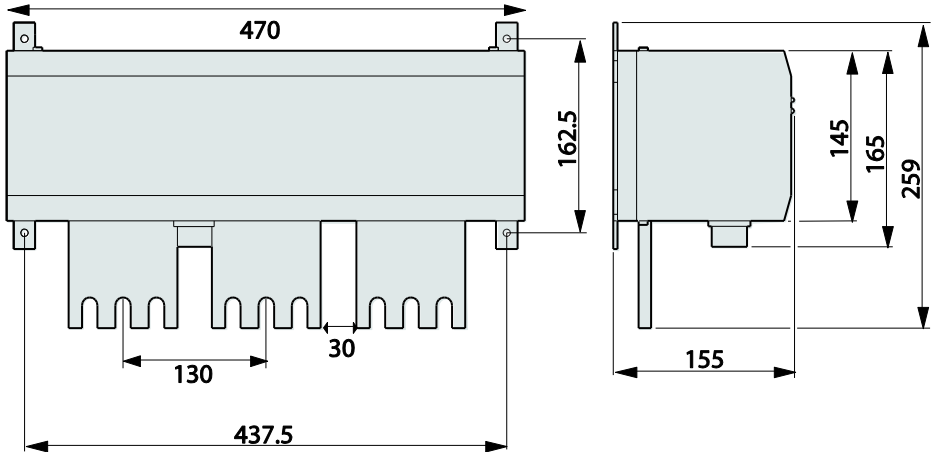
The quenching device creates a permanent 3-pole galvanic short-circuit within 2 ms including detection of the arc-fault.

The arc voltage breaks down and the arc-fault is quenched.

The quenching device must be exchanged after an arc-fault related shutdown when tripped.

6. Dimensions

VAM 3QD-T quenching device



Units: millimetres

VAM 3QD-B is identical in size, but busbar termination is located on top.

7. Technical data

7.1. Quenching device VAM 3QD

QD rating's	
Rated impulse-withstand voltage	Uimp: 8 kV
Rated insulation voltage	Ui: 1,000 V
Rated operational voltage	690 V / AC
Overvoltage category/degree of pollution	III / 3
Rated short-time withstand current	Icw: 85 kA / 1 s 105 kA / 500 ms 150 kA / 200 ms
Operation time	
VAM 3QD Mechanical operation time from control signal:	550 µs ±20% (excluding detection time of the arc fault detection system)
Total arc fault mitigation time:	<2 ms, with VAMP221 or 321 system (including detection, evaluation and mitigation of the arc fault by VAM 3QD)
Ambient data	
Enclosure protection	IP00
Storage temperature	-20 to +65 °C
Ambient temperature	-10 to +75 °C
Dimensions (wxhxd)	470 x 165 x 155 mm
Weight	Approx 15 kg
Busbar connection	3 x 100 x 10 copper busbar
Clearance between conductor centres	130 mm
Clearance between edge to edge	30 mm

7.2. Standards

General standards

Product standard	DIN EN 50178, DIN EN 60439
Basic specification	DIN EN 50082-2, DIN EN 50081-1

High voltage test

IEC 60255-5 1)	2.5 kV (rms)/50 Hz, 1 min
DIN EN 50178 1)	

1) All current paths to other current paths and touchable surfaces

EMC tests for noise immunity

Noise immunity to fast transient interference (Burst)		
DIN EN 61000-4-4, class 4	Power supply, mains inputs	± 4 kV, 2.5 kHz
	Other inputs and outputs	± 2 kV, 5 kHz
Immunity to electrostatic discharge (ESD)		
DIN EN 61000-4-2, class 3	Discharge in air	8 kV
	Contact discharge	6 kV

Immunity to surge voltage		
DIN EN 61000-4-5, class 3	Within a circuit	2 kV
	Current path to earth	4 kV
Immunity to high frequency electromagnetic fields		
DIN EN 61000-4-3, class 3		10 V/m
Immunity to conducted disturbances		
DIN EN 61000-4-6, class 3		10 V
Immunity to power frequency magnetic fields		
DIN EN 61000-4-8, class 5	Continuous	100 A/m
	3 s	1000 A/m

EMC tests for emitted interference

Measurement of the radio interference voltage	
DIN EN 55011	Limit value class A; Industrial
Measurement of the radio interference emission	
DIN EN 55011	Limit value class A; Industrial

Mechanical limit testing

Vibration testing (sinusoidal)	
DIN EN 60068-2-6	20 cycles per axis 3.0 mm at 2 to 9 Hz 1 gn at 9 to 200 Hz
Shock testing	
DIN EN 60068-2-27	3 x per axis 15 gn, 11 ms half sinusoidal
Transport testing	
DIN EN 60068-2-64	30 min. per axis
Broad band random	1 m^2/s^3 at 0 to 200 Hz 0.3 m^2/s^3 at 200 to 2000 Hz

Climatic testing

Damp heat constant DIN IEC 68-2-3	180 days 40 °C, 93 % rel. humidity
Damp heat cyclic DIN IEC 68-2-30	180 days (180 cycles) 40 °C, > 90 % rel. humidity
Light sensor temperature change	30 cycles 100 °C/–30 °C, 2 h

8. Application example

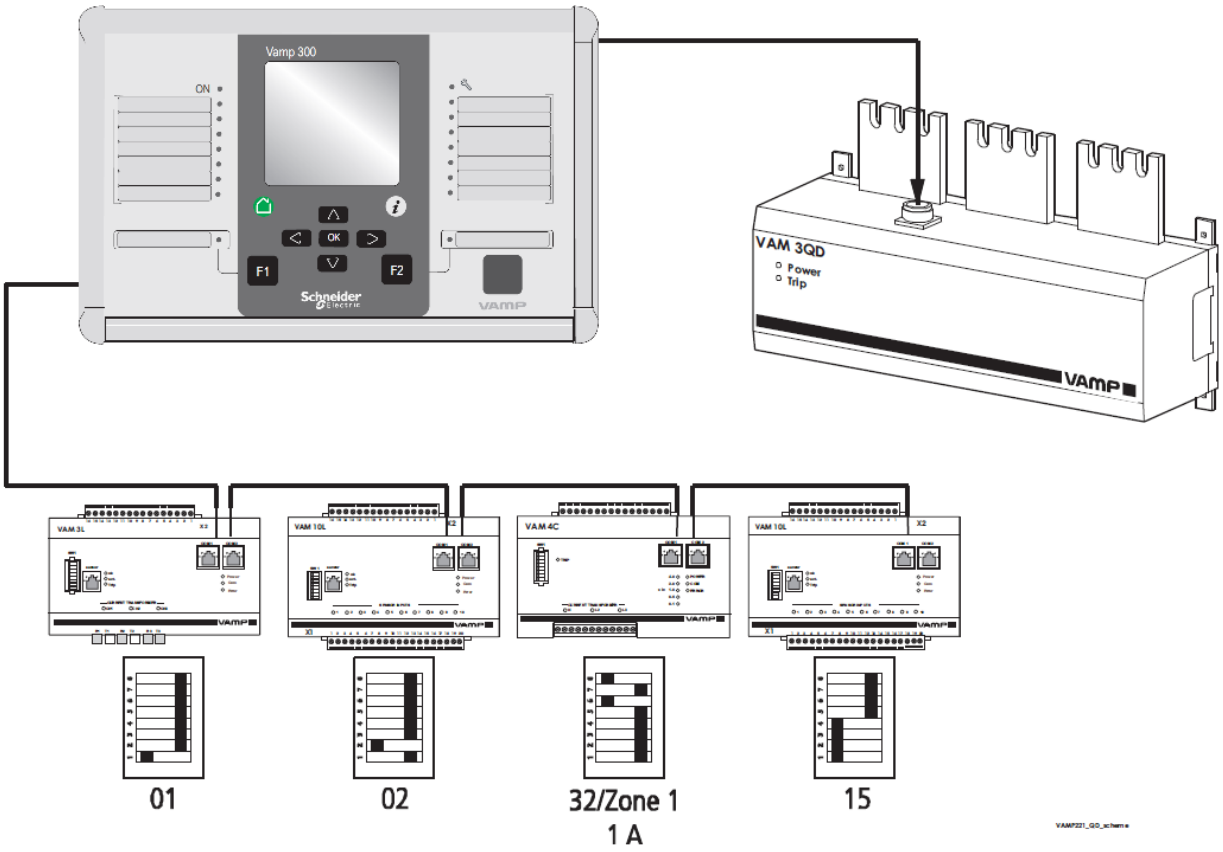


Figure 8-1 Application with a busbar system

9. Installation instruction

Electric current! Danger to life!

Only skilled or instructed persons may carry out the following operations

VAM 3QD-B VAM 3QD-T

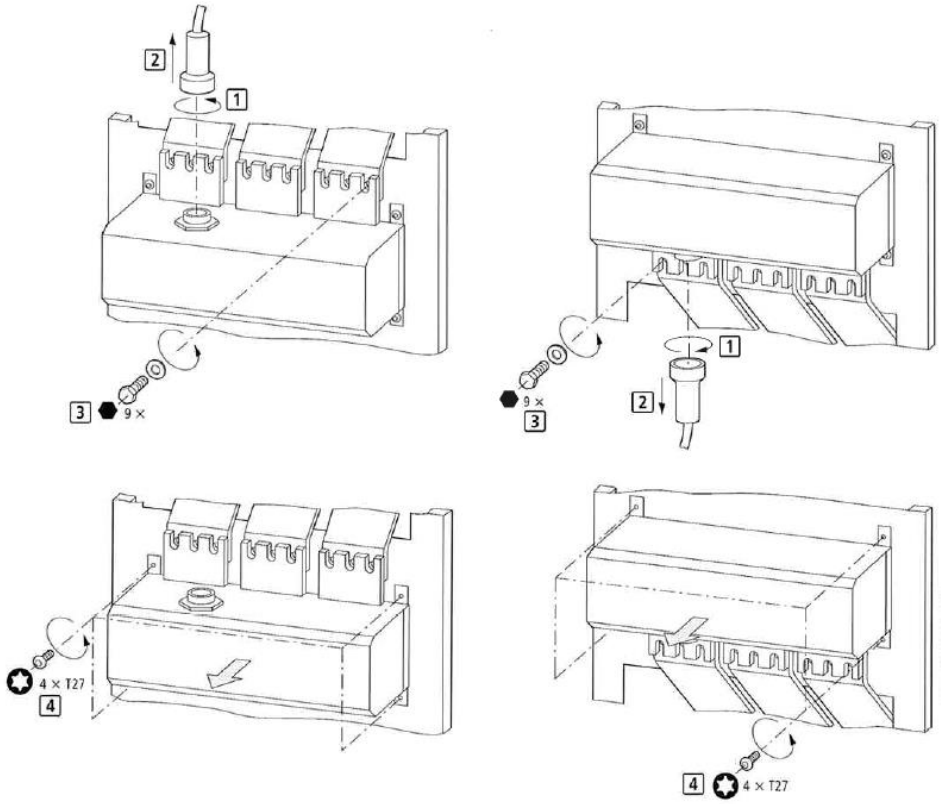


Figure 9-1 Dismantling's of VAM 3QD bottom and top

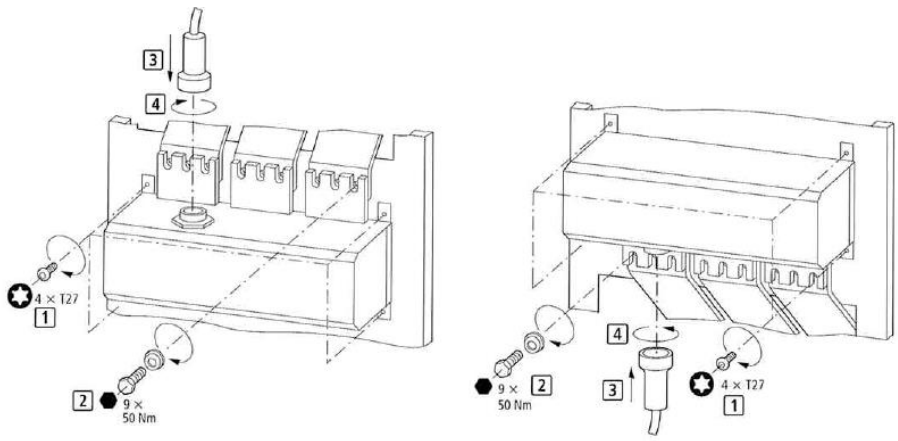


Figure 9-2 Mountings of VAM 3QD bottom and top

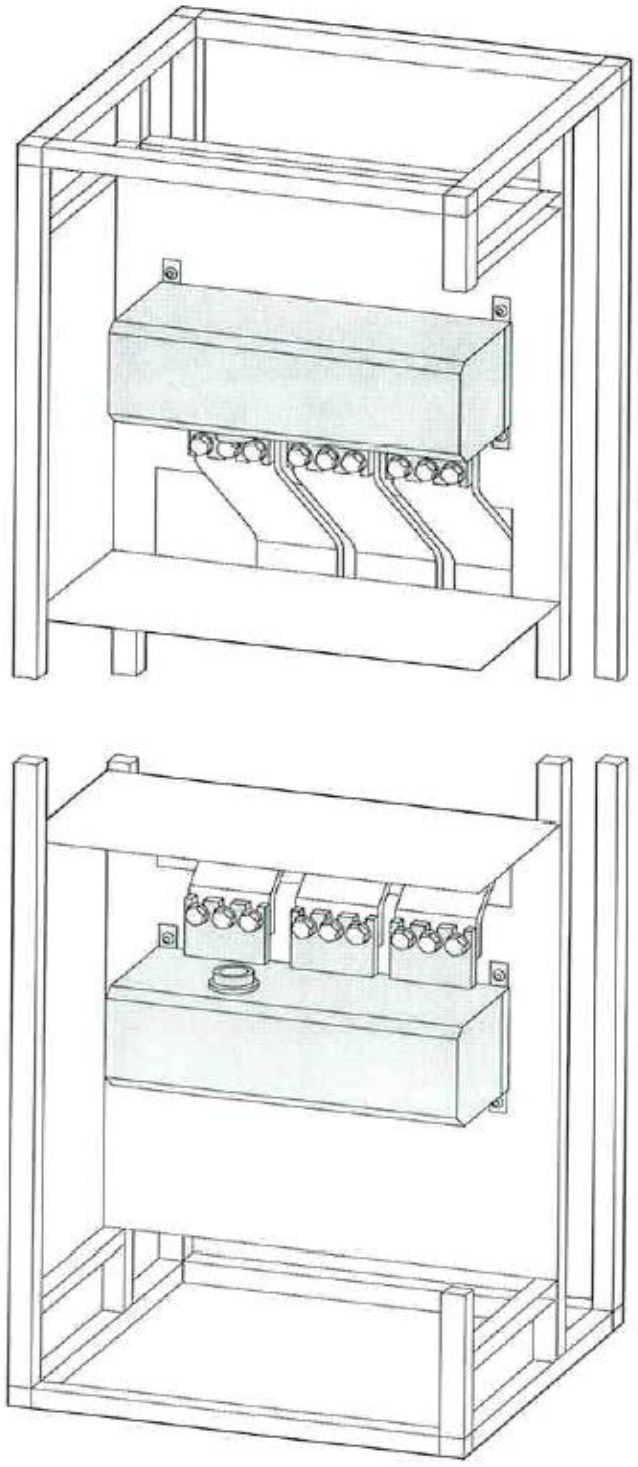


Figure 9-3 Mounting positions of VAM 3QD bottom and top

10. Order information

When ordering, please state:

1. Type designation:
2. Quantity:
3. Options (see respective ordering code):

VAM 3QD ORDERING CODE

TYPE	Explanation
VAM 3QD-T	Busbar connection from bottom
VAM 3QD-B	Busbar connection from top
Cable VX 024-X	Cable for quenching device with VAMP 221, Cable lengths, X= 5 and 10 meters
Cable VX 077	Cable for quenching device with VAMP 321, Cable length 5 meters

11. Reference information

Service :
VAMP Ltd.,
P.O. Box 810
FIN-65101 Vaasa, Finland
Visiting address: Yrittäjänkatu 15
Phone: +358 (0)20 753 3200

12. Appendix

System status from

Customer:	
System operator:	
Location/building:	
Place/date:	
Factory order No.:	
Recorded by:	

General

VAMP 221 / 321 indicator light in control panel front (if available)	
Messages from higher level systems (PLC/PLS)	
Peculiarities, remarks	

Master units

		Master unit_____		Master unit_____		Master unit_____	
Section No.							
Equipment identification code							
Display	RUN mode						
	ERROR mode						
LEDs	Trip1/Trip 2	ON ☐	OFF ☐	ON ☐	OFF ☐	ON ☐	OFF ☐
	Trip3/Trip 4	ON ☐	OFF ☐	ON ☐	OFF ☐	ON ☐	OFF ☐
	Power	ON ☐	OFF ☐	ON ☐	OFF ☐	ON ☐	OFF ☐
	Error	ON ☐	OFF ☐	ON ☐	OFF ☐	ON ☐	OFF ☐
Current signal selector switch position		1A ☐	5A ☐	1A ☐	5A ☐	1A ☐	5A ☐
Serial number							

VAM 3L

Section No.		Equipment identification code			Address:					
LEDs	Sensor	CH1			CH2			CH3		
		ON	OFF	FLASHES	ON	OFF	FLASHES	ON	OFF	FLASHES
		☐	☐	☐	☐	☐	☐	☐	☐	☐
	Status	POWER			COM			ERROR		
		ON	OFF		ON	OFF		ON	OFF	
		☐	☐		☐	☐		☐	☐	
	Mobile sensor	OK			ACTION					
		ON	OFF	FLASHES	ON	OFF	FLASHES			
		☐	☐	☐	☐	☐	☐			
Serial number										

DIP switch	NO.	ON	OFF
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		

Section No.		Equipment identification code			Address:					
LEDs	Sensor	CH1			CH2			CH3		
		ON	OFF	FLASHES	ON	OFF	FLASHES	ON	OFF	FLASHES
		☐	☐	☐	☐	☐	☐	☐	☐	☐
	Status	POWER			COM			ERROR		
		ON	OFF		ON	OFF		ON	OFF	
		☐	☐		☐	☐		☐	☐	
	Mobile sensor	OK			ACTION					
		ON	OFF	FLASHES	ON	OFF	FLASHES			
		☐	☐	☐	☐	☐	☐			
Serial number										

DIP switch	NO.	ON	OFF
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		

VAM 4C

Section No.		Equipment identification code			Address:					
LEDs	Sensor	L1			L2			L3		
		ON ☐	OFF ☐	FLASHES ☐	ON ☐	OFF ☐	FLASHES ☐	ON ☐	OFF ☐	FLASHES ☐
	Status	POWER			COM			ERROR		
		ON ☐	OFF ☐		ON ☐	OFF ☐		ON ☐	OFF ☐	
Serial number										

DIP switch	NO.	ON	OFF
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		

Section No.		Equipment identification code			Address:					
LEDs	Sensor	L1			L2			L3		
		ON ☐	OFF ☐	FLASHES ☐	ON ☐	OFF ☐	FLASHES ☐	ON ☐	OFF ☐	FLASHES ☐
	Status	POWER			COM			ERROR		
		ON ☐	OFF ☐		ON ☐	OFF ☐		ON ☐	OFF ☐	
Serial number										

DIP switch	NO.	ON	OFF
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		

VAM 10L

Section No.		Equipment identification code			Address:					
LEDs	Sensors	1			2			3		
		ON	OFF	FLASHES	ON	OFF	FLASHES	ON	OFF	FLASHES
		☐	☐	☐	☐	☐	☐	☐	☐	☐
		4			5			6		
		ON	OFF	FLASHES	ON	OFF	FLASHES	ON	OFF	FLASHES
		☐	☐	☐	☐	☐	☐	☐	☐	☐
		7			8			9		
		ON	OFF	FLASHES	ON	OFF	FLASHES	ON	OFF	FLASHES
		☐	☐	☐	☐	☐	☐	☐	☐	☐
		10								
		ON	OFF	FLASHES						
		☐	☐	☐						
	Status	POWER			COM			ERROR		
		ON	OFF		ON	OFF		ON	OFF	
		☐	☐		☐	☐		☐	☐	
	Mobile sensor	OK			ACTION					
		ON	OFF	FLASHES	ON	OFF	FLASHES			
		☐	☐	☐	☐	☐	☐			
Serial number										

DIP switch	NO.	ON	OFF
	8		
	7		
	6		
	5		
	4		
	3		
	2		
	1		

VAM 3QD quenching device

<table>
<tr><td>Section No.</td><td colspan="2">Equipment identification code:</td><td colspan="2">Equipment identification code of the actuated master unit:</td></tr>
<tr><td rowspan="2">LEDs
(Not used with VAMP 321)</td><td colspan="2">POWER</td><td colspan="2">ERROR</td></tr>
<tr><td>ON
☐</td><td>OFF
☐</td><td>ON
☐</td><td>OFF
☐</td></tr>
<tr><td>Type</td><td colspan="4">VAM 3QD</td></tr>
<tr><td>Serial number</td><td colspan="4"></td></tr>
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<tr><td>Section No.</td><td colspan="2">Equipment identification code:</td><td colspan="2">Equipment identification code of the actuated master unit:</td></tr>
<tr><td rowspan="2">LEDs
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We reserve the right to changes without prior notice

VAMP Ltd.

Street address: Yrittäjänkatu 15
Post address:
P.O.Box 810, FIN 65101 Vaasa,
Finland

Phone: +358 20 753 3200

Internet: m.vamp.fi
Email: vamp@vamp.fi