

VAMP 210

Generator protection relay

Technical Data Sheet

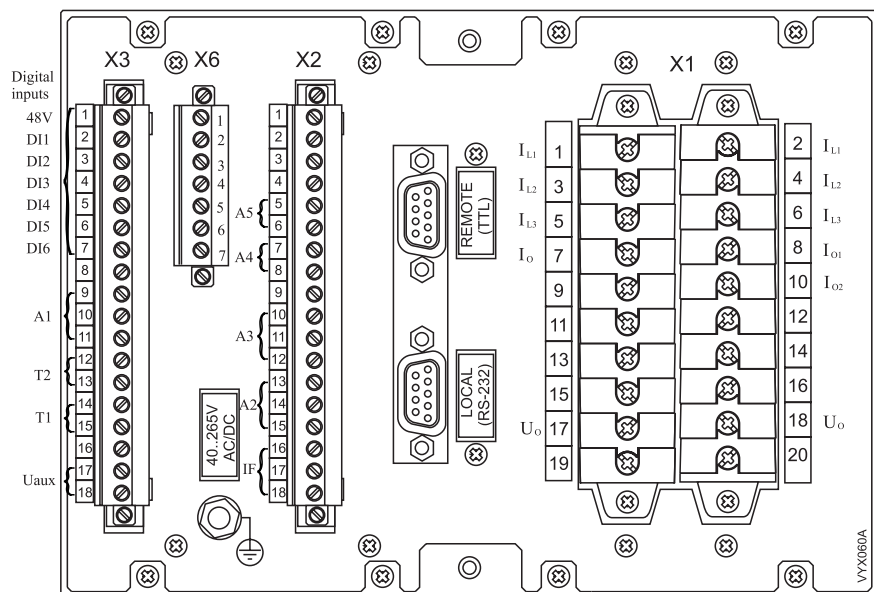
Application

The numerical generator protection relay VAMP 210 includes all the essential functions needed for protection of small or medium-sized power generators in modern unmanned fully automatic power plants. Further the relay includes several programmable functions, such as arc, thermal and circuit breaker protection and communication protocols for various protection and communication situations.

The generator protection relay provides comprehensive protection for generators in various power plant types, such as hydro, steam and diesel power plants. The same relay type can be used for the protection of a single generator as well as for several generators running in parallel.

The modern technology in association with an extensive self-supervision system and a reliable construction ensures an extremely high availability for the VAMP 210 protection relay.

Connections



The generator protection relay is connected to the protected object through the following measuring and control connections:

- Phase currents I_{L1} , I_{L2} ja I_{L3} (terminals X1: 1-6)
- Residual currents I_{o1} and I_{o2} (terminals X1: 7-10)
- Phase-to-phase voltages U_{12} and U_{23} (terminals X1: 11-14)
- Residual voltage U_0 (terminals X1: 17-18)

Digital inputs

Further the generator protection relay can collect status information and alarm signals via six binary inputs (terminals X3: 2-7).

The binary inputs can be used to:

- Block protection stages under certain conditions.
- Get time stamped event code from any auxiliary contact.
- Control the output relays.
- Supervise the trip circuit.

The binary uses the internal 48 V dc auxiliary voltage of the relay (terminal X3: 1). Potential-free contacts must be available in the protected object for transfer of status information to the relay.

Auxiliary voltage

The external auxiliary voltage U_{aux} (standard 40...265 V ac or dc) for the relay is connected to the terminals X3: 17-18.

Note!

Polarity of the auxiliary voltage U_{aux} (24 V dc, option B):
- = X3:17 and + = X3:18.

Output relays

The generator protection relay is equipped with seven configurable output relays and a separate output relay for the self-supervision system:

- Trip relays T1 ja T2 (terminals X3: 12-13 and 14-15)
- Alarm relays A1 - A5 (terminals X2: 5-6, 7-8, 10-12, 13-15 and X3: 9-11)
- Self-supervision system output relay IF (terminals X2: 16-18)

Arc protection

The optional arc protection card includes two arc sensor channels. The arc sensors are connected to terminals X6: 4-5 and 6-7.

The arc information can be transmitted and/or received through the digital input and output channels. This is a 48 Vdc signal.

Connections:

- X6: 1 Digital input (BI)
- X6: 2 Digital output (BO)
- X6: 3 GND
- X6: 4-5 Sensor 1
- X6: 6-7 Sensor 2

The GND must be connected together between the GND of the connected devices.

Disturbance recorder

The disturbance recorder can be used to record all measured signals i.e. currents and voltages, status information of digital inputs (DI) and digital outputs (DO). The digital inputs include also the Arc light information. The digital outputs include the Arc binary output information (BO).

Recorder capacity is 48 000 bytes. There can be a maximum of 5 recordings and the maximum selection of channels in one recording is 12 (limited in waveform recording).

The recorder can be triggered by any protection stage start or trip signal. The trig signal is selected in the output matrix. The recording can also be triggered manually.

When recording is made also the time stamp will be memorized.

The recordings can be viewed by VAMPSET program. The recording is in COMTRADE format so also other programs can be used to view the recordings.

For more detailed information, see separate Disturbance Recorder manual VMDR.EN0xx.

Self supervision

The functions of the micro controller and the associated circuitry as well as the program execution are supervised by means of a separate watchdog circuit. Besides supervising the relay the watchdog circuit attempts to restart the micro controller in a fault situation. If the restarting fails the watchdog issues a self-supervision alarm because of a permanent relay fault.

When the watchdog circuit detects a permanent fault it always blocks any control of the other output relays, except for the self-supervision output relay.

Also the internal supply voltage is supervised. Should the auxiliary supply of the relay disappear, an IF alarm is automatically given, because the IF output relay is normally always energized when the auxiliary supply is on and within the permitted range.

Communication

PC port

The PC port is used for on-site parameterization of the relay, for downloading of the program and for reading relay parameters to a PC.

For connection to a PC, one RS 232 serial port is available on the front panel of the relay. Any connection to the port is done with the connection cable type VX 003-3.

Remote control connection

The relay can be connected to higher level systems, e.g. network control systems via the serial port named REMOTE on the rear panel. To the port a SPA-Bus, ModBus, ProfiBus or IEC-103 connection can be made using a special internal or external bus connection module. The bus type selection and the parameterization of the bus are carried out as the relay is configured.

Optional accessories are available for RS 485 connection (VMA 3 CG), Ethernet connection over TCP/IP protocol (VEA 3 CG) and ProfiBus connection (VPA 3CG). Please see the corresponding documentation for more details.

	Standards interface	Option modules			
		Internal	Internal	Internal	External
Protocol	RS 232: VX004-M3 or VX008-4	Plastic:	RS 485:	ProfiBus:	Ethernet: VEA3CG + VX003 + (VX004-M3)
ModBus	X	X	X		
SPA-Bus	X	X	X		
ProfiBus				X	
IEC-60870-5-103	X	X	X		
ModBus/ TCP					X
Transparent TCP/IP					X

Technical data

Connections

Measuring circuitry

Rated current I_n - Current measuring range - Thermal withstand - Burden	1 A or 5 A 0 - 50 x I_n 4 x I_n (continuously) 20 x I_n (for 10 s) 100 x I_n (for 1 s) < 0.1 VA ($I_n = 1$ A) < 0.2 VA ($I_n = 5$ A)
Rated voltage U_n - Voltage measuring range - Continuous voltage withstand - Burden	50 - 120 V (configurable) 0 - 175 V (100 V/110 V) 250 V < 0.5 V A
Rated frequency f_n - Frequency measuring range	45 - 65 Hz 16 - 75 Hz
Terminal block: - Solid or stranded wire	Max. wire dimension: 4 mm ² (10-12 AWG)

Auxiliary voltage

	Type A (standard)	Type B (option)
Rated voltage U_{aux}	40 - 265 V ac/dc 110/120/220/240 V ac 48/60/110/125/220 V dc	18...36 V dc 24 V dc
Power consumption Max. permitted interruption time	< 7 W (normal conditions) < 15 W (output relays activated) < 50 ms (110 V dc)	
Terminal block: - Phoenix MVSTBW or equivalent	Max. wire dimension: 2.5 mm ² (13-14 AWG)	

Digital inputs

Number of inputs	6
Operation time	0.00 – 60.00 s (step 0.01 s)
Polarity	NO (normal open) or NC (normal closed)
Inaccuracy: - Operate time	±1% or ±10 ms
Internal operating voltage	48 V dc
Current drain when active (max.)	Approx. 20 mA
Current drain, average value	< 1 mA
Terminal block: - Phoenix MVSTBW or equivalent	Max. wire dimension: 2.5 mm ² (13-14 AWG)

Trip contacts (T1 and T2)

Number of contacts	2 making contacts
Rated voltage	250 V ac/dc
Continuous carry	5 A
Max. making current	15 A
Breaking capacity, AC	2 000 VA
Breaking capacity, DC (L/R=40ms)	50 W
Contact material	AgNi 90/10
Terminal block: - Phoenix MVSTBW or equivalent	Max. wire dimension: 2.5 mm ² (13-14 AWG)

Alarm contacts (A1 - A5) and IF

Number of contacts:	3 change-over contacts (relays A1, A2 and A3) 2 making contacts (relays A4 and A5) 1 change-over contact (IF relay)
Rated voltage	250 V ac/dc
Max. make current	15 A
Continuous carry	5 A
Breaking capacity, AC	2 000 VA
Contact material	AgNi 0.15 goldplated
Terminal block - Phoenix MVSTBW or equivalent	Max. wire dimension 2.5 mm ² (13-14 AWG)

Local serial communication port

Number of ports	1 on front and 1 on rear panel
Electrical connection	RS 232
Data transfer rate	1 200 - 38 400 kb/s

Remote control connection

Number of ports	1 on rear panel
Electrical connection	TTL (standard) RS 485 (option) RS 232 (option) Plastic fibre connection (option)
Data transfer rate	1 200 - 38 400 kb/s
Protocols	ModBus, RTU master ModBus, RTU slave SpaBus, slave IEC-60870-5-103 Profibus DP (option) TCP/IP (option)

Tests and environmental conditions

Disturbance tests (EN 50263)

Emission - Conducted (EN 55022) - Emitted (EN 55022)	0.15 - 30 MHz 30 - 1 000 MHz
Immunity - Static discharge (ESD) - Fast transients (EFT) - Surge - Conducted RF field - Emitted RF field - GSM test	EN 61000-4-2, class III 6 kV contact discharge 8 kV air discharge EN 61000-4-4, class III 2 kV, 5/50 ns, 5 kHz, +/- EN 61000-4-5, class III 1 kV, 1.2/50 µs, common mode 2 kV, 1.2/50 µs, differential mode EN 61000-4-6 0.15 - 80 MHz, 10 V/m, 80% AM (1 kHz) EN 61000-4-3 80 - 1000 MHz, 10 V/m, 80% AM (1 kHz) EN 61000-4-3 900 MHz, 10 V/m, pulse modulated
1 MHz burst	IEC 60255-22-1 1 kV, differential mode 2,5 kV, common mode
Voltage interruption	IEC 60255-11

Test voltages

Insulation test voltage (IEC 60255-5)	2 kV, 50 Hz, 1 min
Surge voltage (IEC 60255-5)	5 kV, 1.2/50 µs, 0.5 J

Mechanical tests

Vibration (IEC 60255-21-1)	10...60 Hz, amplitude ± 0.035 mm 60...150 Hz, acceleration 0.5g sweep rate 1 octave/min 20 periods in X-, Y- and Z axis direction
Shock (IEC 60255-21-1)	half sine, acceleration 5 g, duration 11 ms 3 shocks in X-, Y- and Z axis direction

Environmental conditions

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

Casing

Degree of protection (IEC 60529)	IP20 / Flush mounted IP54
Dimensions (W x H x D)	208 x 155 x 225 mm
Material	1 mm steel plate
Weight	4.2 kg
Color code	RAL 7032 (Casing) / RAL 7035 (Back plate)

Package

Dimensions (W x H x D)	215 * 160 * 275
Weight (Relay, Package and Manual)	5.2 kg

Protection stages**Overcurrent protection stages****Overcurrent stage I> (50/51)**

Setting range	0.10 – 4.00 x I_{gn}
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
IDMT function: - 4 curve groups (IEC 60255-3) - Time multiplier T_p	EI, VI, NI, LTI *) 0.05 – 3.20
Start time Reset time Reset ratio	<60 ms <60 ms 0.97
Inaccuracy: - Starting - Operate time at definite time function - Operate time at IDMT function	±2% of set value ±1% or ±30 ms ±5% or at least ±30 ms ($I < 50 \times I_n$ and $I < I_{set} * 20$)

*) EI = Extremely Inverse, NI = Normal Inverse, VI = Very Inverse, LTI = Long Time Inverse

Overcurrent stage I>> (50/51)

Setting range	0.10 – 20.00 x I_{gn}
Definite time function: - Operating time	0.04 – 300.00 s (step 0.01 s)
Start time Reset time Reset ratio	<30 ms <60 ms 0.97
Inaccuracy: - Starting - Operate time	±2% of set value ±1% or ±25 ms

Voltage restrained overcurrent stage I_V> (51V)

Settings: - $I_{V>}$ - U_{X1}, U_{X2} - I_{Y1}, I_{Y2}	0.50 – 4.00 x I_{gn} 0 – 150 % 0 – 200 % $I_{V>}$
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Start time Reset time Reset ratio	<60 ms <60 ms 0.97
Inaccuracy: - Starting - Operate time	±3% of set value ±1% or ±30 ms

Unbalance stage $I_2>$ (46)

Multiplier K_2	2 – 30 %
Definite time function: - Operate time	1.0 – 600.0 s (step 0.1 s)
IDMT function: - Time multiplier k_1	1 – 40 s
Start time	<300 ms
Reset time	<300 ms
Reset ratio	0.95
Inaccuracy: - Starting - Operating time	$\pm 3\%$ units or 0.5% of rated value $\pm 5\%$ or ± 300 ms

Earth-fault protection stages**Earth fault stage $I_0>$ (50N/51N)**

Setting range	0.005 - 1.000 pu
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
IDMT function: - 4 curve groups (IEC 60255-3) - Time multiplier k	EI, VI, NI, LTI *) 0.05 - 3.20
Start time	<60 ms
Reset time	<60 ms
Reset ratio	0.97
Inaccuracy: - Starting - Operating time at definite time function - Operating time at IDMT function.	$\pm 2\%$ of set value or $\pm 0.3\%$ of rated value $\pm 1\%$ or ± 30 ms $\pm 5\%$ or at least ± 30 ms ($I < 5 \times I_n$ and $I < I_{set}$ *20)

*) EI = Extremely Inverse, NI = Normal Inverse, VI = Very Inverse, LTI = Long Time Inverse

Earth fault stage $I_0>>$ (50N/51N)

Setting range	0.01 - 2.00 pu
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	0.97
Inaccuracy: - Starting - Operating time at definite time function	$\pm 2\%$ of set value or $\pm 0.3\%$ of rated value $\pm 1\%$ or ± 30 ms

Earth fault stages $I_{02}>$, $I_{02}>>$ (50N/51N)

Setting range:	0.005 – 2.000 pu, for $I_{02}>$ 0.01 – 2.00 pu, for $I_{02}>>$
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	0.97
Inaccuracy: - Starting - Operating time at definite time function	$\pm 2\%$ of set value or $\pm 0.3\%$ of rated value $\pm 1\%$ or ± 30 ms

Directional earth fault stage $I_{0\phi}$ (67N)

Residual current setting range	0.01 – 1.00 pu
Residual voltage setting range	1 – 20%
Operating principle	$I_0 \cos \phi / I_0 \sin \phi$
Definite time function: - Operating time	0.10 – 300.00 s (step 0.02 s)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	0.95
Inaccuracy: - Starting - Operating time at definite time function	$\pm 3\%$ of set value or $\pm 0.5\%$ of rated value $\pm 1\%$ or ± 30 ms

Residual voltage stages $U_{0>}$ and $U_{0>>}$ (59N)

Residual voltage setting range	1 – 60 %
Definite time function: - Operating time	0.3 – 300.0 s (step 0.1 s)
Start time	<300 ms
Reset time	<300 ms
Reset ratio	0.97
Inaccuracy: - Starting - Operating time	$\pm 2\%$ of set value or $\pm 0.3\%$ of rated value $\pm 1\%$ or ± 150 ms

Voltage protection stages**Overvoltage stages $U_{>}$ and $U_{>>}$ (59)**

Setting range	50 – 150% x U_{gn}
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	0.97
Inaccuracy: - Starting - Operating time	$\pm 2\%$ of set value $\pm 1\%$ or ± 30 ms

Undervoltage stage $U_{1<}$ (27)

Function based on the measurement of the positive phase sequence voltage	
Setting range	20 – 120% x U_{gn}
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Undervoltage blocking - Blocking time, when $I < 1\% \times I_{gn}$	2 – 80% x U_{gn} (common with $U_{1<<}$) 0 – 30 s (common with $U_{1<<}$)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	1.03
Inaccuracy: - Starting - Operating time	$\pm 3\%$ of set value or 0.5% of the rated value $\pm 1\%$ or ± 30 ms

Undervoltage stage $U_1 < (27/60)$

Function based on the measurement of the positive phase sequence voltage	
Setting range	20 – 80% x U_{gn}
Definite time function: - Operating time	0.06 – 300.00 s (step 0.01 s)
Undervoltage blocking - Blocking time, when $I < 1\% \times I_{gn}$	2 – 80% x U_{gn} (common with $U_1 <$) 0 – 30 s (common with $U_1 <$)
Start time	<30 ms
Reset time	<60 ms
Reset ratio	1.03
Inaccuracy: - Starting - Operating time	$\pm 3\%$ of set value $\pm 1\%$ or ± 25 ms

Power protection stages**Thermal overload stage $T > (49)$**

Settings: - Time constant τ - Max. allowed continuous load current $k \times I_n$ (Θ_{trip} = thermal trip level) - Heating alarm level Θ_{alarm}	2 – 60 min 0.80 – 1.20 x I_n 60 – 99% x Θ_{trip}
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Underexcitation stage $Q < (40)$

Settings: - Q_1 and Q_2	0 – -100% x S_{gn}
Definite time function: - Operating time	0.08 – 300.00 s (step 0.02 s)
Start time	<60 ms
Reset time	<60 ms
Reset ratio	1.03 (x S_{gn})
Inaccuracy: - Starting - Operating time	$\pm 3\%$ of set value or $\pm 0.5\%$ of rated value $\pm 1\%$ or ± 150 ms

Reverse power stages $P <$ and $P << (32)$

Setting range:	-0.5 – -20-0% x P_m , for $P <$ -1 – 20% x P_m , for $P <<$
Definite time function: - Operating time	0.3 – 300.0 s (step 0.1 s)
Start time	<300 ms
Reset time	<300 ms
Reset ratio	1.05
Inaccuracy: - Starting - Operating time	$\pm 3\%$ of set value or $\pm 0.5\%$ of rated value $\pm 1\%$ or ± 150 ms

Frequency protection stages**Overfrequency stages $f>$ and $f>>$ (81H)**

Setting range	46 – 70 Hz
Definite time function:	
- Operating time	0.10 – 300.00 s (step 0.02 s)
Undervoltage interlocking	2 - 100% x U_{gn} (Common for both stages)
Start time	<80 ms
Reset time	<60 ms
Reset ratio	0.998
Inaccuracy:	
- Starting	±20 mHz
- Operating time	±1% or ±30 ms

Underfrequency stages $f>$ and $f>>$ (81L)

Setting range	40 – 64 Hz
Definite time function:	
- Operating time	0.10 – 300.00 s (step 0.02 s)
Undervoltage interlocking	2 - 100% x U_{gn} (Common for both stages)
Start time	<80 ms
Reset time	<60 ms
Reset ratio	1.002
Inaccuracy:	
- Starting	±20 mHz
- Operating time	±1% or ±30 ms

Circuit breaker failure protection stage**Circuit breaker failure protection CBFP (50BF)**

Relay to be supervised	T1 or T2
Definite time function:	
- Operating time	0.1 – 10.0 s (step 0.1 s)
Inaccuracy:	
- Operating time	±100 ms

Arc fault protection stages (option)

The operation of the arc protection depends on the setting value of the $ArcI>$ current limit. The current limit cannot be set, unless the relay is provided with the optional arc protection card.

Arc protection stage $ArcI>$ (50AR)

Setting range	0.5 - 10.0 pu
Arc sensor connection	S1, S2, S1/S2, BI, S1/BI, S2/BI, S1/S2/BI
Operating time	~15 ms

Arc protection stages $ArcI_{0>}$, $ArcI_{02>}$ (50AR)

Setting range	0.05 - 1.00 pu
Arc sensor connection	S1, S2, S1/S2, BI, S1/BI, S2/BI, S1/S2/BI
Operating time	~15 ms

Disturbance Recorder (DR)

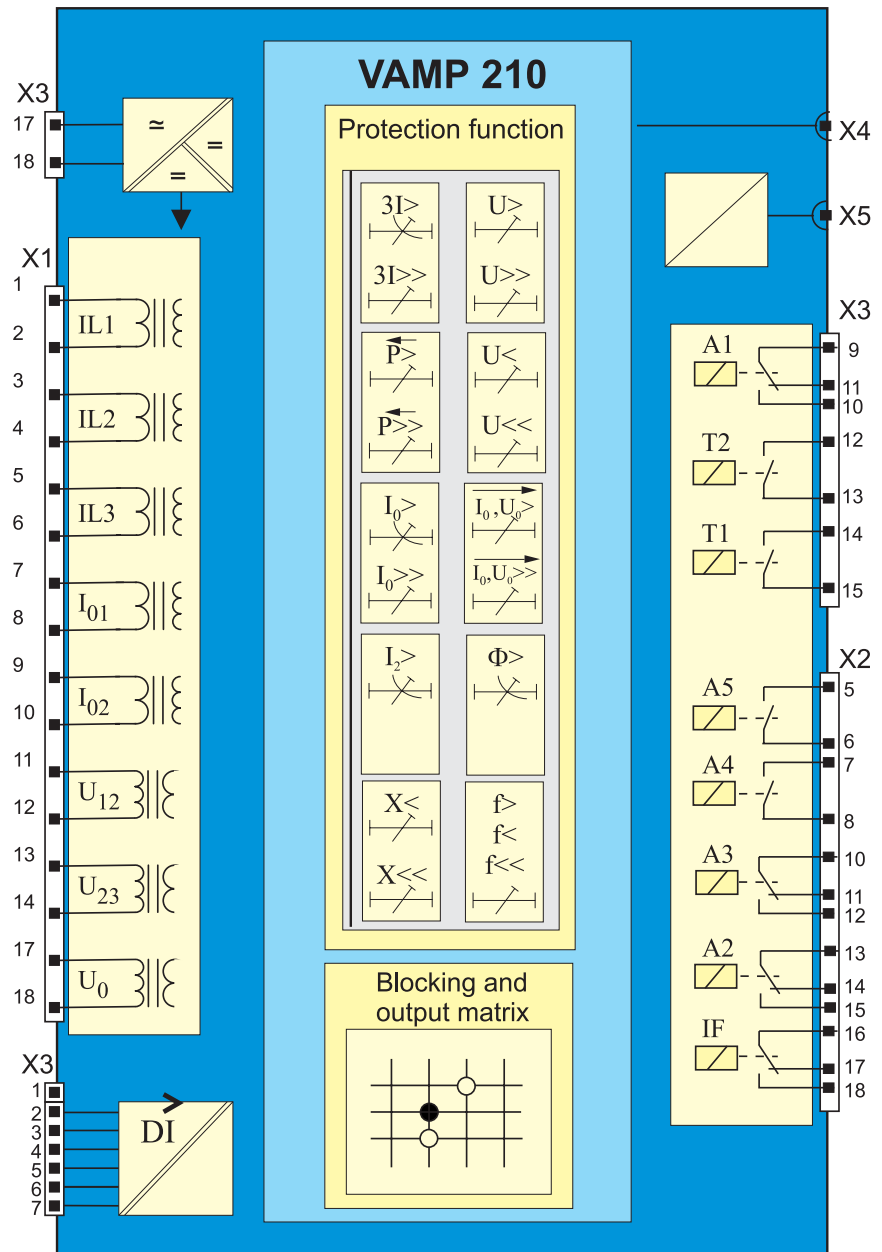
The operation of Disturbance recorder depends on the following settings. The recording time and number of records depend on the time setting and number of selected channels.

Disturbance recorder (DR)

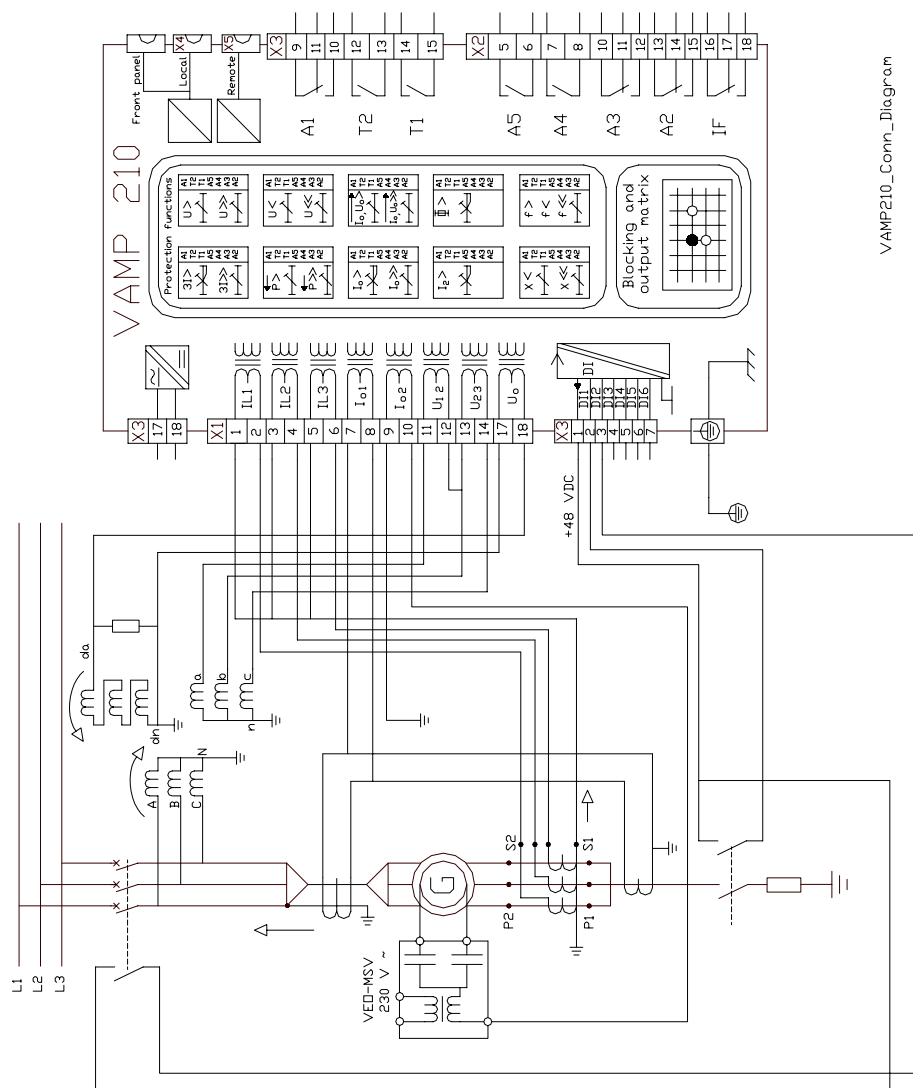
Mode of recording:	Saturated / Overflow
Sample rate:	
- Waveform recording	32/cycle, 16/cycle, 8/cycle
- Trend curve recording	10, 20, 200 ms
	1, 5, 10, 15, 30 s
	1 min
Recording time (one record)	0.1 s – 12 000 min (must be shorter than MAX time)
Pre trigger rate	0 – 100%
Number of selected channels	0 – 12

Block diagram

vamp210lohko



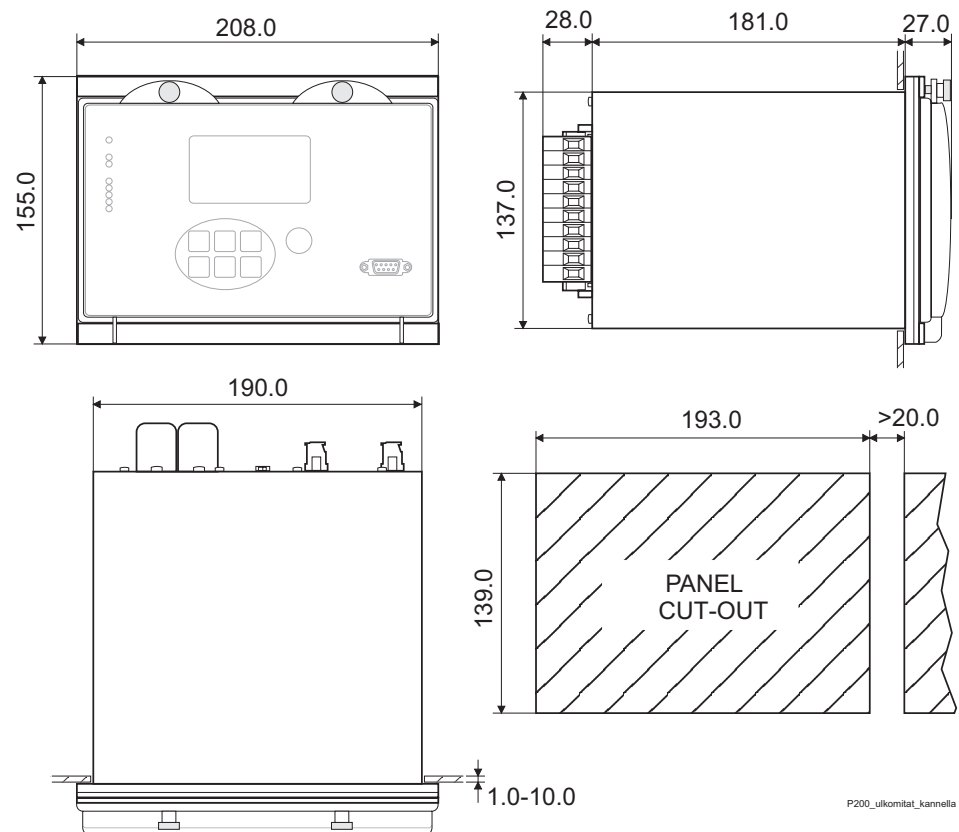
Connection diagram



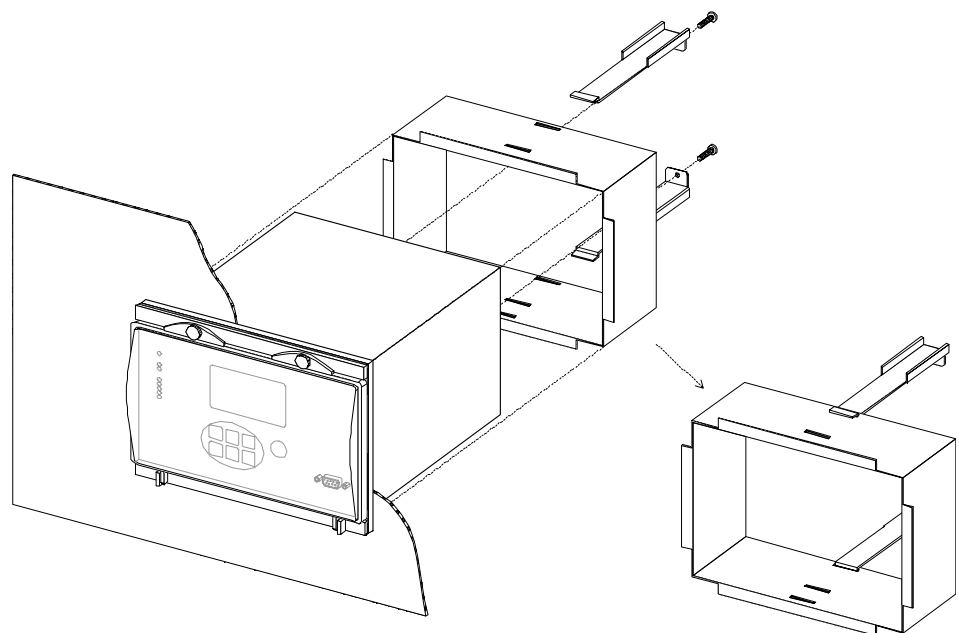
VAMP210_Conn_Diagram

Construction

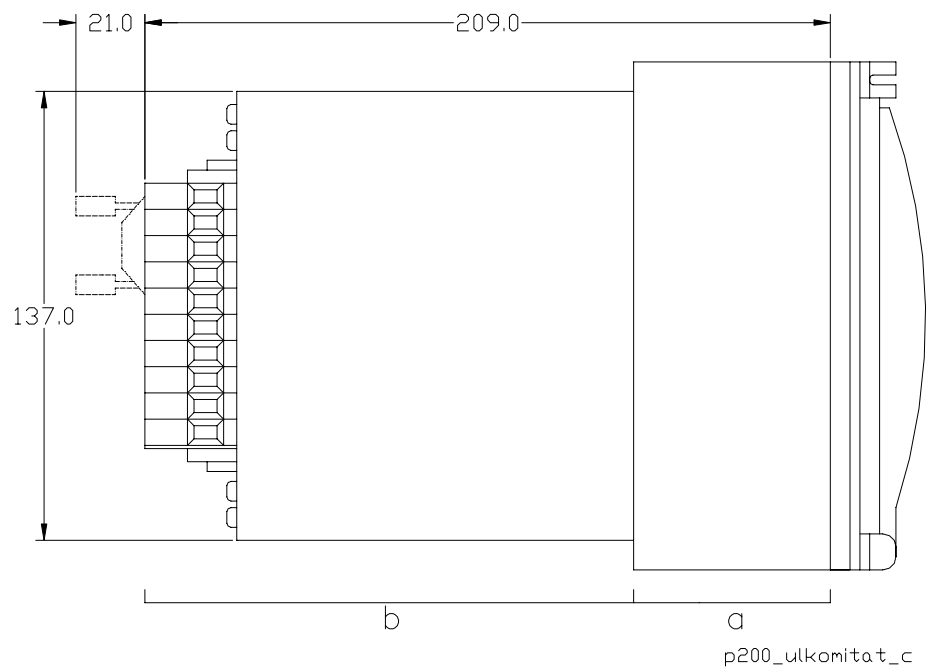
Dimensional drawing



Panel mounting



Semi-flush mounting



Depth with raising frames

Type designation	a	b
VYX076	40 mm	169.0 mm
VYX077	60 mm	149.0 mm

Order information

When ordering, please, state:

Type designation: VAMP 210

Quantity:

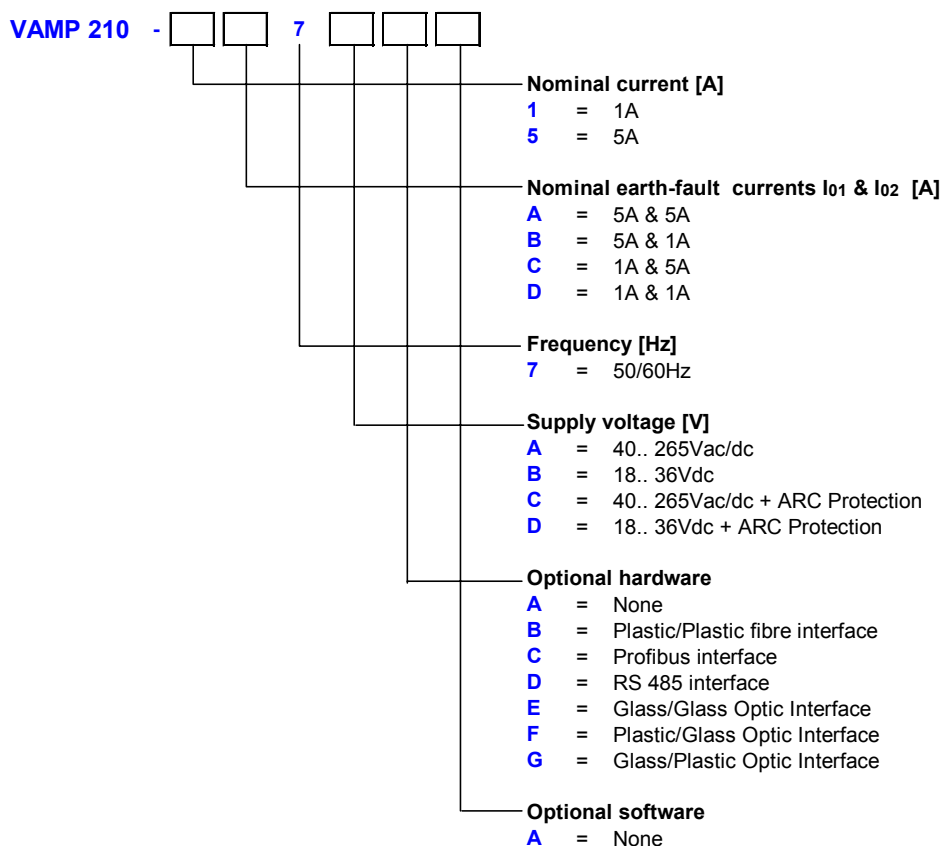
Auxiliary voltage:

Rated current:

Rated earth fault current:

Options:

VAMP 210 ORDERING CODE



Accessories :

Order Code	Explanation	Note
VEA 3 CG	Ethernet Interface Module	VAMP Ltd
VPA 3 CG	Profibus Interface Module	VAMP Ltd
VMA 3 CG	RS485 Interface Module	VAMP Ltd
VX003-3	Programming Cable (VepSet, VEA 3 CG)	Cable length 3m
VX004-M3	TTL/RS232 Converter Cable (for Modicon PLC, ..)	Cable length 3m
VX007-F3	TTL/RS232 Converter Cable (for VPA 3 CG)	Cable length 3m
VX007-F3	TTL/RS232 Converter Cable (for VMA 3 CG)	Cable length 3m
VX008-4	TTL/RS232 Converter Cable (for Modem MD42, ILPH, ..)	Cable length 4m
VA 1 DA-6	Arc Sensor	Cable length 6m
VYX076	Raising Frame for 200-serie	Height 40mm
VYX077	Raising Frame for 200-serie	Height 60mm
VM690/230	3 Phase Nominal Voltage Matching Transformer	690V->230V , 400V->110V

Reference information

Documentation:

Mounting and Commissioning Instructions VMMC.EN0xx

VAMPSET User's Manual VMV.EN0xx

Manufacturer data:

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We reserve the rights to changes without prior notice

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