VAMP 135

Over-, under-, residual voltage and frequency relay

Operation and configuration instructions

Technical description

Table of Content

1. General

This part of the manual describes the general functions of the over-, under-, residual voltage and frequency relay VAMP 135 and includes the relay operation instructions. It also includes instructions on parameterization and configuration of the relay and instructions on changing of settings.

The second part of the publication includes detailed protection function descriptions as well as application examples and technical data sheets.

The Mounting and Commissioning Instructions are published in a separate publication, with the code VMMC.EN0xx.

1.1. Relay features

The over-, under-, residual voltage and frequency relay VAMP 135 is ideal for power plant, utility and industrial applications. It features the following protection functions:

- Three overvoltage stages
- Three undervoltage stages
- Two residual overvoltage stages
- Two overfrequency stages
- Two underfrequency stages
- Circuit breaker failure protection

The VAMP 135 relay can be connected to the system to be protected using three alternative modes, which are selected during commissioning. The following modes can be selected: Line, Line+U_0 and Phase. For more detailed information, see Chapter 2.2 in this manual and Chapter 5.5 in the Technical description part of this manual.

The VAMP 135 relay is equipped with a voltage measuring transducer. The output signal of the transducer can be wired to an external meter or a local automation system. Further VAMP 135 includes a disturbance recorder.

The relay communicates with other systems using common protocols, such as the Modbus RTU, Profibus DP, Modbus/TCP, IEC-103 and it can be connected to the fibre-optic SPA bus.

1.2. Operating safety

The terminals on the rear panel of the relay may carry dangerous voltages, although the auxiliary voltage is switched off. A live current transformer secondary circuit must not be opened.

Disconnecting a live circuit may cause dangerous voltages! Any operational measurements must be carried out according to national and local handling directives and instructions.

Carefully read through the relay operation instructions before any relay operational measures are carried out.

2. User interface

2.1. General

The VAMP 135 relay can be controlled in three ways:

- Locally with the push-buttons on the relay front panel
- Locally with a PC connected to the serial port on the relay front panel
- Via the remote control port on the relay rear panel.

2.2. Local panel

Figure 2.2-1 below shows the location of the components of the local user interface on the front panel of the relay.

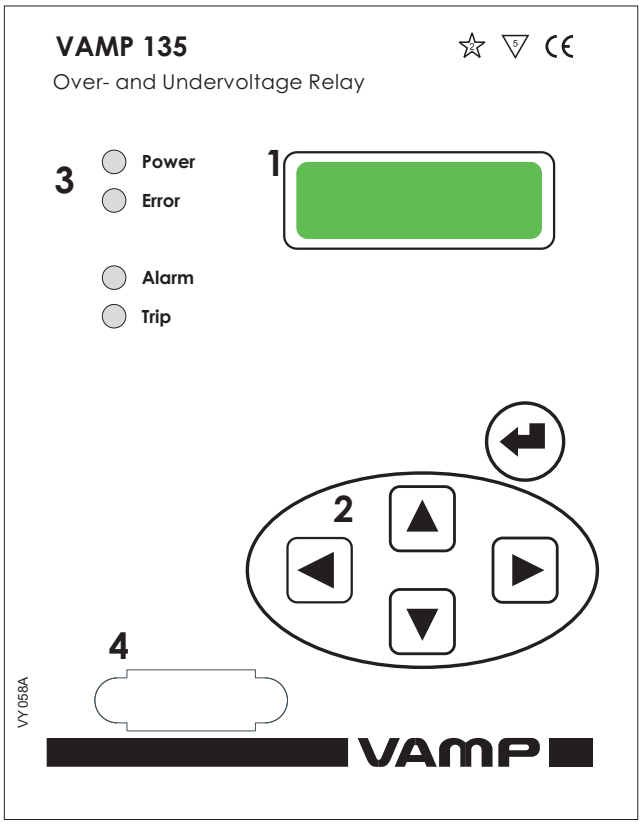


Figure 2.2-1. Relay front panel.

1. Alpha-numerical LED display
2. Key pad
3. LED indicators
4. RS 232 serial communication port for a PC

2.2.1. Display

The VAMP 135 relay is provided with a clear 10 character alphanumerical LED display, which normally shows a scrolling text.

Use the SERVICE/Setup/Bright menu to set the brightness of the display. The display is dimmed after a preset time.

Use the SERVICE/Setup/ScrolDelay menu to set the scrolling speed of the display text.

2.2.2. Key pad

Use the key pad and the display to navigate through the menus and to set the required parameters. The keypad comprises the following keys:

LEFT, RIGHT, UP, DOWN and the ENTER key.

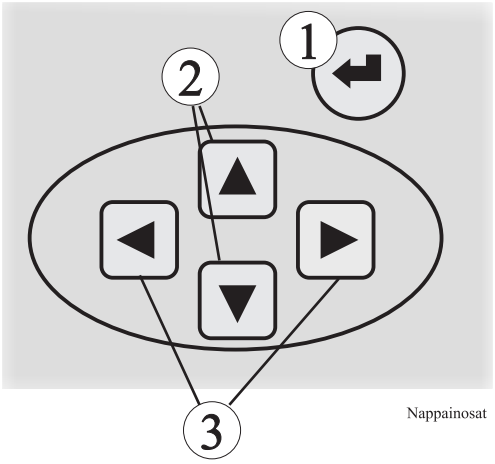


Figure 2.2.2-1. Components of the key pad.

1. Enter and confirmation key (ENTER)
2. UP/DOWN [INCREASE/DECREASE] arrow keys (UP/DOWN)
3. LEFT/RIGHT arrow keys [for selection of digit position] (LEFT/RIGHT)

2.2.3. Indicators

The relay front panel holds 4 LED indicators:

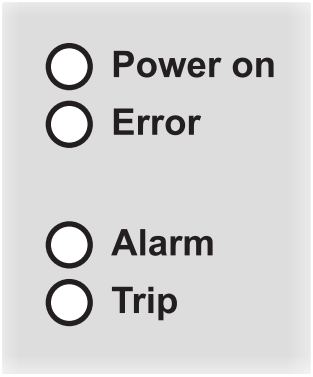


Figure 2.2.3-1. Relay operation indicators.

Relay operation indicators:

Power on	auxiliary voltage switched on
Error	self-supervision fault, the self-supervision output relay operates in parallel with the indicator
Alarm	starting of protection stage
Trip	tripping of protection stage

3. Local panel operations

The local panel can be used to read measured values, set parameters and configure relay functions. However, please note that some of the parameters can only be set by means of a PC connected to the local communication port. Further, some parameters are factory set.

3.1. Navigation in the menus

All setting, resetting, etc. functions are carried out via menu functions:

1. Use UP and DOWN arrow keys to move up and down in the main menu. The active menu is the one seen in the display. The menu names are shown with their full length or abbreviated, e.g. U STATUS = status display for the different voltage stages.
2. Use the RIGHT key to move to the function level of the required menu, e.g. U> Stat.
   Use the LEFT key to cancel the selection.
3. Use the RIGHT key to move to the parameter level of the selected function, e.g. SCntr.
   Use the UP and DOWN keys to scroll through the other parameters on the same function level.
4. Confirm the selection of setting state of the requested parameter by pushing ENTER and by entering the password corresponding to the setting level.
5. Push LEFT for at least 2 s to exit from the setting state of a parameter without changing the setting value or,
6. Push ENTER to confirm and store the parameter setting.

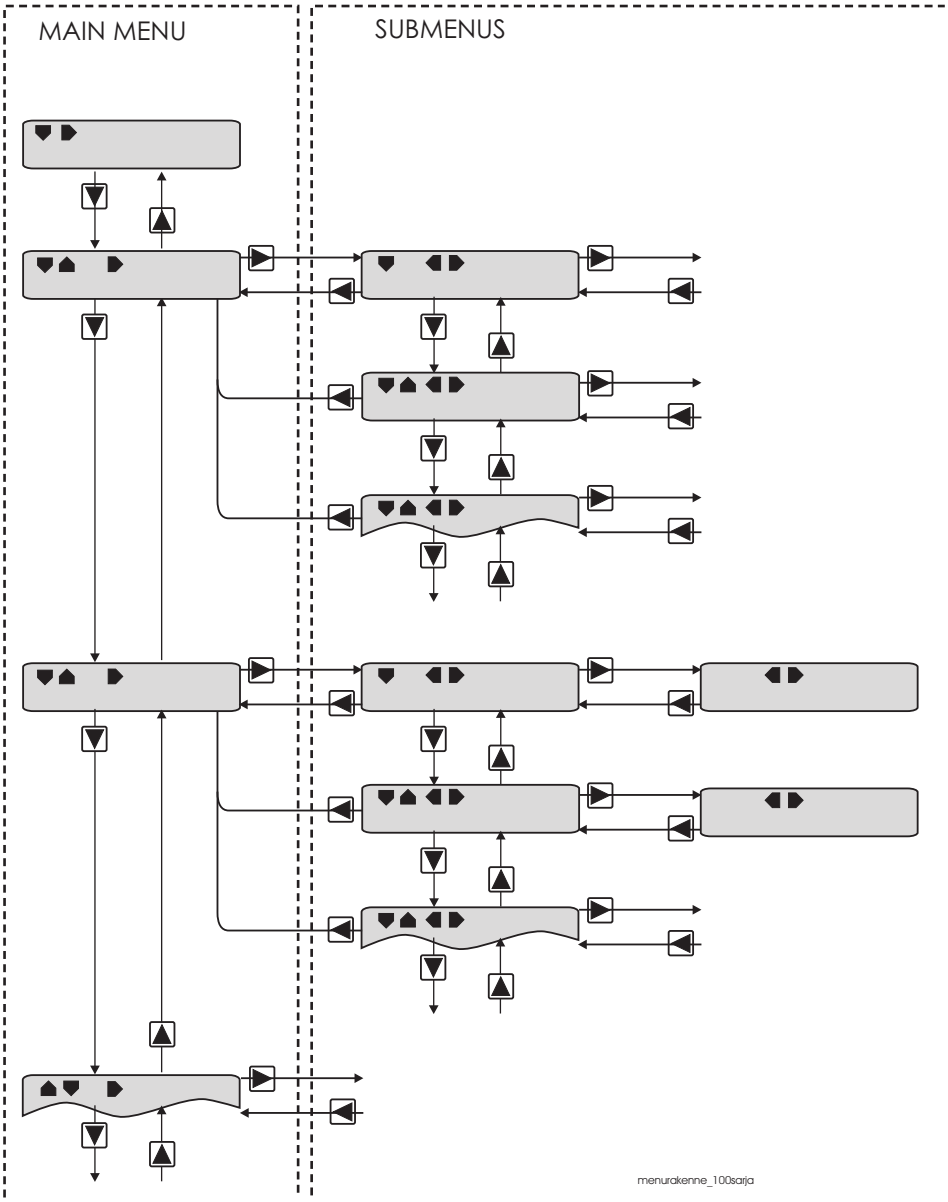


Figure 3.1-1. The principle of the menu structure and navigation in the menus.

3.1.1. Function menu table

The structure of the menu is clear and straightforward. The main menu holds eighteen submenus, each with varying numbers of submenus and parameters.

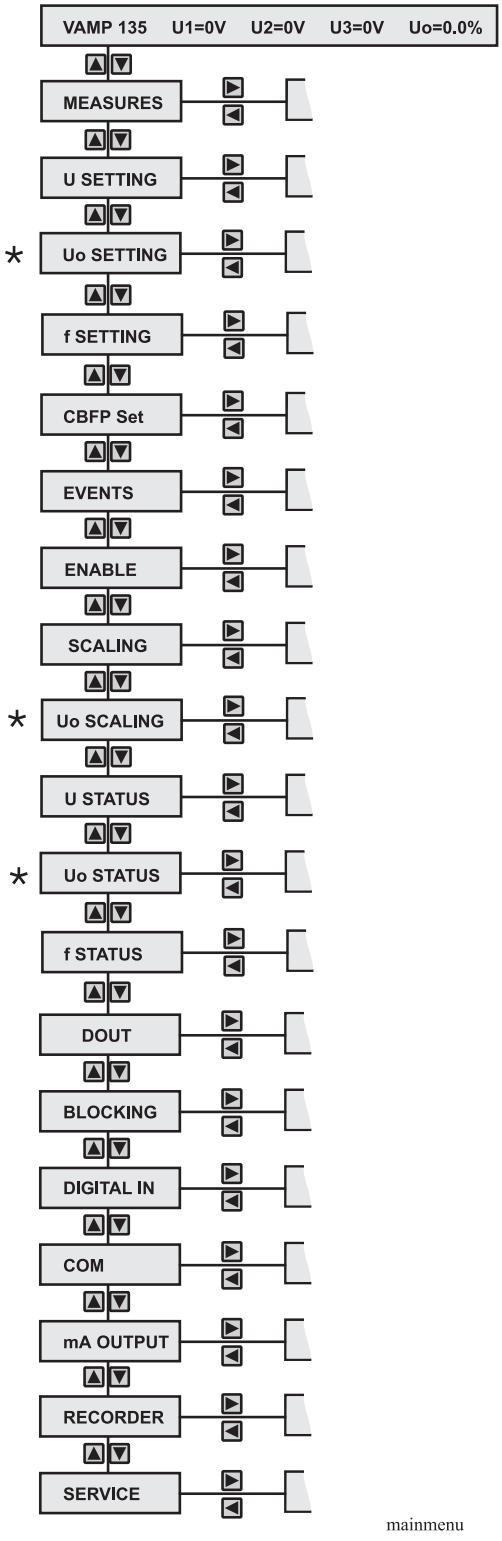


Figure 3.1.1-1. Main menu of the VAMP 135 relay.

3.1.2. Basic menu structure of protection functions

Example U>:

U SETTING / U> SET:

U>	12000V	Set value of protection function [V]
U>	120%Un	Set value of protection function [%Un]
t>	0.20s	
ReleaseDly:	0.06s	Release delay
Hysteresis:	3.0%	

U STATUS / U> stat:

SCntr	-	Start counter
TCntr	-	Trip counter
Force	-	Enabling and disabling force function (ON/OFF)
Status	-	-, Start, Trip

3.2. Operating levels

The relay features three operating levels, i.e. the User, the Operator and the Configuration level. The purpose of the operating levels is to prevent accidental change of relay configurations, parameterizations or settings.

USER level

Use: Parameter values, for example, can be read

Opening: Level permanently open

Closing: Closing not possible

OPERATOR level

Use: Settings of protection stages, for example, can be changed.

Opening: The default password is 1.

Setting state: On entering the parameter setting state a password must be given, see 3.2.1

Closing: The level is automatically closed 10 minutes after a key being pushed last or a setting being performed via the local port. Closing can also be performed by giving the password 9999.

CONFIGURATOR level

Use: The configuration level is needed during the commissioning of the relay. The turns ratios of the voltage transformers, for example, can be set.

Opening: The default password is 2

Setting state: On entering the parameter setting state a password must be given, see 3.2.1

Closing: The level is automatically closed 10 minutes after a key being pushed last or a setting being performed via the local port. Closing can also be performed by giving the password 9999.

3.2.1. Opening operating levels

1. Move to the item to be changed, e.g. U SETTING/U>Set/ U>: 120%Un. Push the ENTER key twice on the front panel.

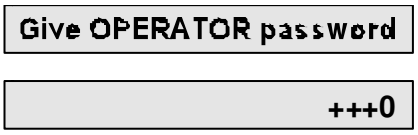


Figure 3.2.1-1. Opening an operating level

2. Enter the password needed for the desired level: The password may contain four digits. The digits are supplied one by one by first moving to the position of the digit using the RIGHT key and then setting the desired digit value using the UP key.
3. Push ENTER.

3.2.2. Changing of passwords

The set password can only be changed locally using a PC connected to the local RS 232 port on the relay.

4. Operating measures

General

Carefully study the operating instructions in Chapters 1 through 3 of this manual before any operating measures are taken or before any relay settings or functions are changed.

The relay can be controlled by means of the MMI on the relay front panel, a PC running the VAMPSET software, a PC running suitable terminal software or a remote control system.

4.1. Measured data

The measured values can be read from the main menu MEASURES and its submenus shown in the figure below.

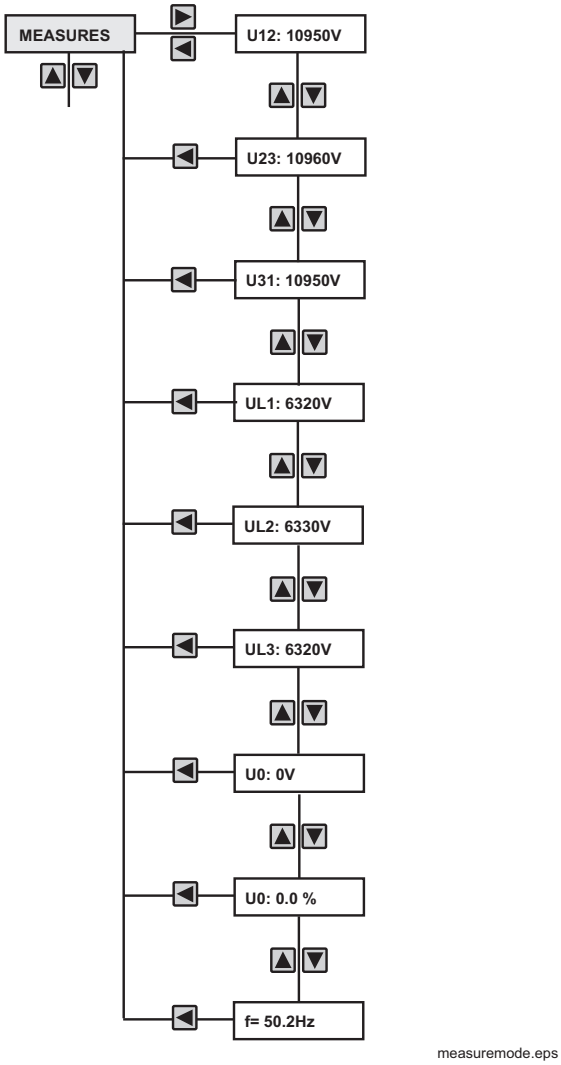


Figure 4.1-1. Measures menu of the VAMP 135 relay.

4.2. Operation indicators

LED indicators	Explanation	Measure/ remarks
Power LED lit	The auxiliary power switched on	Normal operating state
Error LED lit	An internal relay fault has been detected	The relay attempts to reboot. If the error LED remains lit, call for maintenance
Alarm LED lit	One or several signals of the output relay matrix have been assigned to output Alarm and the output has been activated by one of the signals. (see Chapter 5.5)	The LED is switched off, when the signal that caused output Alarm to activate, e.g. the START signal, resets. The resetting depends on the type of configuration; Connected or Latched.
TRIP LED lit	One or several signals of the output relay matrix have been assigned to output Trip and the output has been activated by one of the signals. (see Chapter 5.5)	The LED is switched off, when the signal that caused output Trip to activate, e.g. the TRIP signal, resets. The resetting depends on the type of configuration; Connected or Latched.

Resetting latched indicators and output relays

All indicators and output relays can be given a latching function in the configuration.

There are two ways to reset latched indicators and relays:

1. Move to the initial display, from the alarm list, by pushing the CANCEL key for approx. 3 s. Then reset the latched indicators and output relays by pushing the ENTER key.
2. Acknowledge each event in the alarm list one by one, by pushing ENTER the equivalent times. Then, in the initial display, reset the latched indicators and output relays by pushing the ENTER key.

The latchings can also be reset via the communications bus or via a DI input configured for that purpose.

4.3. Reading of event register

The event register can be read from the Events item of the main menu:

1. Push the RIGHT key once, the displays shows the Event info text
2. Push the RIGHT key once, the displays shows Count: x, where x = the number of recorded events
3. Push the DOWN key once, the display shows the ClrEv text. The event register can now be reset.
4. Push the LEFT key to return to the Event info menu (by pressing twice you can return to the main menu)
5. Push the DOWN key to return to the Event list menu:

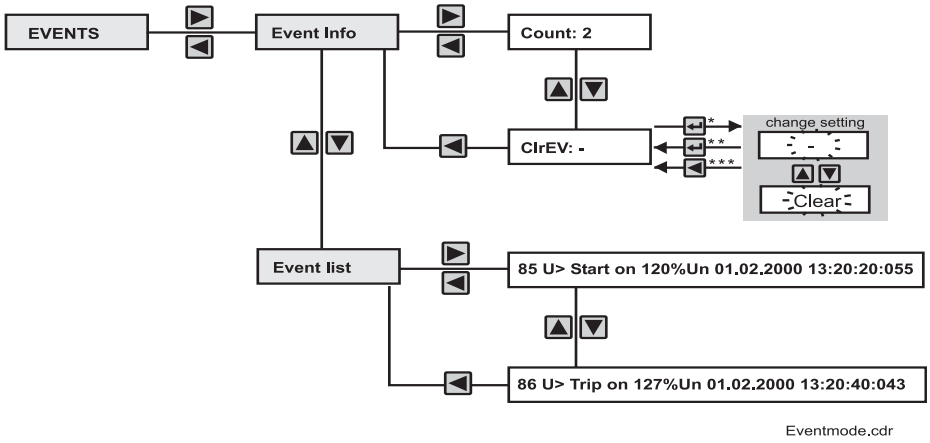


Figure 4.3-1. Event register, example.

6. Push the RIGHT key once to enter the event list, the display shows the last Event list text. Scroll the event list by pushing the UP and DOWN keys.
7. Push the LEFT key twice to move from the event list to the main menu.

4.4. Forced control (Force)

In the SERVICE menu it is possible to use forced control of the output relays, e.g. for testing purposes.

To activate the forced control function (also see Figure 4.4-1):

1. Open access level CONFIGURATION
2. Move to the SERVICE level of the main menu.
3. Push the RIGHT key once to move to the submenu Relays
4. Push the RIGHT key once to move to the output relays' force setting parameter Force:

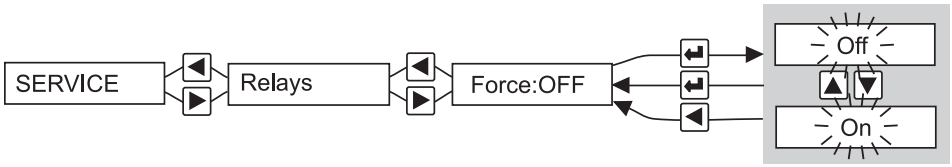


Figure 4.4-1. Activation of the Force function.

5. Push the ENTER key while on the Force: level to be able to change the setting (the parameter to be set is blinking)
6. Push the UP and DOWN keys to change the OFF text to the ON text in the display (Force function activated).
7. Push the ENTER key to confirm the setting and to move back to the Force: level
8. The Force: level has a selection list. Push the UP and DOWN keys to select the desired output relay, which is controlled on and off by forced control:
9. Push the ENTER key to obtain the setting state, e.g. Relays/T1.
10. Push the UP or DOWN key to change the selection 0 -> 1.
11. Push the ENTER key to perform a controlled operation of the output relay (e.g. the T1 is activated) and to return to the Force: level.
12. Push the LEFT key for more than 2 s to return from the Force: setting state to the normal Force: state without changing the control state.
13. Push the LEFT key to return from the Force: setting state to the Relays submenu.
14. Push the LEFT key to return to the main menu.

4.5. Setting range limits

Note!

If parameters requiring a setting value are given out-of-range settings, a fault message will be obtained when the setting is confirmed with the ENTER key. Adjust the setting to within the allowed setting range.

4.6. Adjusting display contrast and scroll speed

The readability of the LCD varies with the brightness of the surrounding. When needed, the brightness can be adjusted in the SERVICE/Setup/Bright: menu.

The scroll speed of the text in the display can be adjusted in the SERVICE/Setup/ScrolDelay: menu.

4.7. Setting date and time

Date, time and style are set in the SERVICE/Setup/Date, Time and Style menus.

5. Configuration and parameter setting

User level: CONFIGURATOR

- Choose the protection functions in the ENABLE position of the main menu, see chapter 5.2.

  NOTE!

  Protection functions not enabled will not be shown in the submenus.
- Change the parameters of over- and undervoltage protection functions in the U SETTING position of the main menu, see chapter 5.3.
- Change the parameters of residual voltage protection functions in the Uo SETTING position of the main menu, see chapter 5.3.

  Note!

  The U_0 protection functions are available only if U_{mode}: Line+ U_0 or Phase is selected. See Chapter 2.2. of Technical description.
- Change the parameters of frequency protection functions in the f SETTING position of the main menu, see chapter 5.3.
- Change the parameters of Circuit Breaker Failure Protection function in the CBFP Set position of the main menu, see chapter 5.3.
- Set the voltage scaling (e.g. U_{prim}, U_{sec}, U_{mode}, etc.) in the SCALING position of the main menu, see chapter 5.4.
- Set the residual voltage scaling (U_{0sec}) in the U_0 SCALING position of the main menu, see chapter 5.4.
- Configure the digital outputs in the DOUT position of the main menu, see chapter 5.5.
- Configure the interlockings in the BLOCKING position of the main menu, see chapter 5.6.
- Configure the digital input in the DIGITAL IN position of the main menu, see chapter 5.7.
- Choose and configure the communication buses in the COM position of the main menu, see chapter 5.8.
- Configure the analog output in the mA OUTPUT position of the main menu, see chapter 5.9.
- Set the Date and time in the SERVICE position of the main menu, see chapter 5.11.

NOTE!

Some of the parameters, for instance the password, can only be altered via the RS 232 serial communication port using a PC.

5.1. Principle of parameter setting

This example shows how to change the scaling of the voltage transformers. Same principle is used to change other parameters, see Figure 5.1-1.

1. Use the DOWN key of the front panel to move to item SCALING of the main menu.
2. Use the RIGHT key to move one step to the right, the text Uprim: 10000V appears in the display. Use the DOWN key to select the Usec, Umode and Un.
3. Use the ENTER key twice to move to give the operator password. Use the ENTER key to confirm the password.
4. Use the UP and DOWN key to change the setting value and use the RIGHT and LEFT key to move from digit to digit.
5. Use the ENTER key to confirm the function or push the LEFT key for >2 s to cancel the function.
6. Push the LEFT key twice to return to the main menu.

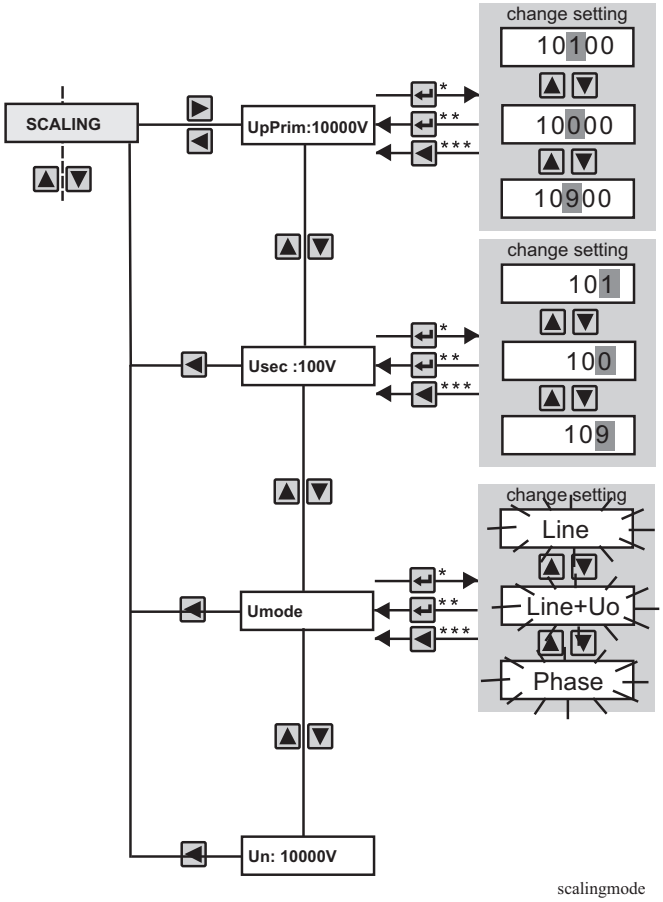


Figure 5.1-1. Changing parameters.

5.2. Enabling and disabling protection functions (ENABLE)

Via the submenus of the ENABLE menu, all the protection functions can be enabled (ON) or disabled (OFF):

ENABLE U

- Over- and undervoltage stages (U> U>>, U>>>, U<, U<< and U<<<)

ENABLE Uo

- Residual voltage stages (Uo> and Uo>>)

Enable f

- Over- and underfrequency stages (f>, f>>, f< and f<<)

Ena CBFP

- Circuit Breaker Failure Protection stage (CBFP)

RESET

- Reset the software of the VAMP 135 relay and reset latches (Reset and Latch)

NOTE!

Disabling a protection function will remove the item from the menu.

5.3. Setting protection function parameters

The settings of the selected protection functions can be read and set separately in the submenus of each function.

Available protection stages

- U>, U>>, U>>>, U<, U<<, U<<< (U SETTING)
- Uo>, Uo>> (Uo SETTING)
- f>, f>>, f<, f<< (f SETTING)
- CBFP (CBFP Set)

5.4. Scaling of measuring transformers

Via the submenus of the SCALING menu the following can be read and set:

SCALING

- Voltage transformer primary value (Uprim)
- Voltage transformer secondary value (Usec)
- Voltage measuring mode (Umode)
- Nominal line voltage (Un)

Via the submenus of the U_0 SCALING menu the following can be read and set:

Uo SCALING

- Residual voltage secondary value (Uosec)

5.5. Configuring digital outputs DOUT

Via the submenus of the DOUT menu the following functions can be read and set:

Configuration of the output signals to the output relays T1 and T2, A1 – A3 and the operation indicators (LED).

5.6. Configuring blocking matrix BLOCKING

Configuration of the blockings is done under the BLOCKING menu. Any start or trip signal can be used to block the operation of any wanted protection stage.

5.7. Configuring the digital input DIGITAL IN

Via the DIGITAL IN menu the following functions can be read and set:

- Status of the digital input (DI1)
- Operation delay (D1 dly)
- Polarity of the input signal (DI1pol), either normally open (NO) or normally closed (NC) circuit.
- Remote release of latches using digital input (RemRel)
- Selection to event register (OnEvent and OffEvent)

5.8. Configuring communication protocols COM

Via the submenus of the COM menu the following functions can be read and set:

Active

- Communication protocol of REMOTE port (Protocol)
- Message counter (Msg#)
- Communication error counter (ERRORS)
- Communication time-out counter (Tout)

Profibus

- Profibus profile (Mode)
- Transfer rate of converter
- Profibus Tx Buf lentgh (InBuf)
- Profibus Rx Buf lentgh (OutBuf)
- ProfiBus address (Addr)
- Type of the ProfiBus converter (Conv)

ModBus

- Device slave number at ModBus Slave Protocol or target slave number at ModBus Master protocol (Addr)
- ModBus transfer rate (bit/s)
- ModBus parity check (Parity)

SpaBus

- Slave number (Addr) when relay connected to SPA-Bus
- SPA-Bus transfer rate (bit/s)
- Event mode (Emode)

IEC-103

- Slave address (Addr)
- Transfer rate (bit/s)

TCP/IP (ModBus TCP, only in VAMPSET)

- IP address of the relay (IPAddr)
- Subnet mask (NetMsk)
- IP address of the Name Server (NameSv)
- IP address of the SNTP Server (NTPSvr)
- IP address of the Gateway (Gatew)
- IP port number for Protocol (Port)

Local Port

- Transfer rate of local serial bus (bit/s)

5.9. Analog output mA OUTPUT

Via the submenus of the mA OUTPUT menu the following functions can be read and set:

- Analog output reading / editing a forced value (AO)
- Enabling / disabling of forced control of the analog output (FORCE)
- Choosing the coupling of analog output (Link)
- Setting the coupling minimum value (Min)
- Setting the coupling maximum value (Max)
- Setting the analog output minimum value (AOmin)
- Setting the analog output maximum value (AOmax)

Available couplings to analog output

- U12, U23, U31, Uline
- UL1, UL2, UL3
- U_0, U2/Un
- f
- DI, DO

5.10. Disturbance recorder menu RECORDER

Via the disturbance recorder menu the following functions can be read and set:

- Recording mode (Mode)
- Sample rate (Rate)
- Recording time (Time)
- Pre trig time (PreTrig)
- Scroll list of active links (Links)
- Add a link to the recorder (AddLink)
- Clear all links (ClrLink)
- Manual trigger (MnlTrig)
- Count of ready records (ReadyRec)

5.11. Service menu SERVICE

Via the submenus of the Service menu the following functions can be read and set:

Relays

- Enabling / disabling of forced control of the output relays (FORCE)
- The status of the output relays (T1 and T2, A1 – A3 and IF)
- The forced control of the output relays (T1 and T2, A1 – A3 and IF)

Setup

- Setup of screen brightness (Bright)
- Setup of screen scroll delay (ScrlDelay)
- Changing of password (ChgPwd)
- Changing of date, time and date style(Date, Time, Style)

DeviceInfo

- Serial number of the device (SerN)
- Software version (Prgver)

6. PC software

6.1. PC user interface

The PC interface is intended to be used for on site parameterization of the relay and for loading of the relay software from a computer or reading of measured values to a computer.

The RS 232 serial port is available for the connection of a local PC on the front panel of the relay. To connect a PC to the serial port use a connection cable of type VX 003.

6.1.1. Using the VAMPSET program

See separate user's manual for the VAMPSET software, VMV.EN0xx. If the VAMPSET software is not available please download it from www.vamp.fi.

6.2. Remote control connections

The protection relay communicates with higher-level systems, e.g. remote control systems, via the serial port (REMOTE) on the rear panel of the relay.

Modbus, SPA bus, IEC 60870-5-103, Profibus or Modbus TCP can be used as REMOTE communication protocols (see details in Chapter 2.6.2. in technical description).

Additional operation instructions for various bus types are to be found in their respective manual.

7. Commissioning configuration

7.1. Factory settings

When delivered from the factory, the relay has been given factory default settings or settings defined by the customer. The actual configuration can be read from the workshop test report or from the final test report.

7.1.1. Configuration during commissioning

The configuration and settings of the over-, under-, residual voltage and frequency relay VAMP 135 is defined and checked during commissioning in accordance with the instructions given in Chapter 5 of this manual, for example in the following order:

1. Selection of protection mode in menu U SCALING/U_{mode}
2. Scaling of the rated values of the phase voltage transformers in menu U SCALING
3. Scaling of the rated values of the residual voltage transformer U_0 SCALING
4. Setting the adaptive frequency fn.

The scaling is done in the software block of the measured signals, Figure 7.1.1-1. Thus the scaling affects all the protection functions.

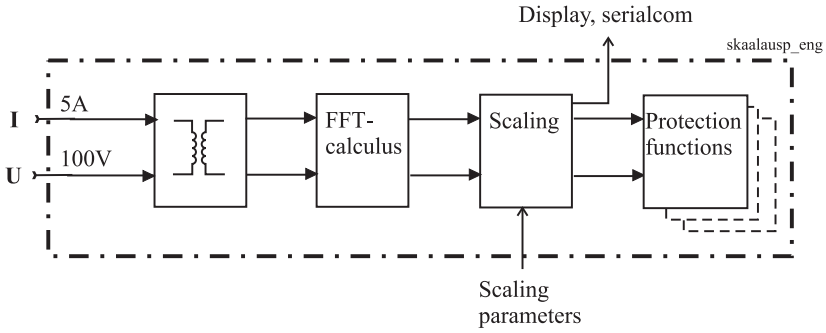


Figure 7.1.1-1 Principle for scaling the measured values of the VAMP 135 relay.

5. Activation of the desired protection functions, ENABLE menu, see Chapter 5.2.
6. Setting values of the protection functions, U SETTING, U_0 SETTING and f SETTING menus, see Chapter 5.3.
7. Configuration of the starting and tripping signals of the protection stages to the desired output relays and the LED indicators (DOUT menu), see Chapter 5.5.
8. Configuration of the blocking matrix (BLOCKING menu), see Chapter 5.6.

9. Selection of the communication protocol and setting of the communication parameters (COM menu), see Chapter 5.8.
10. Other required parameters, for example the DI input, mA output and circuit breaker failure protection.

7.1.2. Configuration examples

The following example illustrates the calculation and scaling of setting values and the grouping of output relays in a typical protection configuration. The numerical values given in the example are to be regarded as guidelines only.

Example:

The example is based on the technical application drawing of Chapter 3, in the technical description.

In the application the following functions and stages are used:

- Three-stage overvoltage protection (U>, t>; U>>, t>> and U>>>, t>>>)
- Three-stage undervoltage protection (U<, t<; U<<, t<< and U<<<, t<<<)
- Two-stage residual voltage protection (Uo>, to> and Uo>, to>>)
- Two-stage overfrequency protection (f>, t> and f>>, t>>)
- Two-stage underfrequency protection (f<, t< and f<<, t<<)

The above functions are enabled via the ENABLE menu by selecting the "On" in the Enable U, Enable Uo and Enable f display, see Chapter 5.2, the functions not to be included are disabled by selecting the “Off” value.

1 Output data:

Give within the parenthesis are the configuration menus where the settings are done.

Selection of protection mode

Selection of the protection mode (SCALING/U mode:)		Line+Uo

Transforming ratios of measurement transformers

Voltage transformers (VT) (SCALING)	Unom Usec	2000 V 100 V
Residual voltage transformer (VT) (Uo SCALING)	Uosec	100 V

2 Selection of setting values:

Protection stage:	Parameter:	Setting:
Overvoltage stage U>	U> t> ReleaseDly Hysteresis	120% 0.20 s 0.06 s 3.0%
Overvoltage stage U>>	U>> t>>	130% 0.10 s
Overvoltage stage U>>>	U>>> t>>>	140% 0.06 s
Undervoltage stage U<	U< t< ReleaseDly Hysteresis NoCmp	120% 0.20 s 0.06 s 3.0% 10%
Undervoltage stage U<<	U<< t<< NoCmp	70% 2.00 s 10%
Undervoltage stage U<<<	U<<< t<<< NoCmp	60% 0.50 s 10%
Residual voltage stage Uo>	Uo> t> ReleaseDly	10% 0.40 s 3%
Residual voltage stage Uo>>	Uo>> t>>	20% 0.10 s
Overfrequency stage f>	f> t>	51 Hz 0.20 s
Overfrequency stage f>>	f>> t>>	52.0 Hz 0.10 s
Underfrequency stage f<	f< t< Ublock	48.0 Hz 3.00 s 40%
Underfrequency stage f<<	f<< t<< Ublock	47.0 Hz 0.10 s 40%

3 Blocking matrix

The required blocking of the protection functions are configured in the BLOCKING menu, see Chapter 5.6.

In the example, the auxiliary contact of the voltage measuring contactor in connected to DI input. This input blocks the U< function selected in the BLOCKING/DI Block menu.

4 Output relay configuration

The required grouping of output relays and output signals are configured in the DOUT menu, see Chapter 5.5.

In the example, relay T1 is programmed to open the circuit-breaker with a trip signal (for example U>>) selected in the DOUT menu.

Table of Content

1. Introduction

This part of the manual describes the protection functions, provides a few application examples and contains technical data. This part of the manual also includes the operating instructions.

Mounting and Commissioning Instructions are provided in a separate mounting and commissioning manual (VMMC.EN0xx).

1.1. Application

The versatile basic protection functions, the wide variety of additional functions and several available communication protocols render the Over-, under-, residual voltage and frequency relay VAMP 135 an ideal protection relay for power plants and substations as well as for industry, marine and off-shore applications.

The modern technology in association with an extensive self-supervision system and a reliable construction ensures an extremely high availability for the VAMP 135 protection relay.

The relay is used for over-, undervoltage, residual voltage as well as over- and underfrequency feeder protection. The relay can also be used in other applications where a single-, two- or three-phase protection relay is needed.

1.2. Main features

- Fully digital signal handling with a powerful 16 bit micro processor and high measuring accuracy on all setting ranges due to an accurate 12 bit A/D conversion technique.
- Easy enabling and disabling of protection functions according to the needs of the intended application.
- Wide setting ranges for the protection functions: for example overvoltage, undervoltage and residual voltage supervision by measuring the phase voltages, over and undervoltage supervision by measuring the line voltages, overvoltage, undervoltage and residual voltage supervision by measuring two line voltages and residual voltages (The third line voltage is calculated).
- Flexible external control and blocking possibilities due to the digital signal control input (DI).
- Easy adaptation of the relay to various substations and alarm systems due to a flexible signal-grouping matrix in the relay.
- Recording of events and fault values into an event register, from which data can be read via the key pad and the display or by means of the PC based VAMPSET user interface.
- Signals from the relay's voltage measurement transducer can be wired to an external meter or a SCADA system.
- Handy configuration, parameterization and reading of information via the user panel or by means of the PC based VAMPSET user interface.
- Easy to connect to power plant automation systems due to versatile serial connection and several available communication protocols.
- Latest events and indications are in non-volatile memory
- Reliable built-in self-regulating dc/dc converter for auxiliary power supply within the supply voltage range 40 - 265 V dc/ac, optionally 24 V dc.
- Built-in disturbance recorder for evaluating primary and secondary, as well as neutral currents of the protected object.

2. Functions

The individual protection functions of the VAMP 135 voltage and frequency relay with residual voltage protection can independently of each other be enabled or disabled according to the requirements of the application. See the configuration instructions, Chapter 5 and 7, in the Operation and configuration instructions.

2.1. Principles of the numerical protection technique

The VAMP 135 relay is designed using numerical technology. This means that all signal filtering, protection and control functions are made by digital processing.

The numerical technology used in the relay is primarily based on an adapted fast Fourier-analysis (FFT), in which case the number of calculations (multiplications and additions) required to filter out the measuring quantities remains reasonable.

By using synchronized sampling of the measured signal (phase or residual voltage) and a sample rate according to the 2^n series, the FFT technique leads to a solution, which can be realized with just a 16-bit microcontroller, without using a separate DSP (Digital Signal Processor).

The synchronized sampling means an even number of 2^n samples per period, e.g. 16 samples/period. This means that the frequency must be measured and the number of samples per period must be controlled accordingly, so that the number of samples per period remains constant should the frequency change.

Figure 2.1-1 shows the main components of a relay using numerical technology; i.e. the relay comprises input transformers, digital input adapters, output relays, A/D converters and a micro controller including memory circuits. Further the relay needs a power supply and a user interface.

Figure 2.1-2 shows the heart of the numerical technology or the main block diagram of the calculated functions.

Figure 2.1-3 shows a functional principle diagram of a single-phase overvoltage function.

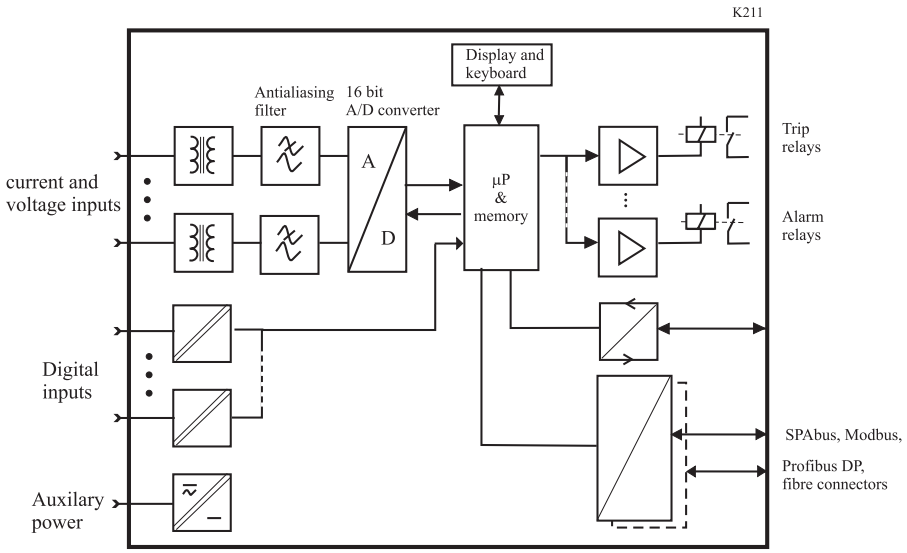


Figure 2.1-1 Principle block diagram of a numerical protection relay.

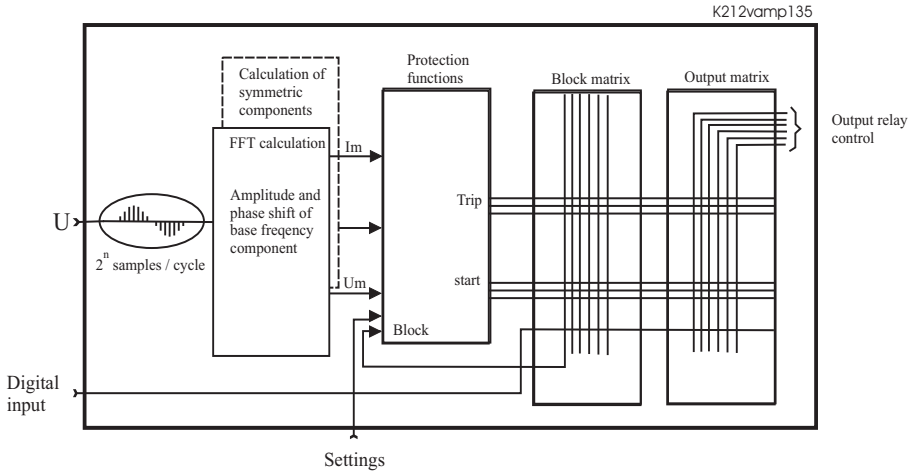


Figure 2.1-2 Block diagram of a software based protection relay.

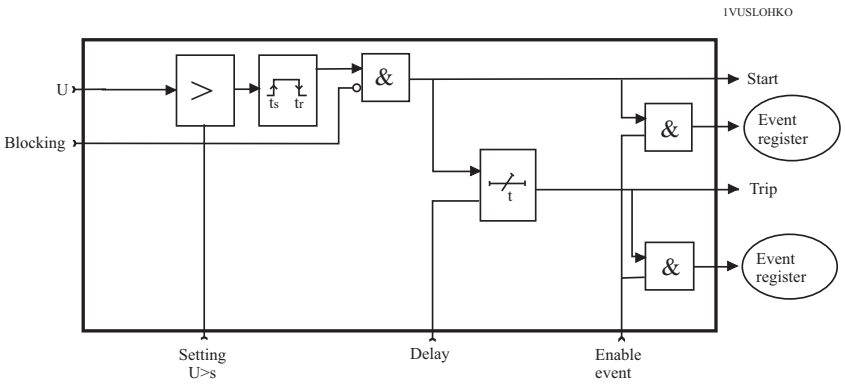


Figure 2.1-3 Block diagram of a single-phase protection function.

2.2. Relay protection configurations

The relay comprises three different protection configurations:

- Overvoltage, undervoltage, residual voltage and frequency supervision with phase voltage measurement. U_{mode} : Phase.
- Overvoltage, undervoltage and frequency supervision with line voltage measurement. U_{mode}: Line.
- Overvoltage, undervoltage, residual voltage and frequency supervision with two line voltage measurements and residual voltage measurement. U_{mode} : Line + U_0.

The configuration mode is selected from the SCALING/ U_{mode} : menu, see Chapter 5.4 in the Operation and configuration instructions.

2.2.1. Protection configuration Phase

SCALING/U_{mode}: Phase

- The relay is connected to the phase voltages U_{L1}, U_{L2} and U_{L3}, see Figure 3.1-1. The line voltages are calculated based on the measured phase voltages.
- The setting values of the overvoltage and undervoltage limits are relative to the rated line voltage U_N (100% = U_N x U_N = ÷3 x U_{VT}. U_{VT} = voltage transformers primary voltage which is defined by the user in the configuration).
- The residual voltage is calculated from the measured phase voltages. A separate broken-delta transformer is not required.
- The setting values of the residual voltage limits are relative to the secondary voltage $VT_{secondary}$ (100% = $VT_{secondary}$), which is defined by the user.

2.2.2. Protection configuration Line

SCALING/Umode: Line

- The relay is connected to the line voltages U_{12}, U_{23} and U_{31}, see Figure 3.2-1.
- The setting values of the overvoltage and undervoltage limits are relative to the rated line voltage U_N (100% = U_N). U_N = voltage transformers primary voltage $VT_{primary}$ which is defined by the user.
- The residual voltage stages U_0> and U_0>> are not in use.

2.2.3. Protection configuration Line+U_0

SCALING/U_{mode}: Line+ U_0

- The relay is connected to the line voltages U_{12}, U_{23} and the residual voltage U_0, see Figure 3.3-1.
- The setting values of the overvoltage and undervoltage limits are relative to the rated line voltage U_N (100% = U_N). U_N = voltage transformers primary voltage $VT_{primary}$ which is defined by the user in the configuration.
- The setting values of the residual voltage limits are relative to the rated residual voltage $VT_{0secondary}$ (100% = $VT_{0secondary}$) which is defined by the user.

2.3. Relay protection functions

2.3.1. Overvoltage protection U>, U>>, U>>> (59)

The three-phase overvoltage unit comprises three separately adjustable overvoltage stages (stage U>, U>> and U>>>).

The overvoltage unit measures the fundamental frequency component of the line voltages. The protection stages operate with definite time characteristics.

The relay starts, if the actual value of any phase exceeds the setting value. If the overvoltage situation continues after the operation time has elapsed, the relay trips.

The overvoltage stages have a fixed start delay. If, however, a delayed alarm about a voltage fault is required, a settable start time and trip time can be obtained by combining two stages. See Figure 2.3.1-2.

The U> stage has a settable release delay, which makes it possible to detect intermittent faults. This means that the protection unit's time counter does not reset immediately after the fault is cleared but resets only after the release delay has elapsed. If the fault appears again before the delay time has elapsed, the delay counter continues from the previous value. This means that the relay trips after a certain number of intermittent faults.

Another application for an extended release delay is to disconnect a small generator from the network during the dead time of an auto-reclose, see Figure 2.3.1-3. In a fault situation breaker Q1 starts the auto-reclose sequence and opens. The voltage relay at Q2 will also pick up any undervoltage or residual overvoltage fault. If the voltage fault remains, Q2 will also trip and reclosing cycle can continue. However, if the fault is cleared by opening the Q1 and then Q2 will not trip the voltage relay at Q2 has a long start release time. In most cases the isolated load is too much for the generator to maintain the frequency during this release time and the Q2 will be tripped by a frequency stage and the possible past voltage fault. Frequency fault or voltage fault in the network alone will not trip Q2. An asynchronised connection of breaker Q1 to the network is blocked with a synchro-check relay.

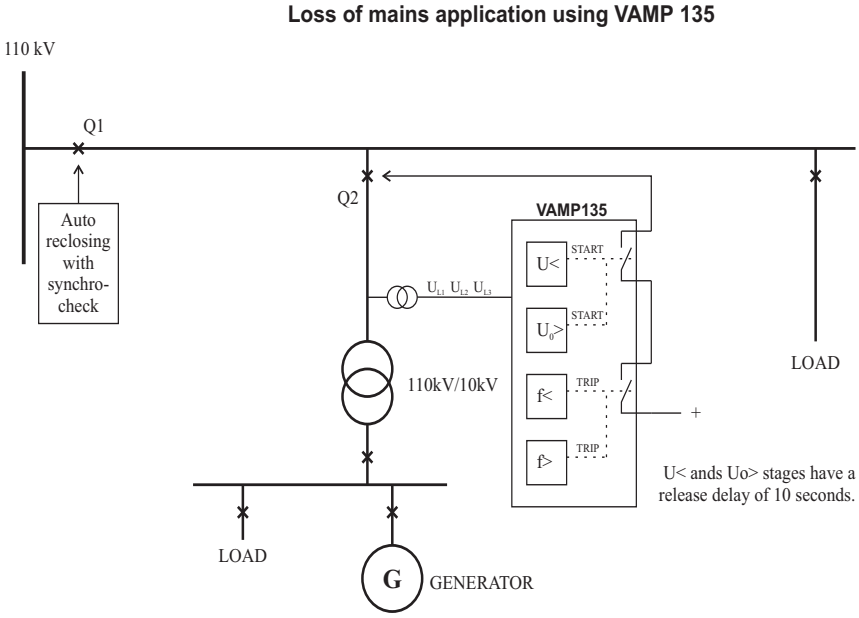


Figure 2.3.1-1. The disconnection of a generator from the network during the dead time of an auto-reclose cycle.

Figure 2.3.1-2 shows the functional block diagram of the overvoltage unit's U>, U>> and U>>> stages.

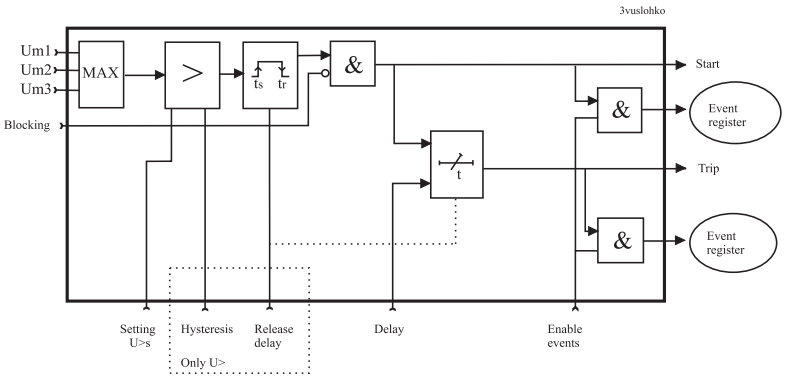


Figure 2.3.1-2. Block diagram of the three-phase overvoltage stages U>, U>> and U>>>.

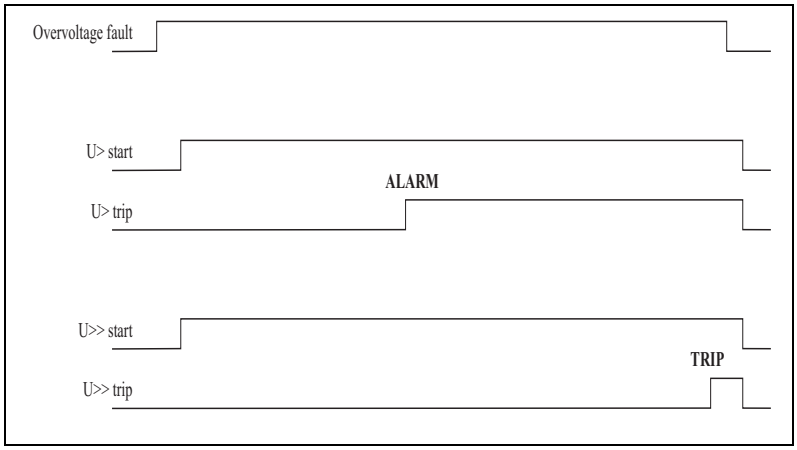


Figure 2.3.1-3. A settable start time is obtained by combining two protection stages.

A settable start time is obtained by combining two protection stages. Both stages detect the overvoltage, but the start signals are ignored. The trip signal of stage U> is used as an alarm signal and trip information from stage U>> is used for the actual trip. The overvoltage setting value for stage U>> has to be higher than the setting value for stage U> to ensure an alarm before trip.

During a short circuit or an earth-fault, breaker Q1 performs an auto-reclose. Breaker Q2 has to be tripped before the auto-reclose of breaker Q1 to ensure that the generator does not continue to feed the fault.

Parameters of the overvoltage stages: U>, U>>, U>>> (59)

	Parameter	Value/unit	
Measured value	U>, U>>, U>>>	V	Max. value of line voltages U12 to U31 primary values
Setting values	U>, U>>, U>>>	%	Setting value in relation to the rated voltage Un
	t>, t>>, t>>>	s	Operation time
	ReleaseDly	s	Release delay [s] (only U>)
	Hysteresis	%	Deadband (only U>)
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.3.2. Undervoltage protection U<, U<<, U<<< (27)

The three-phase undervoltage unit comprises three separately adjustable undervoltage stages (stage U<, U<< and U<<<).

The undervoltage unit measures the fundamental frequency component of the line voltages. The protection stages operate with definite time characteristics.

The relay starts, if the actual value of any phase exceeds the setting value. If the undervoltage situation continues after the start time has elapsed, the relay trips.

The undervoltage stage U< has a settable release delay, which makes it possible to detect intermittent faults. This means that the protection unit's time counter does not reset immediately after the fault is cleared but resets only after the release delay has elapsed. If the fault appears again before the delay time has elapsed, the trip counter continues from the previous fault value. This means that the relay trips after a certain number of intermittent faults.

The undervoltage unit can be blocked with an external digital signal, for example if the secondary voltage of the measuring transformers disappears. The undervoltage unit can also be blocked with an internal blocking signal, which is defined during parametrization. Further the unit can be blocked with a separate NoCmp setting. With this setting all protection stages are blocked when actual values for all phases falls below the set value.

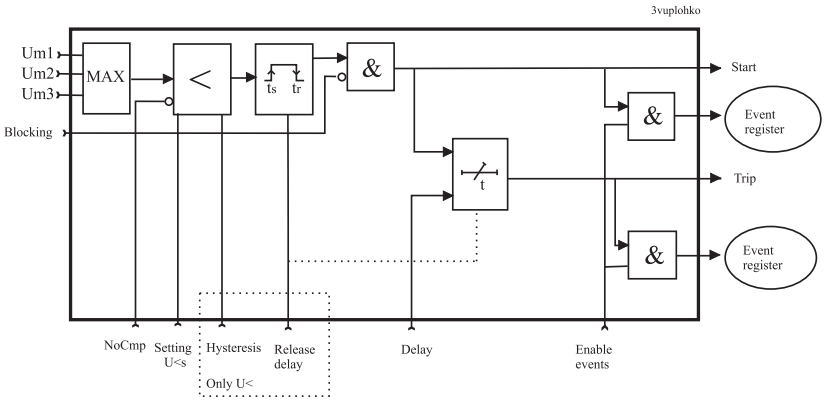


Figure 2.3.2-1. Block diagram of the three-phase undervoltage stages U<, U<< and U<<<

Parameters of the undervoltage stages:

U<, U<<, U<<< (27)

	Parameter	Value/unit	
Measured value	U<, U<<, U<<<	V	Max. value of line voltages U_{12} to U_{31}primary values
Setting values	U<, U<<, U<<<	%	Setting value in relation to the rated voltage U_n
	t<, t<<, t<<<	s	Operation time
	NoCmp	%	Self-blocking value in relation to the rated voltage Un
	ReleaseDly	s	Release delay [s] (only U<)
	Hysteresis	%	Deadband (only U<)
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.3.3. Residual voltage protection U_0>, U_0>> (59N)

The residual voltage unit comprises two separately adjustable residual voltage stages (stage U_0> and U_0>>).

The undervoltage unit measures the fundamental frequency component of the residual voltage, which means that the harmonics will not cause a trip. The protection stages operate with definite time characteristics.

The relay starts, if the actual value for the residual voltage exceeds the setting value. If the overvoltage situation continues after the start time has elapsed, the relay trips.

The residual voltage is measured either with a residual voltage transformer or calculated from the phase voltages according to the selected protection mode:

- Phase: The residual voltage is calculated from the phase voltages and therefore a separate residual voltage transformer is not needed. The setting values are relative to the voltage $VT_{secondary}$ defined at configuration.
- Line+U_0: The residual voltage is measured with an broken-delta transformer. The setting values are relative to the voltage $VT_{0secondary}$ defined at configuration.
- Line: The residual voltage functions are not in use.

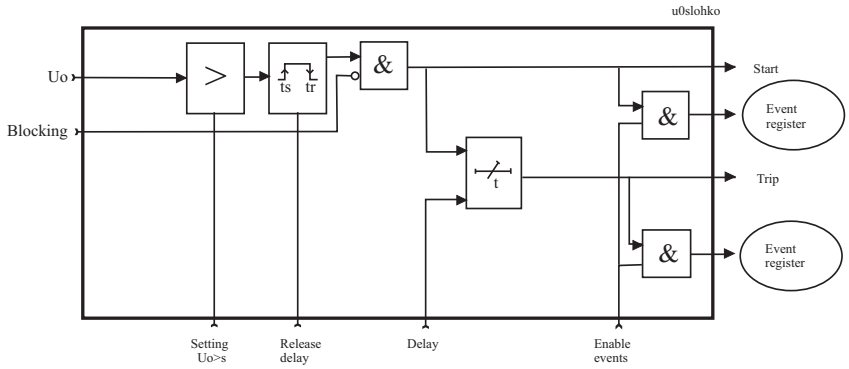


Figure 2.3.3-1. Block diagram of the residual voltage stages U_0> and U_0>>.

Parameters of the residual voltage protection stages:

U_0>, U_0>> (59N)

	Parameter	Value/unit	
Measured value	U_0>, U_0>>	V	Residual voltage U_0 as primary value
Setting values	U_0>, U_0>>	%	Setting value in relation to the rated voltage U_0n
	t>, t>>	s	Operation time
	ReleaseDly	s	Release delay (only U_0>)
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.3.4. Overfrequency and underfrequency protection (81H/81L)

The overfrequency and underfrequency protection consist of two separately adjustable frequency stages (stage f>< or abbreviated form fX and f>>>< or abbreviated form fXX). The protection stages operate with definite time characteristics. The stages can be separately configured as either overfrequency or underfrequency stages. The frequency function measures the frequency based on the measured voltages depending on the configurations of the relay.

If a stage is configured as an underfrequency stage then it functions as explained in paragraph 2.3.5.

When a stage is configured as an overfrequency stage, it starts if the actual value of the frequency exceeds the setting value. If the overfrequency situation continues after the start delay has elapsed, the function trips.

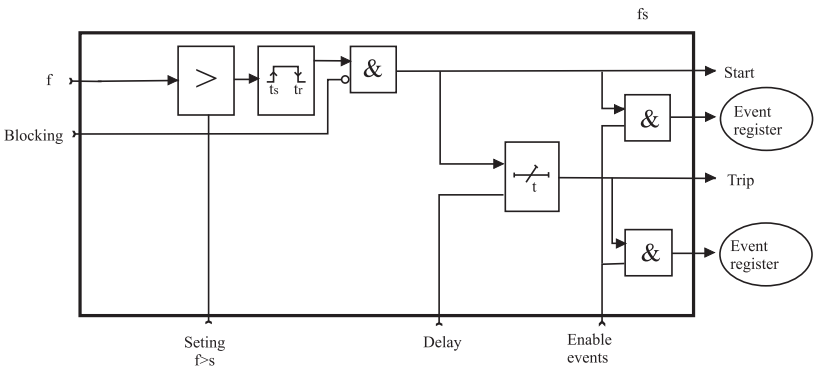


Figure 2.3.4-1. Block diagram of the overfrequency stages f> and f>>

Setting parameters of overfrequency and underfrequency stages:

f><, f>>>< (81)

Parameter	Value	Unit	Default	Description
f><, f>>><	40.0…70.0	Hz	51.0 (f><) 52.0 (f>>>><)	Frequency setting
t><, t>>><	0.10…300.0	s	0.20 (t><) 0.10 (t>>>><)	Definite operation time
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event
Mode	> or <	.	>	Frequency protection mode

Parameter	Value	Unit	Default	Description
LVBlck	2…100	%Un	40	Configurable low voltage blocking limit. Common for f><, f< and f><><, f<<

Measured and recorded values of the overfrequency and underfrequency stages:

f><, f><>< (81)

	Parameter	Value	Unit	Description
Measured value	f		Hz	Frequency
Recorded values	SCntr		-	Start counter (Start) reading
	TCntr		-	Trip counter (Trip) reading
	Flt		Hz	The ma><. fault value
	EDly		%	Elapsed time as compared to the set operating time; 100% = tripping

2.3.5. Underfrequency protection f<, f<< (81L)

The underfrequency unit comprises two separately adjustable frequency stages (stage f< and f<<). The protection stages operate with definite time characteristics.

The overfrequency unit measures the frequency based on the measured voltages.

The relay starts, if the actual value for the frequency goes below the setting value. If the underfrequency situation continues after the start time has elapsed, the relay trips.

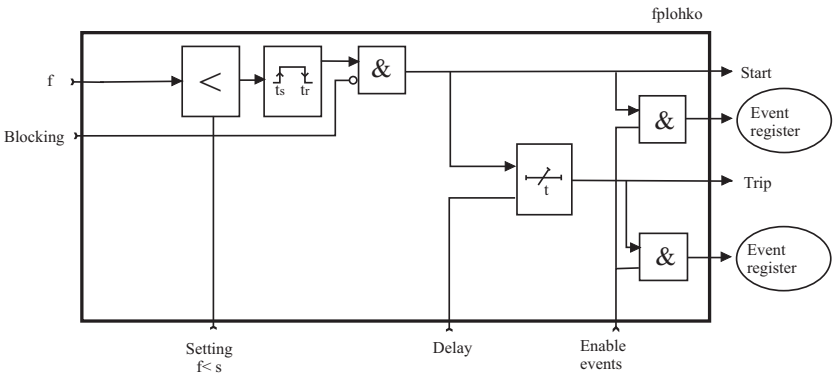


Figure 2.3.5-1. Block diagram of the underfrequency stages f< and f<<

Parameters of the frequency stages:

f<, f<< (81L)

	Parameter	Value/unit	
Measured value	f	Hz	Frequency
Setting values	f<, f<<	Hz	Frequency as primary value
	t<, t<<	s	Operation time
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.3.6. Circuit-breaker failure protection CBFP (50BF)

The operation of the circuit-breaker failure protection is based on the supervision of the operating time, from the pick-up of the trip relay (T1) to the drop-out of the same relay. If that time is longer than the set operating time of the CBFP stage, the CBFP stage is activated (trip relay T2) and remains activated until the T1 relay resets. The supervised - and tripping relay can be configured.

The CBFP stage functions also in earth-fault situations, because its function is merely based on supervision of the function of the output relay T1.

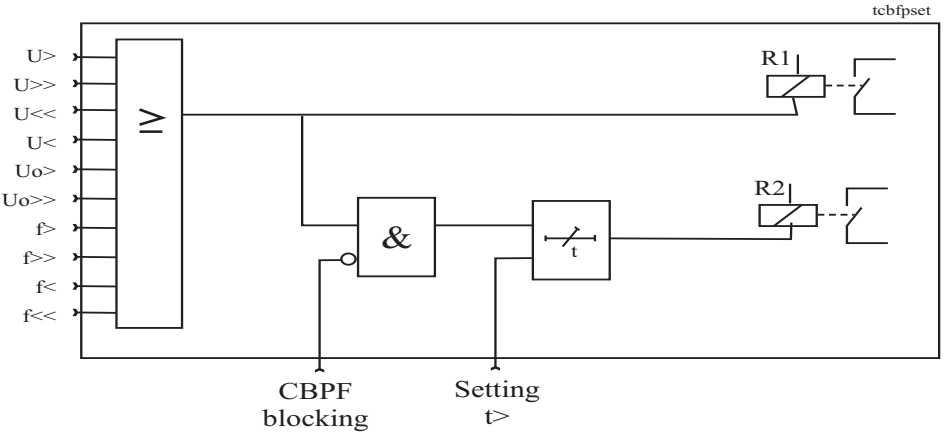


Figure 2.3.6-1. Block diagram of the circuit-breaker failure protection

The CBFP blocking signal prevents the CBFP stage from operating, when the output relays or any other protection function is operated by forced control.

Parameters of the circuit-breaker failure protection

CBFP (50BF)

	Parameter	Value/unit	
Setting values	CBRel		Relay to be supervised
	t>	s	Operation time
Recorded values	SCntr		Start counter (Start) reading
	TCntr		Trip counter (Trip) reading

2.4. Measurement functions of the relay

Measured values

Line voltages U_{12}, U_{23}, U_{31} and phase voltages U_{L1}, U_{L2}, U_{L3}

Measuring range	0 - 265 V	Primary voltages
Inaccuracy	± 1V	

Residual voltage U_0

Measuring range	0 - 100%	VTsec or VT0sec
Inaccuracy	± 0.5 %	

Frequency f

Measuring range	16 - 65 Hz
Inaccuracy	± 10 mHz

Calculated values

From the measured values the relay calculates the following:

- U2/Un, Uline

2.5. Output relay and blocking functions

In the VAMP 135 relay all start and trip signals of the protection stages can be freely routed to the output relays and operation indicators according to the requirements of the application. The functions can also be blocked and for this purpose both internal relay signals and external control signals can be used. Figure 2.5-1 shows the operating principle of the grouping and blocking matrix.

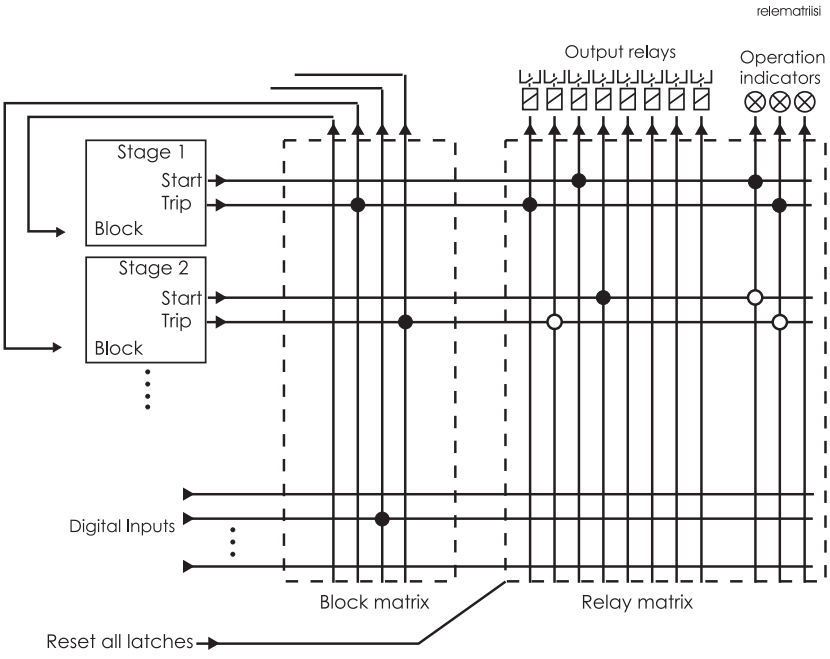


Figure 2.5-1 Operating principle of the grouping and blocking matrices.

2.5.1. Output relay matrix

By means of the relay matrix the output signals of the various protection stages can be combined with the trip relay T1 and T2, alarm relays A1...A3 and the operation indicator L1 (Alarm) and L2 (Trip).

When the signals are combined, two functions can be selected, the signal follower function (o) or the latching function (•), see Figure 2.5-1.

The "Reset all latches" function resets all latched output relays and operation indicators. The reset signal can be given via a digital input, the key pad or the serial port. If the reset signal is to be given via the digital input DI1, the input DI1 must be configured to function as a reset input from DIGITAL IN/RemRel menu.

2.5.2. Blocking matrix

By means of the block matrix the operation of a protection stage can be blocked. During blocking, a stage will not start or if already started the delay counter is halted, thus preventing tripping. The blocking signal can originate from the digital input DI1, or it can be a start or trip signal from a protection stage. In Figure 2.5-1, an active blocking is indicated with a black dot (•) in the crossing point of a blocking signal and a signal to be blocked.

2.6. Communication

2.6.1. 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.

2.6.2. 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 RS485 connection (VSE 002), Ethernet connection over TCP/IP protocol (VEA 3CG) and

Profibus connection (VPA 3CG). Please see the corresponding documentation for more details.

Protocol	Standard interface	Internal option cards	External option modules		
	RS232: VX004-M3 or VX008-4	Plastic fibre:	RS485: VSE 002	ProfiBus: VPA3CG + VX007-F3	Ethernet: VEA3CG + VX015-3
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

Table 2.6.2-1 Communication protocols and physical interfaces on REMOTE serial port.

2.7. 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 (S1, S2 and Arc binary input BI). 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, Arc sensors (S1, S2, BI) and digital input. 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, version 8.x or newer. 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.

Available links

The following channels can be linked to Disturbance Recorder:

- U12, U23, U31, Uline
- UL1, UL2, UL3
- U_0, U2/Un
- f
- DI, DO

Parameters of the Disturbance Recorder

	Parameter	Value/unit	
Setting values	Mode		Mode of the recording
	Rate		Sample rate
	Time	s	Recording time
	PreTrig	%	Pre-trigger time
	MnlTrig		Manual trig
	Size		Size of one recording
	MAX time	s	Maximum time of recordings
	MAX size		Maximum size of recordings
Recorder links	Links		Connected links
	AddLink		Add links
	ClrLnks		Clear links
Recorded values	Status		Status of the recorder
	Time status	%	Status of the pre-triggering
	ReadyRec		Number of ready records

2.8. 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. The IF relay contact is normally closed type of contact. This means that the IF relay contact is closed, when there is an internal fault or there is no auxiliary power supply. If the relay is fully operational with the auxiliary power supply, the IF contact is on the open position.

3. Application examples

3.1. Feeder over-, under- and residual voltage protection (3Phase mode)

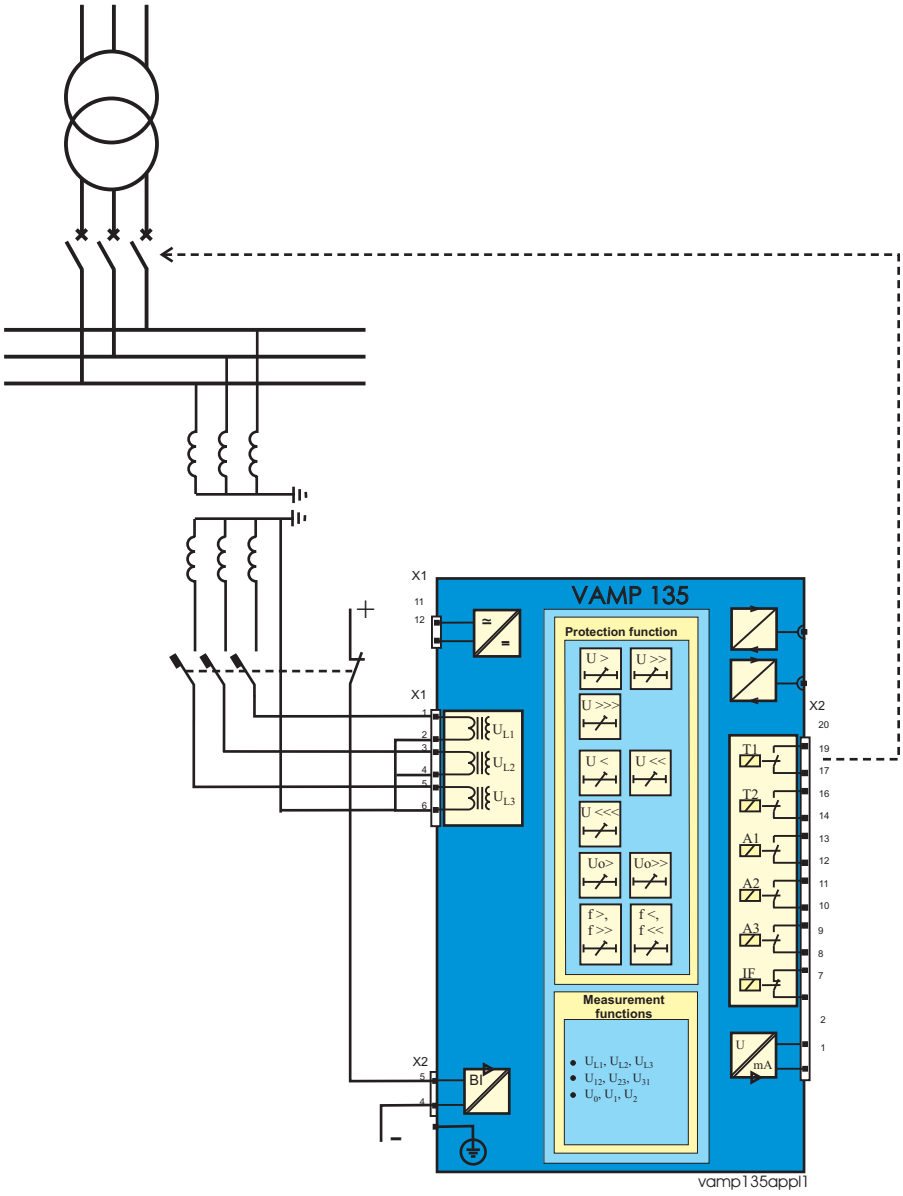


Figure 3.1-1. Three-phase overvoltage, undervoltage and residual voltage protection of a feeder. The voltage measurement mode is set to "3Phase"

The relay is connected to the phase voltages U_{L1}, U_{L2} and U_{L3}. The residual voltage is calculated from the measured phase voltages. The digital input (DI) can be used for blocking of the residual voltage stages. The digital input is controlled by the auxiliary contact of the contactor's secondary measuring circuit.

3.2. Feeder over- and undervoltage protection (3Line mode)

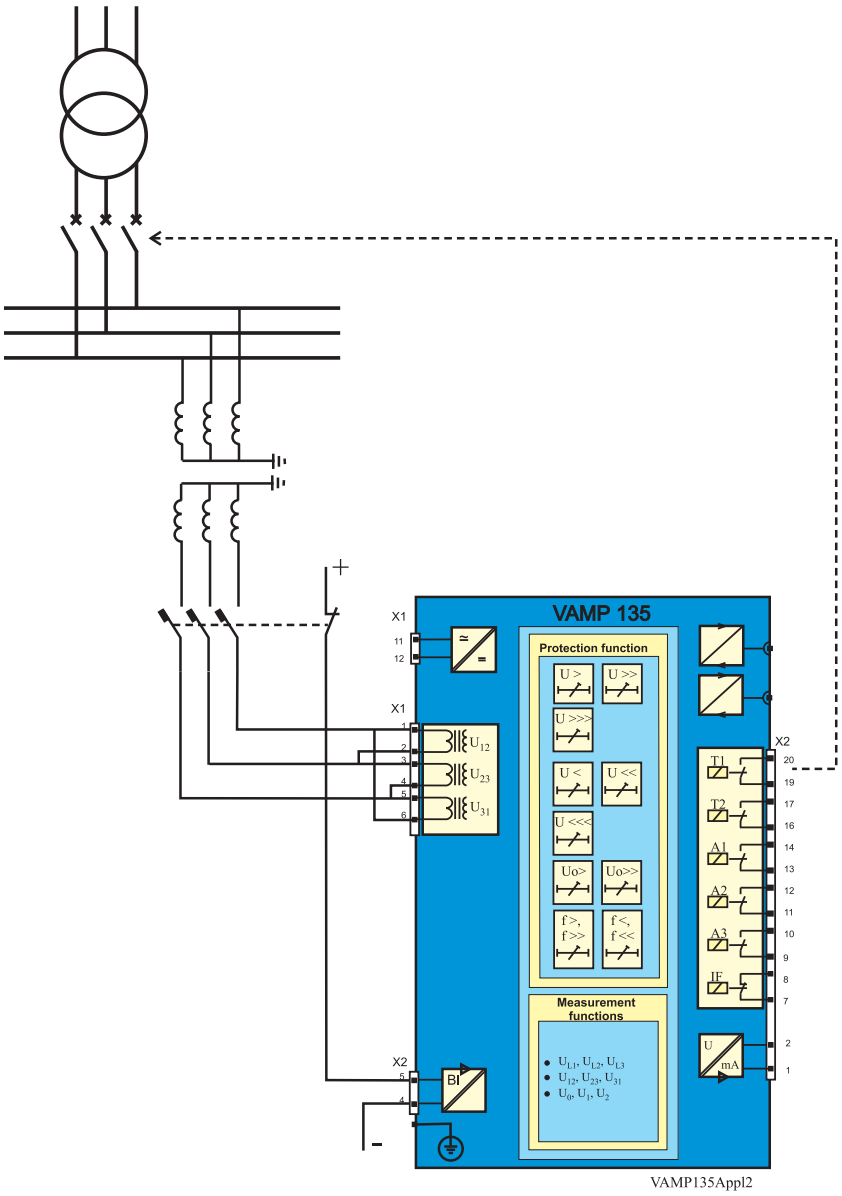


Figure 3.2-1. Over- and undervoltage protection of a feeder. The voltage measurement mode is set to "3Line"

The auxiliary contact of the voltage transformer's contactor is connected to the digital input for blocking of the undervoltage stages. The residual voltage protection is not in use. The analogue output (mA) can be used as a voltage transducer for one line voltage to a local analogue meter or a substation.

3.3. Feeder over-, under- and residual voltage protection

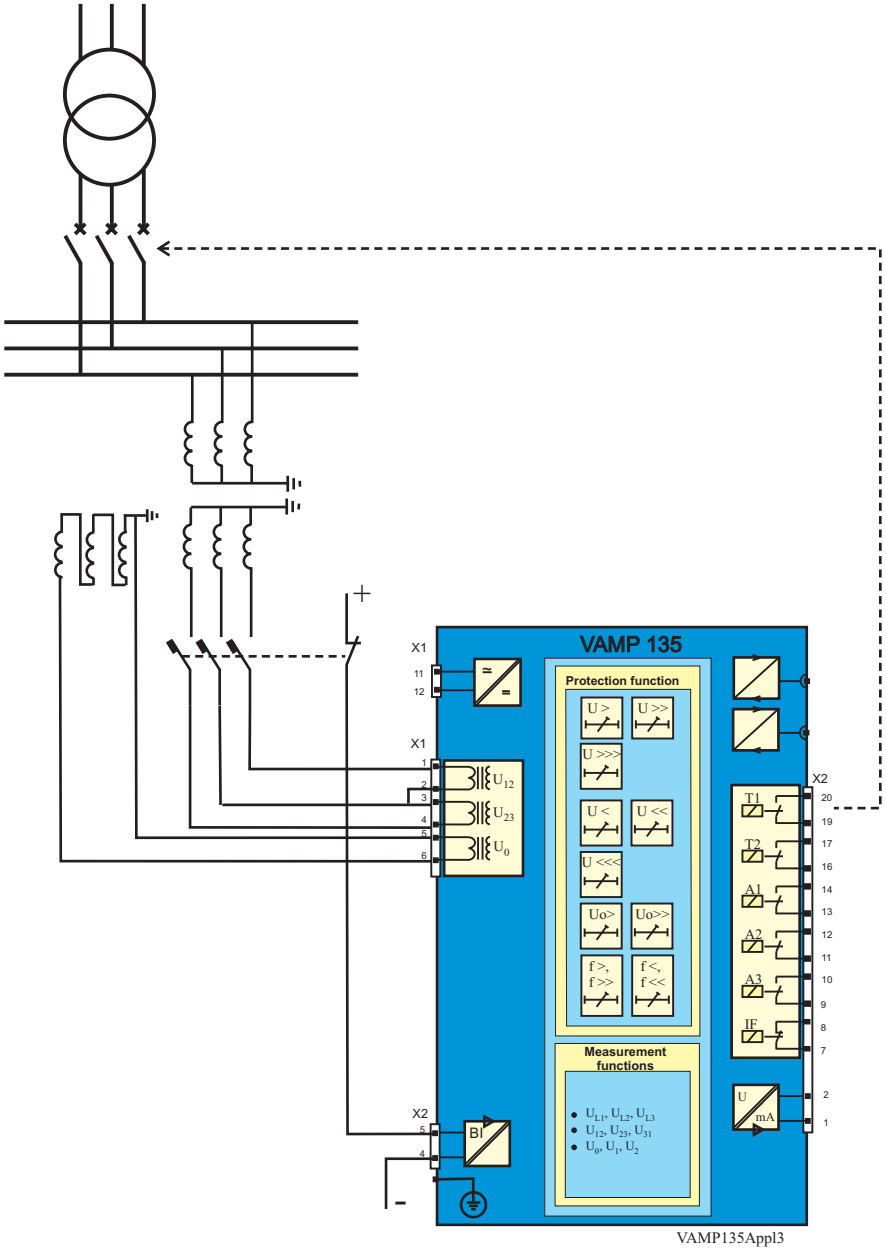


Figure 3.3-1. Three-phase overvoltage, undervoltage and residual voltage protection of a feeder. The voltage measurement mode is set to " 2Line+U_0"

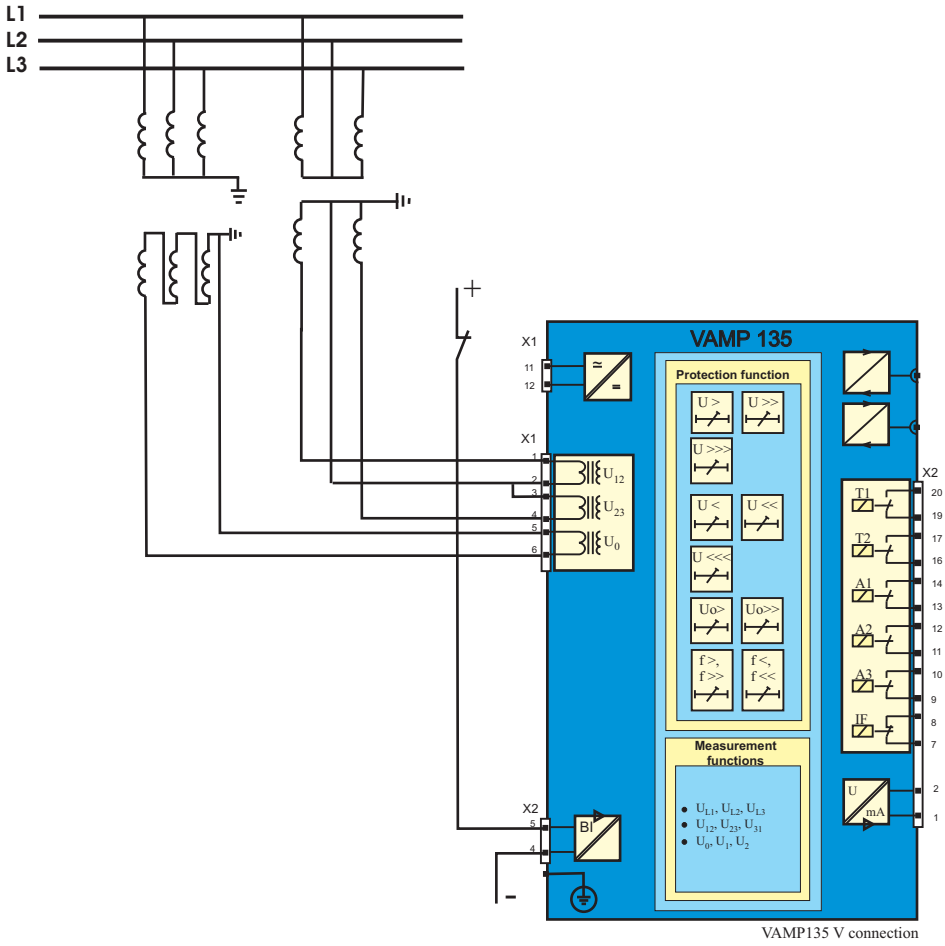


Figure 3.3-2 Three-phase overvoltage, undervoltage and residual voltage protection of a feeder. Voltage transformers are V-connected. The voltage measurement mode is set to "2Line+U_0"

The relay only measures the line to line voltages U_{12} and U_{23}. The line voltage U_{31} is calculated from the other two. The residual voltage is measured with an open-delta transformer. The auxiliary contact of the voltage transformer's contactor is connected to the digital input for blocking of the undervoltage stages.

3.4. Trip circuit supervision

Trip circuit supervision is used to ensure that the wiring from protective relay to the circuit breaker is in order. This circuit is most of the time unused but when the protection relay detects a fault in the network it is too late to notice that the circuit breaker cannot be tripped because of a broken trip circuitry.

A digital input of the relay can be used for trip circuit monitoring.

- The digital input is connected parallel with the trip contacts (Figure 3.4-1).
- A resistor module VR10CB enables supervision also when the circuit breaker is open. The module consist resistor for 110 Vdc and 220 Vdc and is connected according the auxiliary voltage.
- The digital input is configured as Normal Closed (NC).
- The digital input delay is configured longer than maximum fault time to inhibit any superfluous trip circuit fault alarm when the trip contact is closed.
- The trip relay should be configured as non-latched. Otherwise a superfluous trip circuit fault alarm will follow after the trip contact operates and remains closed because of latching.

Figure 3.4-1 shows the situation when the circuit breaker is closed. If the digital input is not in active state it indicates that there is something wrong in the trip circuitry.

Figure 3.4-2 shows the situation when the circuit breaker is open. The resistor module VR10CB ensures that the digital input is in active state also in this situation. If the digital input is not in active state it indicates that there is something wrong in the trip circuitry.

If a communication protocol is in use the digital input event will tell the control system that there is a circuit breaker failure.
If serial communication is not in use, any of the unused output relays can be configured to follow the state of the inverted and delayed digital input. This relay will then give a "trip circuit failure" alarm to the control system if there is a failure.
The user may also configure a dedicated digital input event text, e.g. "TRIP CIRCUIT FAILURE", to be displayed on the local display of the protective relay whenever there is a trip circuit failure.

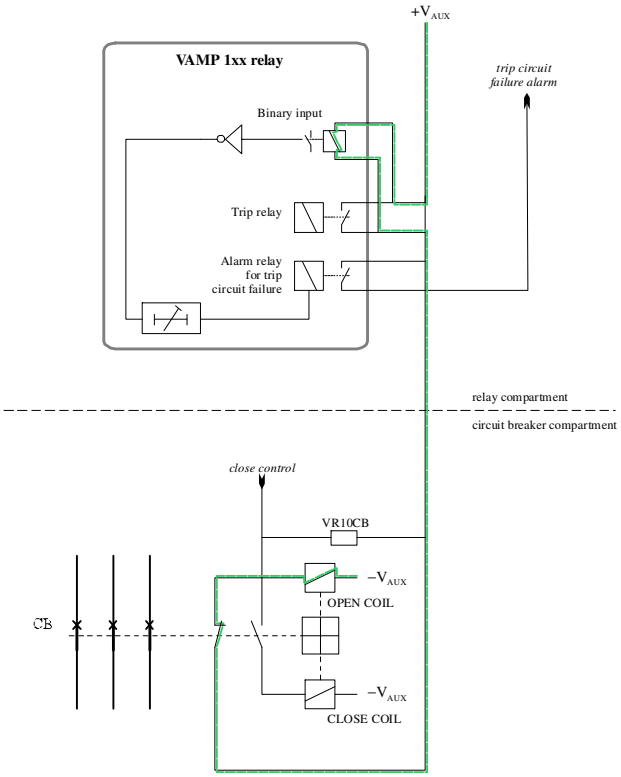


Figure 3.4-1. Trip circuit supervision when the circuit breaker is closed. The supervised circuitry in this CB position is marked with an extra parallel line. The digital input is in active state.

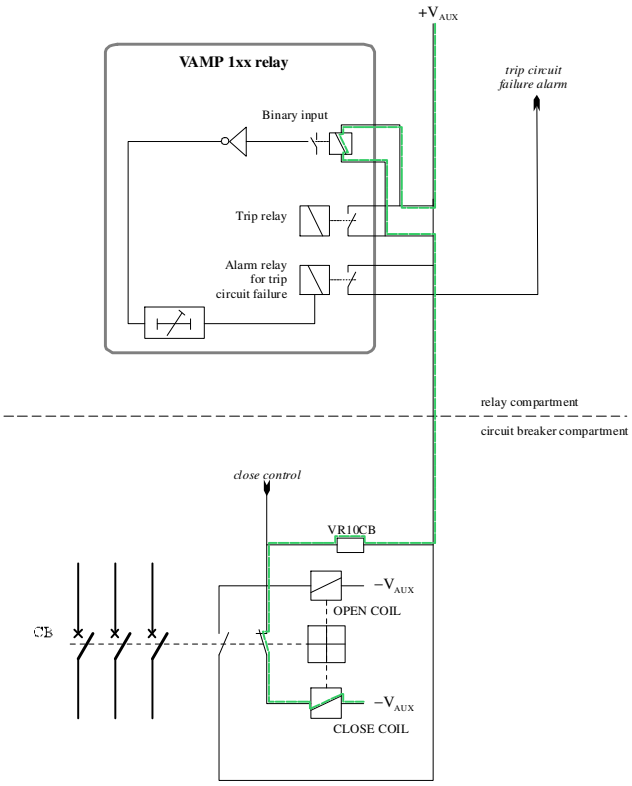


Figure 3.4-2. Trip circuit supervision when the circuit breaker is open. The supervised circuitry in this CB position is marked with an extra parallel line. The resistor device VR10CB offers an active input state for the digital input although the open coil auxiliary contact is open.

4. Connections

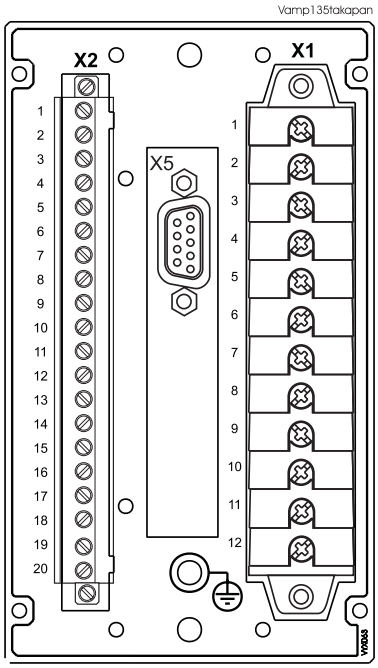


Figure 4-1. Connections on the rear panel of the VAMP 135 relay.

The VAMP 135 relay is connected to the protected object through the following measuring and control connections:

- Phase voltage U_{L1} or line voltage U_{12}, terminals X1: 1 - 2
- Phase voltage U_{L2} or line voltage U_{23}, terminals X1: 3 - 4
- Phase voltage U_{L3} or line voltage U_{31} or residual voltage U_0, terminals X1: 5 – 6

4.1. Digital input

Further the relay can collect position information and alarm signals via the digital input (terminals X2: 4 - 5) and store the information in the event register. The digital input can also be used to block protection stages under certain conditions.

Potential-free contacts for position indication must be available in the protected application.

4.2. Auxiliary voltage

The external auxiliary voltage U_{aux} (standard 40 to 265 V ac/dc or 24 V dc, option B) for the relay is connected to the terminals X1: 11 - 12, Figure 4-1.

Note:
Polarity of the auxiliary voltage U_{aux} (24 V dc, option B):
+ = X1:11 and - = X1:12.

4.3. Output relays

The VAMP 135 relay is equipped with five configurable output relays and a separate output relay for the self-supervision system, Figure 4-1.

- Trip relays T1 and T2 (terminals X2: 19 - 20 and 16 - 17)
- Alarm relays A1 - A3 (terminals X2: 13 - 14, 11 - 12 and 9 - 10)
- Self-supervision system output relay IF (terminals X2: 7 - 8)
- The trip relay T2 can also be used for alarm purposes.

4.4. Serial communication connections

- RS 232 serial communication connection for computers, connector LOCAL (RS 232), connector on the front panel of the relay
- Remote control connection, connector REMOTE (TTL) on the rear panel of the relay (terminal X5), Figure 4-1. See also Table 2.6.2-1.

4.5. Voltage transducer

- The output signal, i.e. 0 - 20 mA or 4 - 20 mA, of the integrated mA transducer is available on terminal X2: 1 - 2.
- Polarity: +=X2:1, -=X2:2

Available couplings to the analogue output

- U12, U23, U31, Uline
- UL1, UL2, UL3
- U_0
- U2/Un
- f

4.6. Block diagram

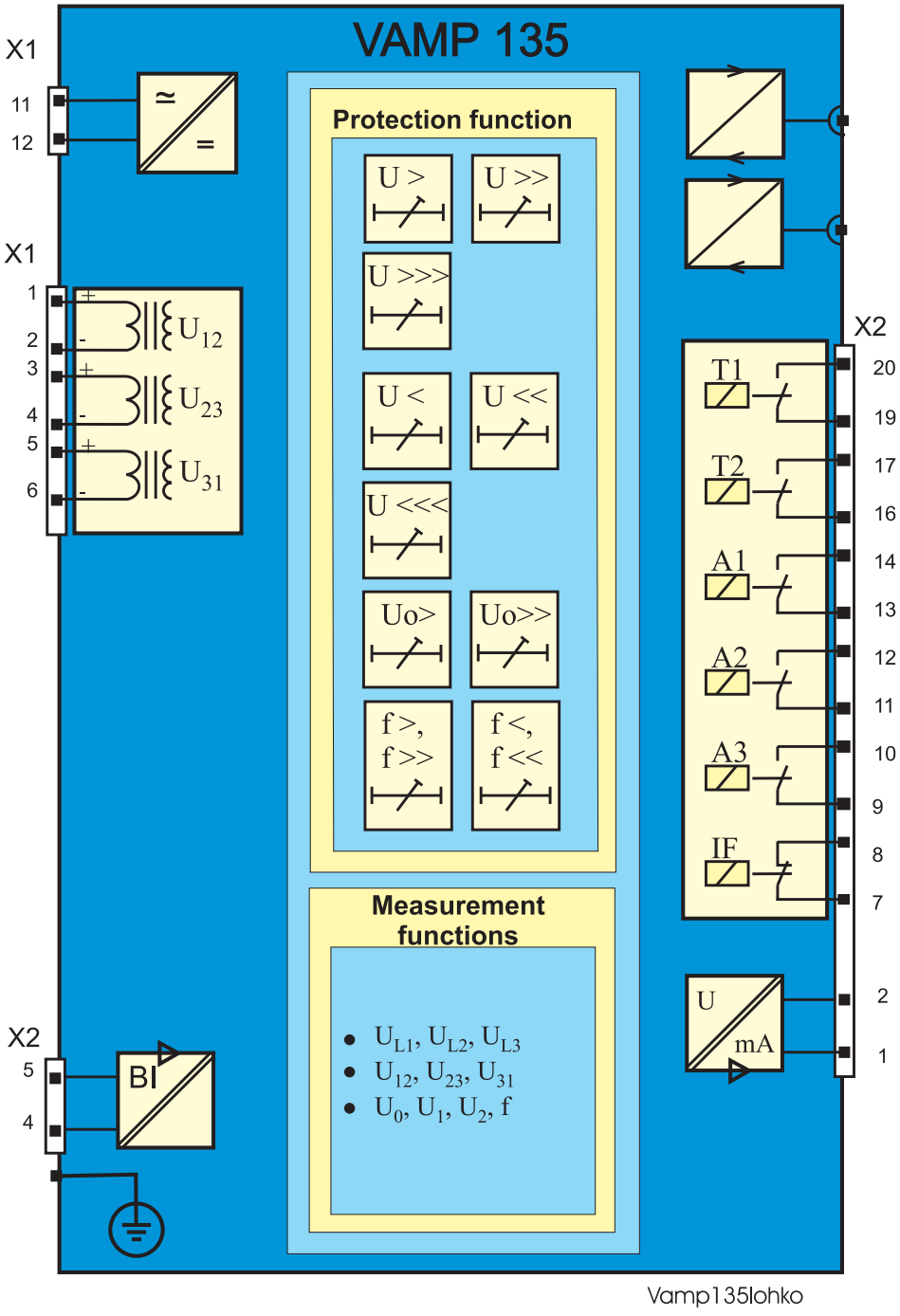


Figure 4.6-1. Block diagram of the overvoltage, undervoltage and frequency relay VAMP 135.

4.7. Connection diagram

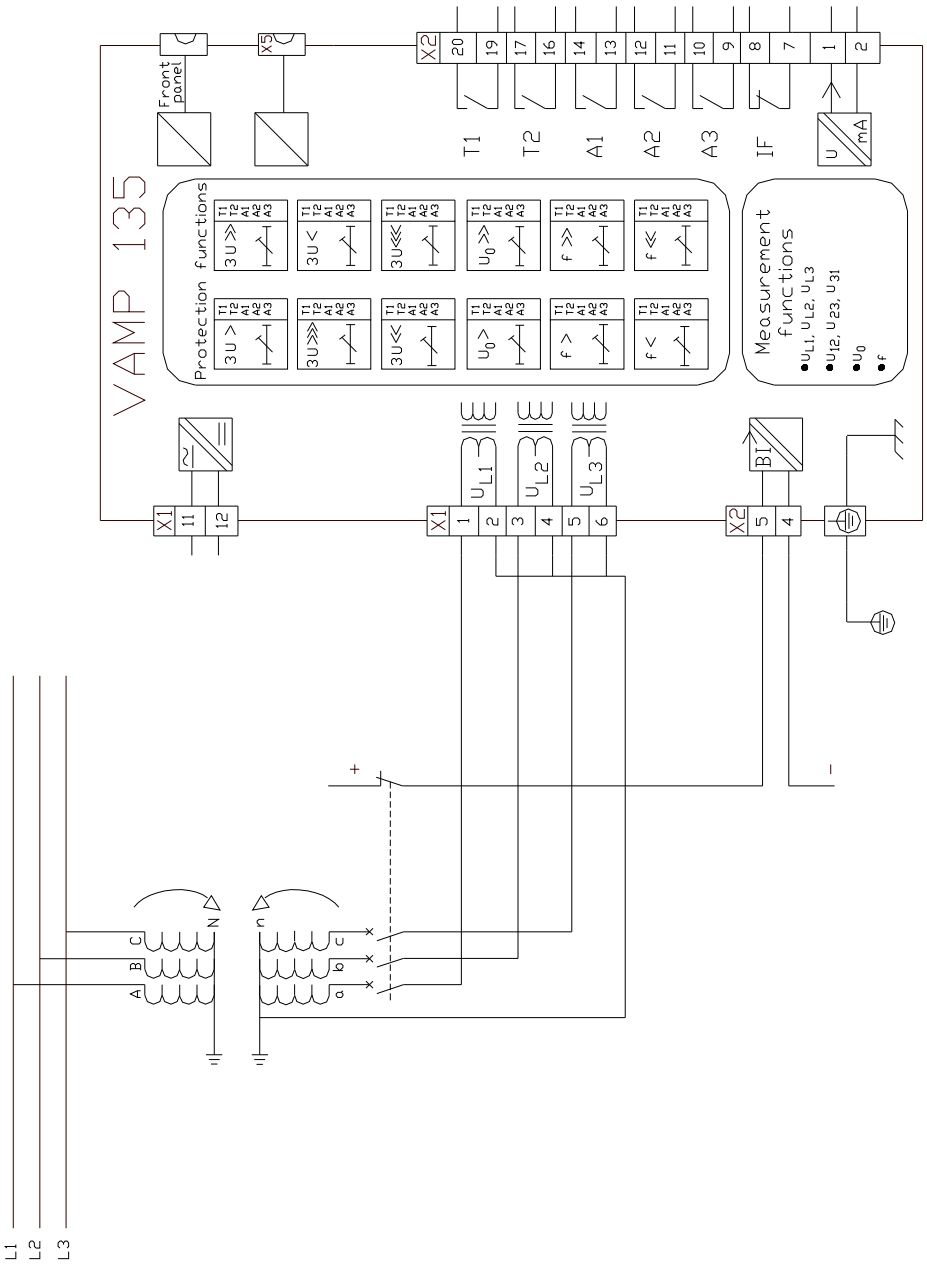


Figure 4.7-1. VAMP 135 connection diagram. Relay contact positions when no power supply connected.

5. Technical data

5.1. Connections

5.1.1. Measuring circuitry

Rated voltage Un - voltage measuring range - thermal withstand - power consumption - inaccuracy 45 – 65 Hz	50 to 240 V 0 to 265 V 275 V (continuous) < 0.5 VA ±0.5% of value or ±0.3% of rated value
Residual voltage Uo - voltage measuring range - accuracy - thermal withstand - power consumption - inaccuracy 45 – 65 Hz	25 to 240 V 0 to 265 V ±1.0% 275 V (continuous) < 0.5 VA ±0.5% of value or ±0.3% of rated value
Rated frequency fn - frequency measuring range - inaccuracy	50/60 Hz 16 - 65 Hz ±10 mHz

5.1.2. Auxiliary voltage

	Type A (standard)	**Type B (option)**
Rated voltage Uaux	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	< 7 W (under normal conditions) < 15 W (as the relay has started)	
Max. permitted ac component of dc supply, point-to-point	<= 12% of rated voltage <= 6% near the limits of the voltage range	
Max. permitted interruption time	< 50 ms (110 V dc)	

5.1.3. Digital input

Number of inputs	1
External control voltage	18 - 265 V ac/dc
Burden	~ 2 mA

5.1.4. Trip contacts (T1 and T2)

Number of contacts	2 making contacts
Rated voltage	250 V ac
Continuous carry	5 A
Max. making current	15 A
Breaking capacity, AC	2 000 W/VA
Breaking capacity, DC (L/R=40ms)	50 W
Contact material	AgNi 90/10

5.1.5. Alarm contacts (A1...A3) and IF

Number of contacts	3 making contacts (relays A1...A3) 1 making contact (relay IF)
Rated voltage	250 V ac
Continuous carry	5 A
Breaking capacity	1 500 W/VA
Contact material	AgNi 0,15 gold plated

5.1.6. Local serial communication port

Number of ports	1 on front panel
Electrical connection	RS 232
Data transfer rate	2 400…38 400 b/s

5.1.7. Remote control port

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 b/s
Protocols	ModBus, RTU master ModBus, RTU slave SPA Bus, slave Profibus DP (option) ModBus TCP (option) Transparent TCP/IP (option) IEC-60870-5-103

5.1.8. mA output

Number of outputs	1
Output signal	0/1 - 5 mA or 0/4 - 20 mA or any between 0...20mA
Load resistance	RL < 600 W
Accuracy	Class 1

5.2. Tests and environmental conditions

5.2.1. 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, 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

5.2.2. 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

5.2.3. 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

5.2.4. 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)

5.2.5. Casing

Degree of protection (IEC 60529)	IP20
Dimensions (W x H x D)	99 x 155 x 225 mm
Weight	1.6 kg

5.3. Protection stages

5.3.1. Overvoltage protection

Overvoltage stages U>, U>> and U>>> (59)

Overvoltage setting range:	0.50 - 1.50 %Un (U>)
	0.50 - 1.60 %Un (U>>, U>>>)
Definite time characteristic:	
- operating time	0.08* - 300.00 s (step 0.02) (U>)
	0.06* - 300.00 s (step 0.02) (U>>, U>>>)
Release delay	0.06 - 300.00 s (step 0.02) (U>)
Hysteresis	0.1 - 20.0% (step 0.1%) (U>)
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±3% of set value
- operate time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

5.3.2. Undervoltage protection

Undervoltage stages U<, U<< and U<<< (27)

Undervoltage setting range	0.20 - 1.20 %Un
Definite time characteristic:	
- operating time	0.08* - 300.00 s (step 0.02) (U<)
	0.06* - 300.00 s (step 0.02) (U<<, U<<<)
Release delay	0.06 - 300.00 s (step 0.02) (U<)
Hysteresis	0.1 - 20.0% (step 0.1%) (U<)
Self-blocking value of the undervoltage	0 – 80 %Un
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	1.03
Accuracy:	
- starting	±3% of set value
- operate time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

5.3.3. Residual voltage protection

Residual voltage stages U_0>, U_0>> (59N)

Residual voltage setting range	1 - 80 % (U_0>)
	10 – 100 % (U_0>>)
Definite time characteristic:	
- operating time	0.3 – 300.0 s (step 0.1 s)
Release delay	0.06 - 300.00 s (step 0.02) (U_0>)
Starting time	<300 ms
Resetting time	<300 ms
Resetting ratio	0.97
Accuracy:	
- starting	±2% of set value or ±3% of U_{0n}
- operate time	±1% or ±30 ms

5.3.4. Overfrequency protection

Overfrequency and underfrequency protection stages f>< and f>>><<(81)

Overfrequency measuring range	46.0 – 70.0 Hz
Definite time function:	
-operating time	0.10* - 300.0 s (step 0.02 s)
Starting time	<100 ms
Resetting time	<100 ms
Resetting ratio	0.998
Accuracy:	
- starting	±20 mHz
- operating time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

5.3.5. Underfrequency protection

Underfrequency stage f< and f<< (81L)

Underfrequency measuring range	40.0 – 64.0 Hz
Definite time function:	
-operating time	0.10* - 300.0 s (step 0.02 s)
Undervoltage blocking	2 - 100 %
Starting time	<60 ms
Resetting time	<60 ms
Resetting ratio	0.97
Accuracy:	
- starting	±20 mHz
- operating time	±1% or ±30 ms

*) This is the instantaneous time i.e. the minimum total operational time including the fault detection time and operation time of the trip contacts.

5.4. Disturbance Recorder (DR)

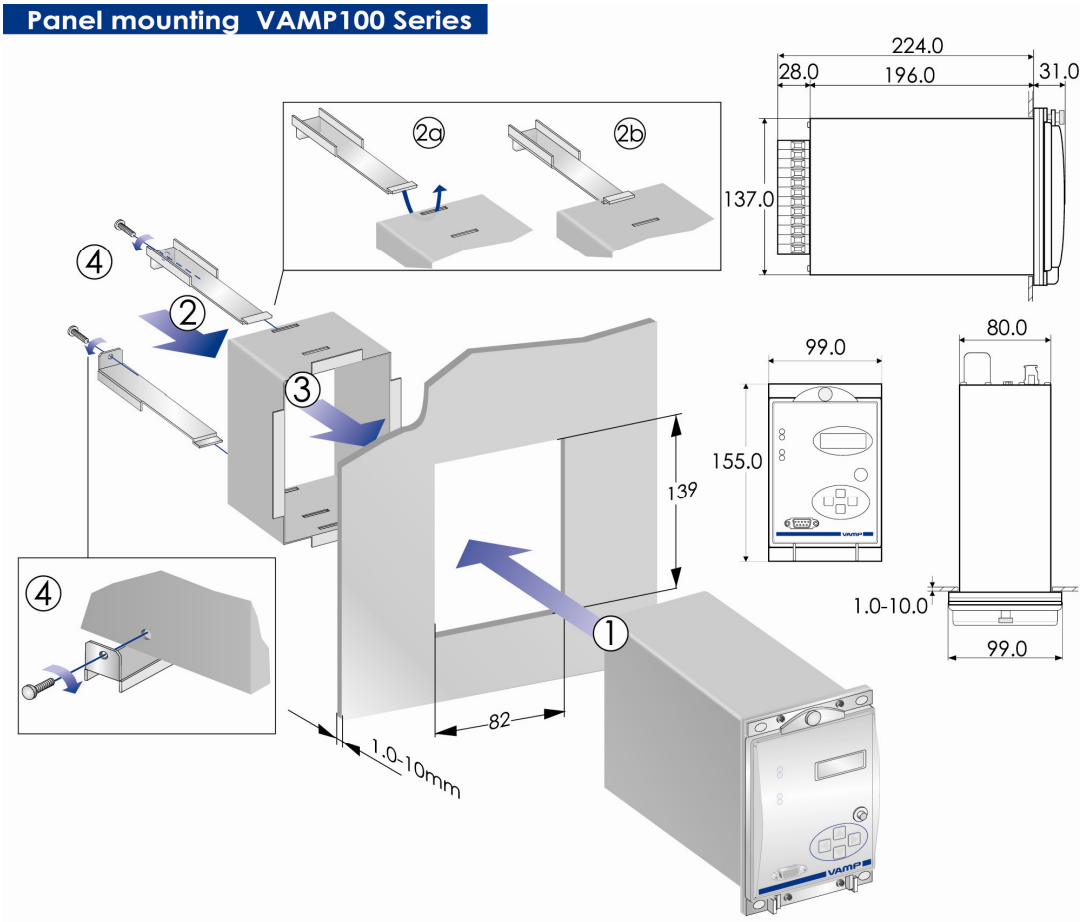
The operation of Disturbance recorder depends on the following settings. The recording time and number of records depend on the time setting and number of selected channels.

Disturbance recorder (DR)

Mode of recording:	Saturated / Overflow
Sample rate:	
- waveform recording	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

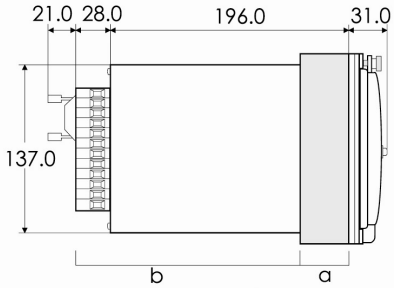
6. Dimensional drawing

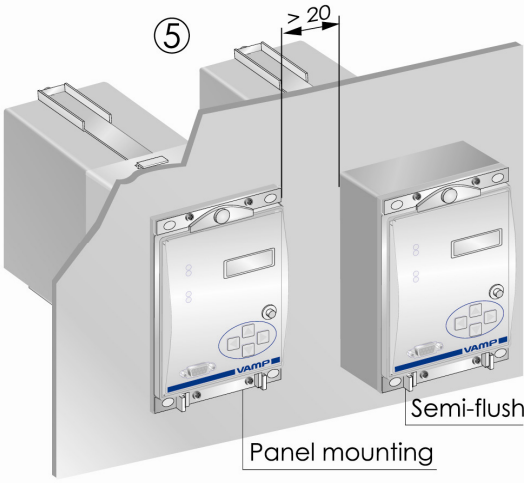
Panel mounting VAMP100 Series



Semi-flush VAMP100 Series

	a mm	b mm	Fixing bracket
VYX078	40	184	Standard for 100 series
VYX079	60	164	Standard for 100 series
VYX232	100	124	2 x VYX199

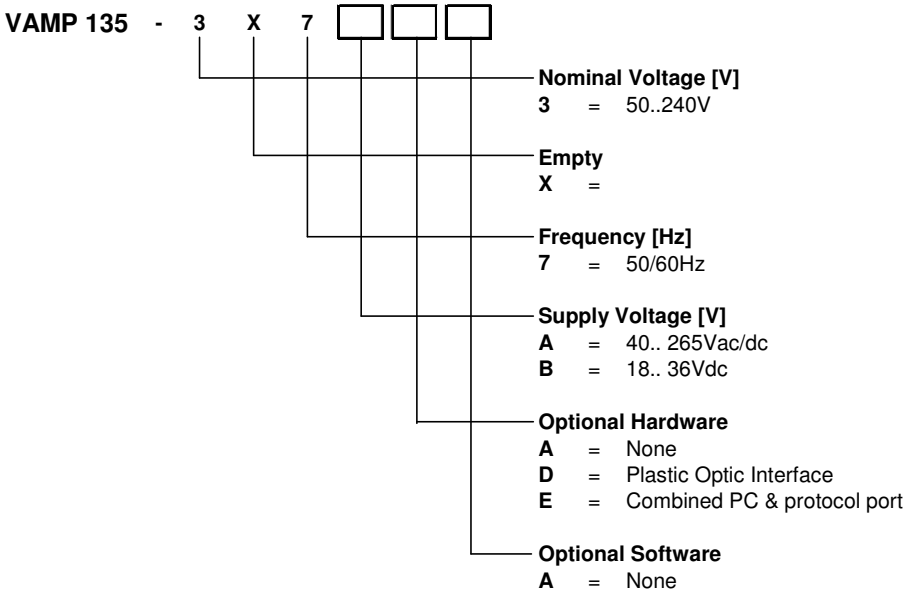




7. Order information

When asking for quotations or when ordering, please, state:
The ordering code:
Quantity:
Options:

VAMP 135 ORDERING CODE



Accessories :

Order Code	Explanation	Note
VEA 3 CG	External Ethernet Interface Module	VAMP Ltd
VPA 3 CG	Profibus Interface Module	VAMP Ltd
VSE001	Fiber optic Interface Module	VAMP Ltd
VSE002	RS485 Interface Module	VAMP Ltd
VX003-3	Programming Cable (VAMPSet, VEA 3 CG+200serie)	Cable length 3m
VX004-M3	TTL/RS232 Converter Cable (for PLC, VEA3CG+200serie)	Cable length 3m
VX007-F3	TTL/RS232 Converter Cable (for VPA 3 CG or VMA 3 CG)	Cable length 3m
VX015-3	TTL/RS232 Converter Cable (for 100serie+VEA3CG)	Cable length 3m
VX008-4	TTL/RS232 Converter Cable (for Modem MD42, ILPH, ..)	Cable length 4m
VYX078	Raising Frame for 100-serie	Height 40mm
VYX079	Raising Frame for 100-serie	Height 60mm
VM690/230	3 Phase Nominal Voltage Matching Transformer	690V->230V , 400V->110V

8. Reference information

Technical documentation:
Mounting and Commissioning Instructions VMMC.EN0xx
VAMPSET Operating Instructions VMV.EN0xx

Manufacturer / Service data:
VAMP Ltd
P.O. Box 810
FIN-65101 Vaasa, Finland
Street address: Yrittäjänkatu 15
Tel: +358 (0)20 753 3200
Fax: +358 (0)20 753 3205
Email: vamp@vamp.fi
URL: http://www.vamp.fi

24h support phone:
Tel . +358 (0)20 753 3264
Email: vampsupport@vamp.fi

We reserve the rights 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
Fax: +358 20 753 3205
Internet: www.vamp.fi
Email: vamp@vamp.fi