MANUAL

Mains failure monitor for mains parallel operation

KNAE 3xx

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BA-KNAE 3xx_EN Version 01

KUHSE
Powerful Solutions

Content

Amendments

Date	Amendment	Name
17-11-30	Creation	Halbauer, Twesten

1 General Remarks

The KNAE 3xx is a device for the monitoring of a 1- or 3-phase mains system on frequency, voltage, phase sequence, angular shift, rate of change of frequency (ROCOF) and vector jump. It is based on 32-bit microcontroller technology and is featured with a backlit graphic display (132 x 32 pixels). Transferring of parameters and data between the KNAE 3xx and a PC system is done by means of an USB interface (USB 2.0 Mini B).

Measurement can be done either with or without neutral connector. The detection of measured values occurs on all measuring paths synchronously by a 12-bit simultaneous ADC. A separate frequency measuring is available for each of the 3 phases. The detection of vector jump can be assigned to a single phase or all phases. Due to a special internal wiring of the terminals, the loss of the neutral conductor can be detected in a 3-wire + N - system. In the internal triggering memory, the KNAE 3xx saves the last, maximum of 52 triggerings and the associated measured values.

By setting of the corresponding parameters, the KNAE 3xx provides the option for monitoring on nominal voltage and frequency in accordance to DIN VDE-AR-N-4105:2011-08 or the dynamic grid support according to the Medium Voltage Guideline of BDEW (Bundesverband der Energie- und Wasserwirtschaft e.V.).

The comfortable configuration of all settings of the KNAE 3xx is done by means of the parameterisation software KuPa010 (– Version V2.36 or later required). Alternatively values can be entered directly at the device. The input to the device can be protected by use of a PIN. The output of display-texts at the device standardly takes place in German and English (switching between languages is possible at any time during operation). Alternative languages, suitable to the customer’s requirements, can be configured and conveniently made available, by means of our parameterisation software KuPa010.

Optionally, the KNAE 3xx is available with two analogue outputs, one of the analogue outputs can be switched between voltage and current (1 x 0(2) V … 10 V / 0(4) mA … 20 mA, 1 x 0(2) V … 10 V).

2 Safety Information

The following safety and installation instructions must be observed when handling the device:

Installation and commissioning only by trained professionals.

The user is responsible for checking the correct configuration of the KNAE 3xx before commissioning or maintaining the device.

Maximum values given in this description must not be exceeded.

The device must be disconnected from the mains during maintenance and installation.

Symbols shown in this description have the following meaning:

	The Caution symbol indicates possible injury or life hazards.
	Explanatory text or hint on special features at the handling or behaviour of the device.

3 Measurement

All three measuring paths are measured simultaneously and all 3 frequencies are detected independently. Voltage and frequency are measured, all other available values are derived therefrom.

3.1 Voltage Measurement

The voltage measurement is a true root mean square value measurement. It operates down to a star-point voltage of approximately 10 V (L-N). As soon as a measuring voltage is detected, the LED of the respective phase lights up. The KNAE 3xx can be used in grids of 57/100 V up to 230/400 V nominal voltage. The three string voltages are measured simultaneously with 32 samples per period. The accuracy of the voltage measurement is better 0.1% of the end value (280/480 V).

3.2 Frequency Measurement

The frequency of all 3 voltages is detected and evaluated separately. The frequency measurement begins with a star-point voltage of approx. 10 V and takes place in the range from approx. 15.0 Hz up to approx. 100.0 Hz. The accuracy at absolute values is better than 0.01 Hz. The evaluated measuring range is limited from 35.0 Hz to 75.0 Hz.

The correct frequency measurement is indicated by means of the 3 green LED on the connection terminals of the measuring inputs (*see Connection Diagram - chap. 4.2.1*). As long as no frequency is measured, the KNAE 3xx operates with the nominal frequency (50 or 60 Hz), which is set by means of parameterisation (*see chap. 6.6*).

3.3 3-Wire- and 3-Wire+N - Systems

Measuring with or without star-point may be selected by the choice of the measurement method. At measuring without star-point, it is not necessary to connect a neutral conductor. Due to a special internal wiring of the terminals, in a 3-wire + N – system the loss of the neutral conductor can be detected and indicated in form of a voltage asymmetric or undervoltage Lx.

3.4 1-Wire Operation

If the KNAE 3xx is set to 1-wire operation, the measurement and monitoring is only carried out on L1 against N (*see chap. 4.2.1*). The limit values for fault angle, rotary field protection, average limit and asymmetric are internally deactivated, vector jump must be adjusted.

3.5 Behaviour at low Voltages

Below a measuring voltage of approx. 20 V, the accuracy of the voltage measurement and the angle measurement decreases. The measuring voltage lower limit is reached at approx. 10 V. Then for frequency and voltage 0 is displayed.

4 Installation

Assembly and commissioning only by trained professionals,
Connection in compliance with VDE 0160.

4.1 Mechanical Installation

The KNAE 3xx is designated for a mounting on a 35 mm top-hat rail, according to DIN EN 60715. The installation width is approx. 100 mm.

4.2 Electrical Installation

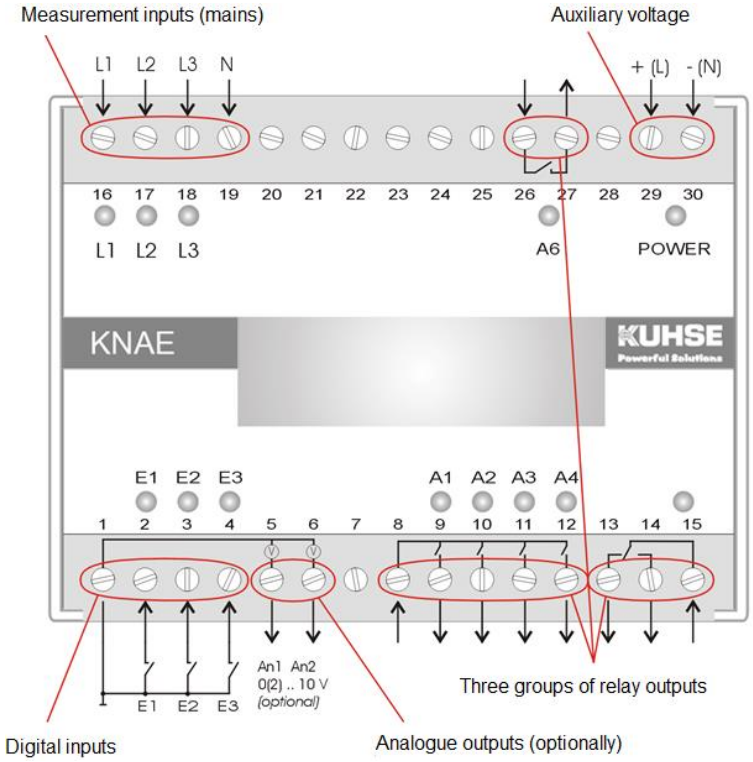
Assembly and commissioning only by trained professionals.

Selecting the cables and the electrical connection of the device, the regulations of the VDE 0100 "Regulations for the Setting up of Power Installations with nominal Values below 1000 V", die VDE "Equipment of Power Installations with Electrical Components" resp. the respective national / local regulations must be observed.

The electrical connection has to be carried out only by trained professional staff (VDE 1000 T. 10).

The device must be disconnected from the mains during maintenance and installation work.

4.2.1 Connection Diagram



4.3 Commissioning

For putting the KNAE 3xx into operation, it is to connect as per connection diagram (*see chap. 4.2.1*). The device is factory calibrated and pre-set with default settings.

4.3.1 Basic Settings

At the first start-up, settings must be made to adapt the KNAE 3xx to the respective system. This includes the nominal voltage according to the system parameters as well as the converter ratios for the voltage measurement. The settings can be done by the supplied, respectively for downloading on our homepage www.kuhse.de available parameterisation software KuPa010, alternatively inputs are possible directly at the device.

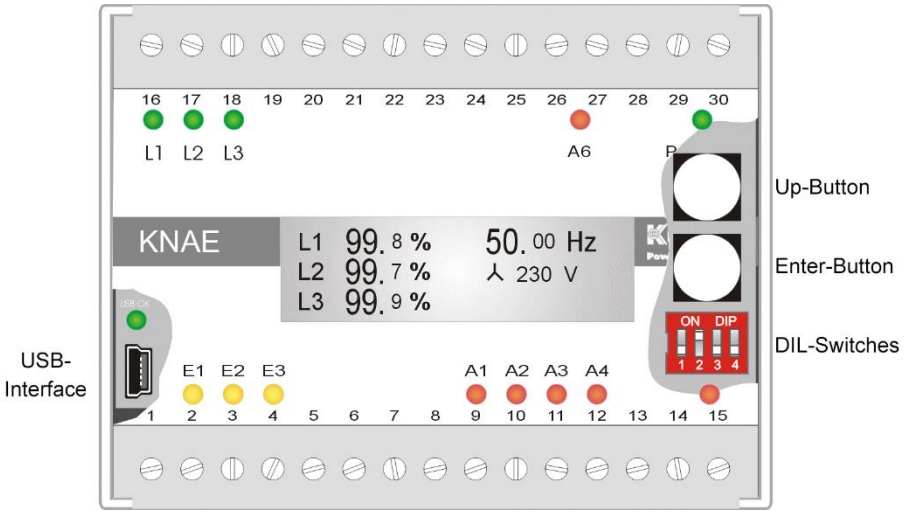
The procedure for parameter input on the device is described in detail in chap. 6.5 – ‘Configuration at the Device’.

5 Operation

The KNAE 3xx is served by means of 2 buttons as well as 4 DIL switches, which can be reached after removal of the front lid.

Using the USB interface, the parameterisation can be carried out with the PC-Software KuPa010.

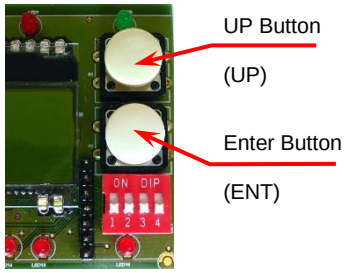
5.1 Overview of the Control Elements



The control elements, DIL switches and communication interface (USB interface) are only accessible, when the front lid of the KNAE 3xx is removed. It is unconditional to avoid to touch other than the here listed elements. After completion of the intended activities, the cover must be replaced.

5.1.1 Buttons

For direct access to the operation of the device, the Voltage - Frequency Guard KNAE 3xx has two buttons (*figured below*). In connection with the DIL switch (*see chap. 5.1.2*) and the graphic display, almost all relevant settings can be performed directly at the device. The following functions are assigned to the buttons:



UP button

Scrolling through various menus

Increasing of a value in the parameter setting (*see chap. 0*)

Deleting of stored trigger values (*see chap.7.3*)

Enter button

Enter a menu item

Exit a (sub-)menu item (press & hold 2s)

Confirming an entry

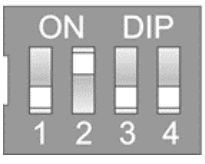
While operating: switching the display output between absolute & relative values

In main screen: performing a limit value reset
(press & hold 2s, *see chap. 7.1.3*)

The functions of the KNAE 3xx buttons mentioned above are not to be viewed as a complete list of all functions. Further details and notes on functions of the buttons of the KNAE 3xx are described in the respective chapter of this document, which refers to the operation of the device by means of the buttons

5.1.2 DIL Switches

The DIL Switches have the following functions:



S1:	OFF	automatic fault message reset acc. parameterisation
	ON	STM auto reset disabled; reset by digital input or reset button (press & hold Enter Button 2s)
S2:	ON	editing of parameters
S3:	ON	change over language
S4:	ON	view / print / delete stored trigger values
S2 + S4:	ON	setting the device clock

5.1.3 LEDs

The LEDs have the following functions:

LED E1 … E3:

The LEDs represent the corresponding digital input. If the input is activated (bridged to KL 1), the associated LED is on (yellow). Hereby the parameterisation of the input after quiescent or working current does not matter.

LED A1 … A6:

The LEDs represent the corresponding relay output. If the relay output is activated (relay energised), the associated LED is on (red). Hereby the parameterisation of the output after quiescent or working current does not matter.

LED L1 … L3

The LED is on (green), when a voltage is detected on the corresponding phase.

LED Operation:

The LED is on (green), while the KNAE 3xx is supplied with auxiliary voltage.

5.1.4 Graphic Display

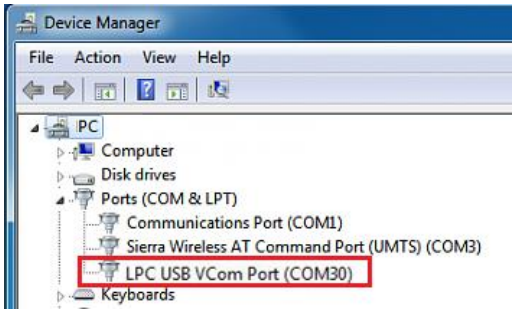
The device status is output via a backlit graphic display with a resolution of 132 x 32 pixels. In connection with the DIL switches and the Buttons (*see chap. 0*) almost all relevant settings can be performed directly at the device. All relevant (measuring-) data are as well shown on the graphic display.

5.1.5 USB Interface / Driver Install

The KNAE 3xx is equipped with an USB interface (mini-USB), which allows parameterisation of the device. To ensure the correct function, the USB driver file 'lpc_driver_setup.exe' must be installed before the first use (file can be found on the delivery included installation medium as well as, after installation of the KuPa010, in the program folder of KuPa010). PCs with the operating system Windows 7 or later are supported.

Connect the KNAE 3xx to the designated PC system using an USB cable (parameterisation cable USB A : USB Mini B) and switch on the auxiliary voltage of the KNAE 3xx.

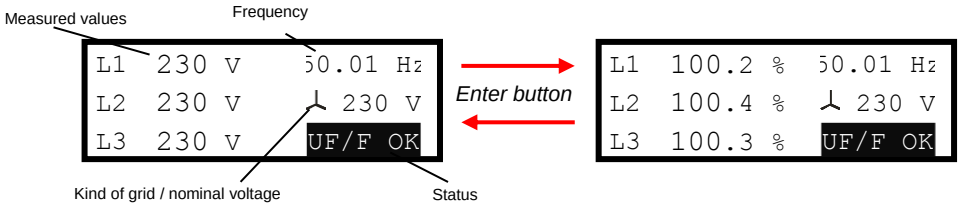
After successful completion of the installation process, the interface 'LPC USB VComPort' should be listed in the Windows device manager (figured right). The parameterisation software KuPa010 now can be used with the KNAE 3xx.



5.2 Display View

5.2.1 Main Screen

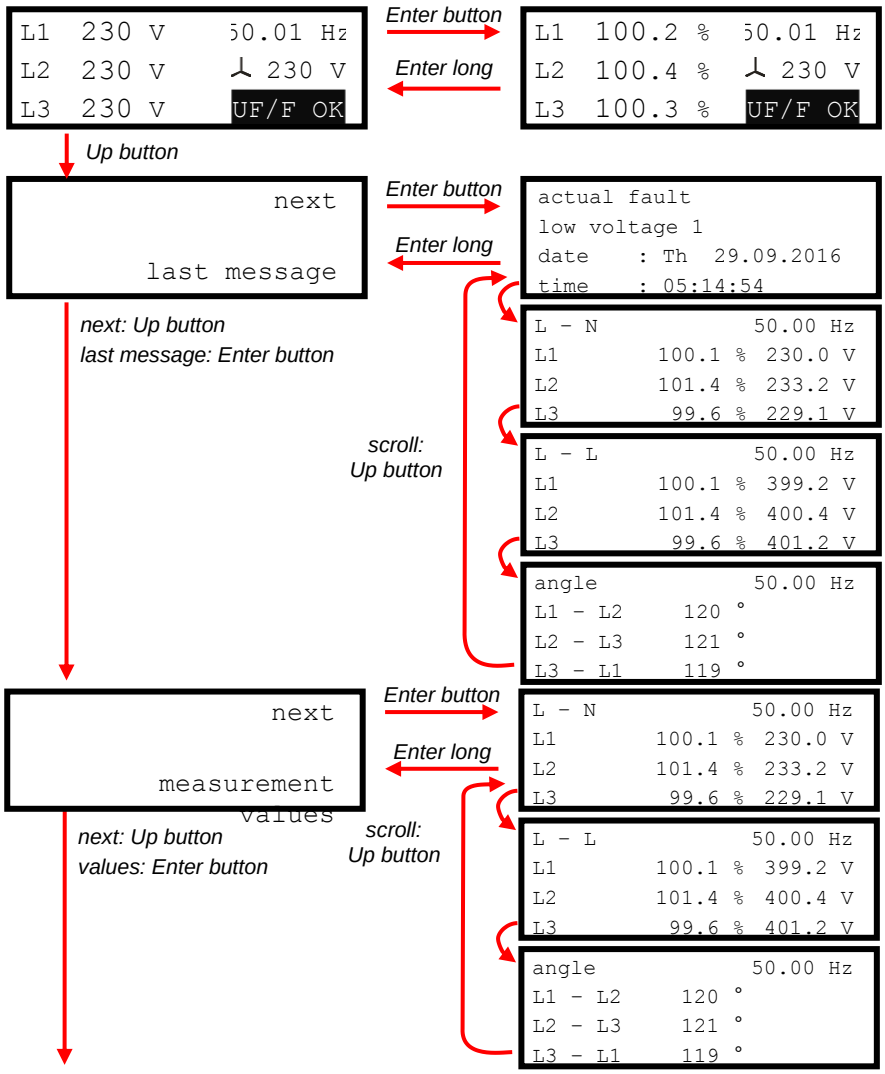
The main screen shows all relevant measured values and messages.



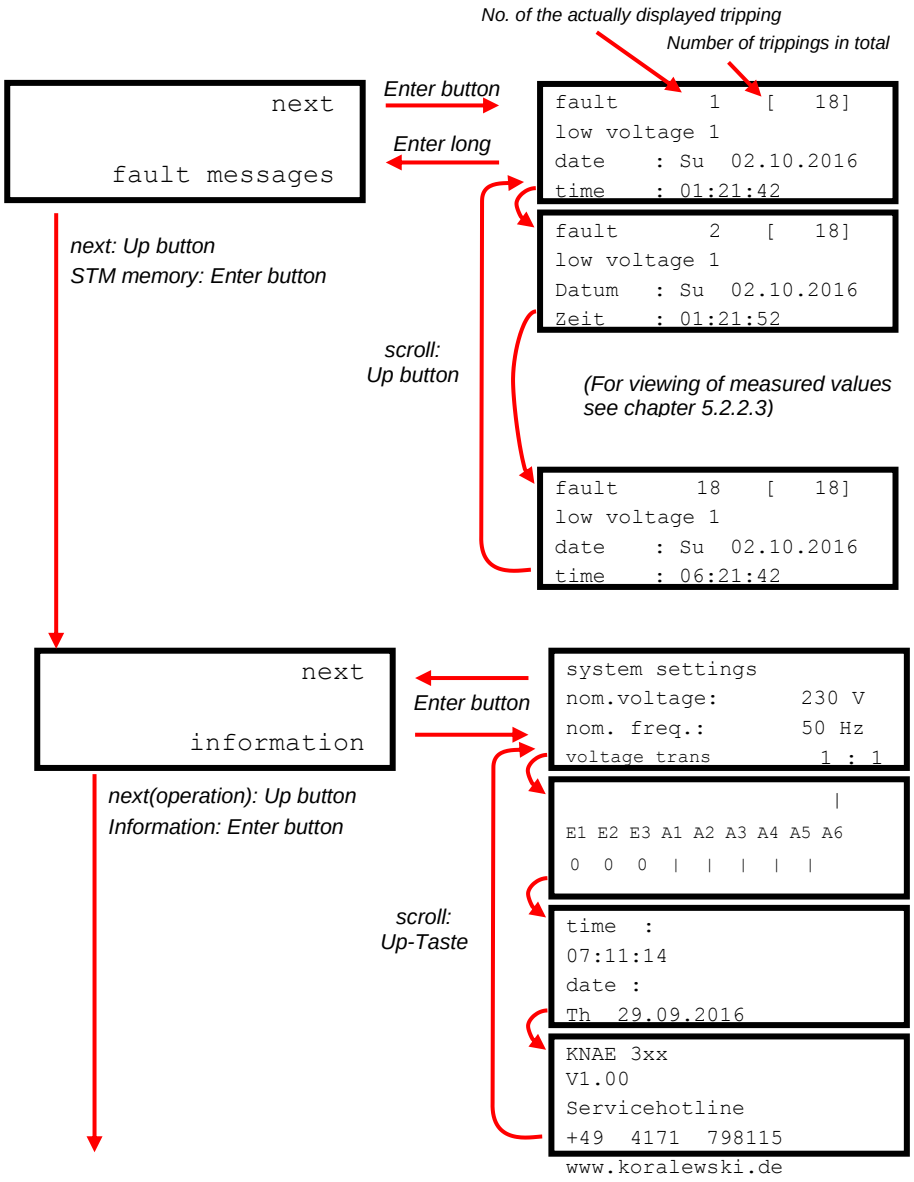
Using the Enter button the displaying of measuring values can be switched between relative and absolute form. Pressing the UP button, the menu will be entered.

5.2.2 Menu Structure

The menu can be called up from the main screen using the UP button. Pressing the Enter button then activates the respective submenu.



(*Onwards on the next page*)



(*Onwards to display in operating mode, see previous page*)

5.2.2.1 Last Message

The last stored message is shown within the menu 'Last Message' – regardless of whether it is still pending. All measuring values available at the time of the message are retrievable. The UP button can be used to scroll through the measuring values listed below, which were present at the time of the message. Actuating the Enter button switches back to the selection menu.

- Type and time of the last message
- Star-point voltage absolute and relative
- Conductor voltage absolute and relative
- Phase angle

5.2.2.2 Measuring Values

The current measured values are displayed in the menu 'Measuring Values'. By means of the parameterisation, the display ranges can be pre-selected or can be set as automatic range switching (default setting 0 -> *see chap. 6)*.

Scrolling is done using the Up button. Actuating the Enter button switches back to the selection menu.

The following measuring values can be displayed:

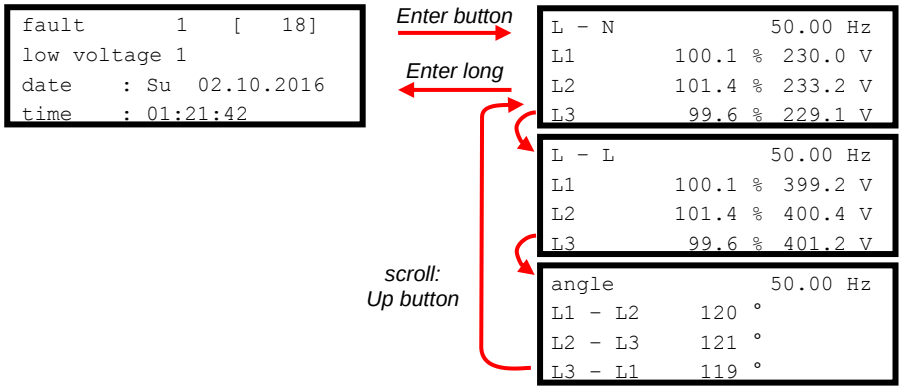
- Star-point voltage of all 3 phases absolute and relative
- Conductor voltage of all 3 Phases absolute and relative
- Phase angle

5.2.2.3 Fault Messages

The 'Fault Messages' menu can be called up via the main menu or by closing of DIL switch 4. In this menu the last 58 on the device stored fault message releases can be displayed. Scrolling through the releases is done with the UP button. Actuating the Enter button changes into the display of individual stored releases. With the Up button one can scroll through the values contained here in. With a long time press (>2s) at the Enter button the display switches back to the previous level.

The following values are retrievable at the point of time of each fault message:

- Type and time of tripping
- Star-point voltage absolute and relative
- Conductor voltage absolute and relative
- Phase angle



5.2.2.4 Info

In the 'Info' screen, important and service information is displayed:

- Nominal values of the system
- Setting of the voltage transformers
- Date and time (also setting)
- Firmware- and service information

6 Configuration of the Device

For a correct adjustment to each individual application, the parameterisation of the device is required. For parameterisation the use of the supplied, respectively for downloading on our Homepage www.kuhse.de available parameterisation software KuPa010 is recommended. The modification of the most operating settings by direct input at the device is possible as well.

At the first start-up, some settings have to be made in order to adapt the KNAE 3xx to the respective system. This includes: nominal voltage, nominal frequency, type of system and voltage transformer ratios. If these parameters are not correctly adjusted to the system, the KNAE 3xx will not work properly.

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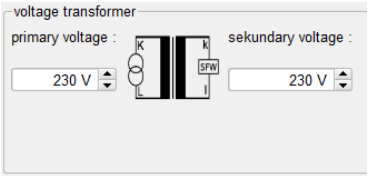
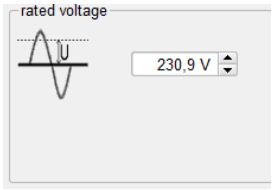
6.1 Converter Setting

The converter ratio for the voltage transformers is specified in the KuPa010 (*figuered right*) or directly at the device in the ratio of primary voltage to secondary voltage.



6.2 Nominal Values of the System



The system nominal values are also entered via KuPa010 or directly at the device.

At 3-wire grid form, the nominal voltage is related to the outer conductor voltage.

At 3-wire + N grid form, the nominal voltage is related to the string voltage.

6.3 Measurement Range Selection

The selection of the respective display area depends on the configuration of the plant. Nominal Voltage and setting of the voltage transformers must be adapted before commissioning. Ex works, the measurement range selection is preset to automatically.

The following display areas are provided:

Value	Voltage U
0	automatic
1	0 .. 99.9 V
2	0 .. 999 V

Value	Voltage U
3	0 .. 9.99 kV
4	0 .. 99.9 kV
5	0 .. 999 kV

6.4 Configuration via KuPa010

Values and settings, which are stored on the KNAE 3xx can be read out at any time from the device with a PC system by means of the parameterisation software KuPa010. The data can be stored on the PC and printed out for documentation purposes. For detailed user instructions of KuPa010, please refer the related user manual, available as download on our homepage www.kuhse.de.

6.5 Configuration at the Device

The setting of most values is also possible directly at the device. The menu for editing the parameters is called up in operating mode (*see chap. 7*), while the main screen is shown in the device display - by closing the DIL switch S2 (*see chap. 5.1.2*). The procedure for the input at the device is described in detail below. The parameter data listed in the section parameter groups (*see chap. 15*) must be observed.

6.5.1 Protection of Input with PIN

The editing at the device can be protected by a four-digit user defined PIN. With activated PIN protection, an input at the device is only possible, after entering the correct PIN.

The PIN is entered digit by digit from right to left (*see also chap. 6.6.2*). Using the UP button the respective digit is incremented, with the Enter button the entry of the number will be confirmed and to cursor moves to the next position. If the last digit of the PIN is entered correctly, the display changes into the 'Parameter Setting' menu (*see chap. 6.6*). If the PIN is entered incorrectly, the input line is reset to 0000. This procedure can be repeated, starting at the last digit (*figured above*).

The PIN protection can be set via KuPa010 or via the parameter setting at the device (*see chap. 15.1*) .

After the PIN has been successfully entered, the input protection is automatically activated again, if for longer than 10 minutes no button has been actuated.

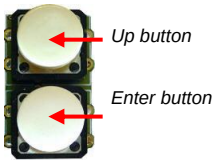
6.6 Parameter Setting

If the DIL switch S2 is closed (ON), the device display changes to the parameter setting. To exit the parameterisation, the DIL switch S2 must be opened (OFF) again. If the parameterisation is exited without correctly completing of a begun input, the newly set value gets lost and the previous setting remains active. Set values are stored permanently in the flash module of the device. The values are retained even at loss of the voltage supply, a battery based buffering is not required.

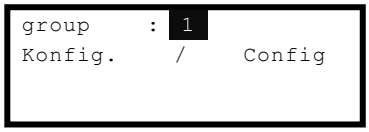
The setting values are arranged in parameter groups (*see chap. 15*). Each group contains a number of setting values and, where appropriate, further properties. The following groups are available:

Configuration (Konfig. / Config)	Group 1
Limit values (Grenzwerte / Limits)	Group 4
Analogue output (Analog Ausg. / Out)	Group 5
Digital output (Digital Ausg. / Out)	Group 6
Digital input (Digital Eing. / In)	Group 7
BDEW (BDEW)	Group 8
VDE4105 (VDE4105)	Group 9
Logic table (Logik)	Group 10

6.6.1 Selection of Groups and Parameters



In parameter setting mode (DIL switch S2 closed, input protection PIN inactive) the device display shows the selection of the parameter group (*parameter groups see chap. 15*). Using the Up button (*see chap. 0*) the respective parameter group, which is intended to be edited, can nun be selected now.

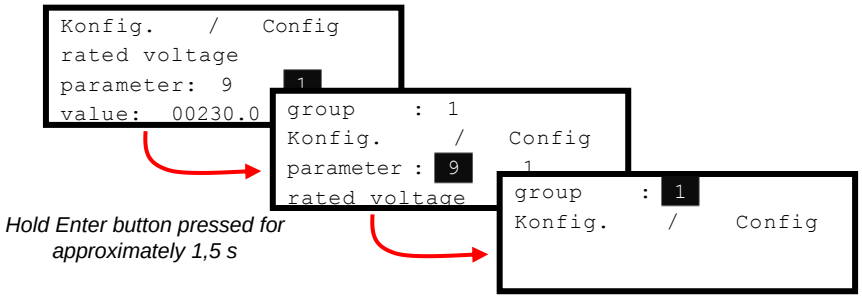


By actuating the Enter button, the display changes into the menu of the selected group. The subgroup with its parameters to be edited (*see chap. 15*) can be selected herein by means of the scroll function of the Up button (*see chap. 0*). Shown in the example (*figured below*): Switching from parameter subgroup 6.1.x (Digital Output A1) to 6.2.x (Digital Output A2).

The selected subgroup is now called up with the Enter button. The parameter to be changed can be selected in this menu item using the Up button. Shown in the example (*figured below*): Switching from parameter 6.2.1 (Function A2) to parameter 6.2.2 (Switching behaviour A2 – *refer to chap. 11.1*).

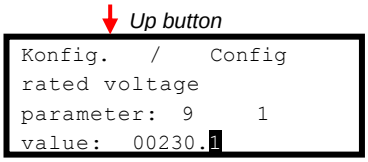
Press the Enter key to call up the menu for the editing of the parameter to be changed. After the entry has been made and the change is confirmed (*see chap. 6.6.2*), the display returns to the menu of the current parameter subgroup.

To move from one menu level to the next higher, that is from the subgroup to the parameter group and from the parameter group (*see chap. 15)* to the group selection, the enter key must be pressed for approx. 1.5 seconds (*figured below*).



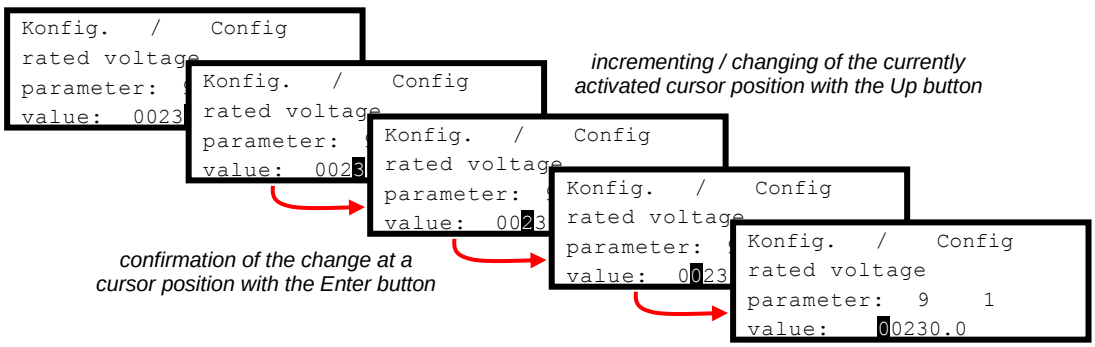
6.6.2 Entering of a Value

After selecting the parameter group and -subgroup, as well as the selection of the parameter value, the editing of the value is initiated by pressing the Enter button again. The cursor is at the last position of the value to be edited (*figured right below*).

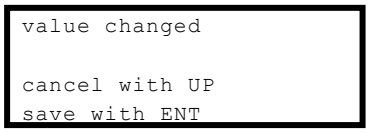


Repeatedly pressing the Up button will increment the number activated under the cursor (*figured right*). If the highest value is reached in this position, the count returns to the lowest value (9 → 0). The desired setting value is confirmed by actuating the Enter button. The cursor moves to the next digit.

This operation is repeated for all digits of the current value to be changed.

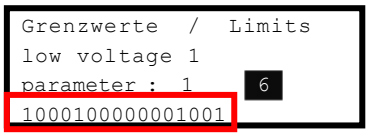


When the last digit (the left position) of the value to be changed has been edited and confirmed with the Enter key, a safety query occurs, with which the change of the parameter value must be confirmed. Using the Up button, the current change can be discarded here. The previous setting is retained. Actuating the Enter button (ENT), the entry of the parameter value is accepted and stored in the flash memory of the KNAE 3xx. The value is valid immediately after confirmation.

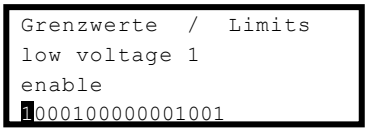


6.6.3 Setting the Fault Message Coding

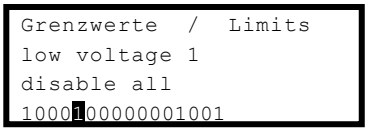
The setting of the fault message behaviour is performed bit by bit for the respective limit values. With the selection of parameter 6.x.6 *see chap. 15.2*) the value in the bottom line of the display is switched to binary number (*figured right*).



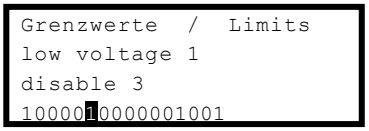
The bit positions 1, 5, 6, 7, 8, 13, 14, 15 and 16 are adjustable:



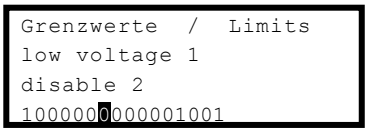
Bit position 1 / Release:
The triggering of the fault message for the respective limit value is activated (1) / not activated (0).



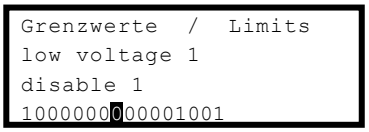
Bit position 5 / disable all ***(only Logic Table [10])***:
The respective limit value can be disabled (1) for the triggering by means of the 'disable all' function.



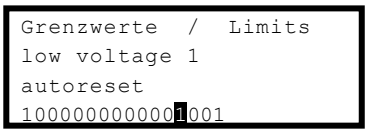
Bit position 6 / disable 3:
The respective limit value can be disabled (1) for the triggering by means of the 'disable 3' function.



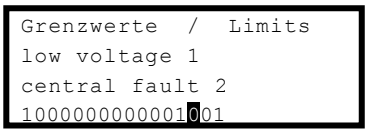
Bit position 7 / disable 2:
The respective limit value can be disabled (1) for the triggering by means of the 'disable 2' function.



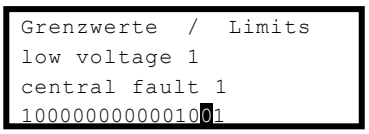
Bit position 8 / disable 1:
The respective limit value can be disabled (1) for the triggering by means of the 'disable 1' function.



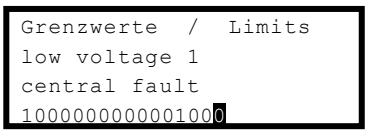
Bit position 13 / autoreset:
The autoreset (*see chap.7.1.3*) is enabled (1) / disabled (0) for the respective limit value.



Bit position 14 / central fault 2:
The fault message triggering for the limit value is additionally - not (0) / carried out (1) under 'central fault 2' (*see chap. 7.1.5*)



Bit position 15 / central fault 1:
The fault message triggering for the limit value is additionally - not (0) / carried out (1) under 'central fault 1' (*see chap. 7.1.5*)



Bit position 16 / central fault ***(only Logic Table [10])***:
The fault message tripping for the limit value is - not (0) / carried out (0) under 'central fault' (see chap. 7.1.5).

6.7 Setting of Time and Date

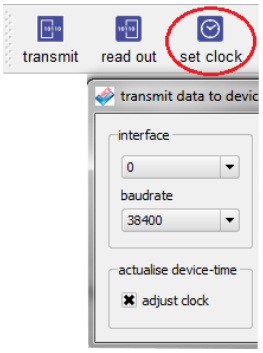
The real-time clock integrated in the KNAE 3xx operates in 24h format and continues to run for at least 72 hours in case of auxiliary power supply fails. Date and time of the KNAE 3xx can be adjusted in different ways.

Using the parameterisation software KuPa010.

Manually at the device.

6.7.1 Via KuPa010

Time and Date are adjustable via KuPa010. On this, the time of the PC system is applied.



The clock of the KNAE 3xx can be set by clicking on 'set clock', or transferring or reading out the configuration. For this, the option 'adjust clock' must be activated during transmission.

6.7.2 Manually Setting of Time

The setting of date and time is called up at the device by closing of the DIL switches S2 and S4. Actuating the Enter button, the editing is activated.

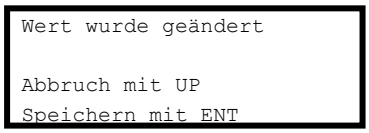
Using the Up button (*see chap. 0*) now the activated digit is altered. The made setting is confirmed by actuating the Enter button, the cursor changes to the next position of the input area (*figured below – refer chap. 6.6.2*).

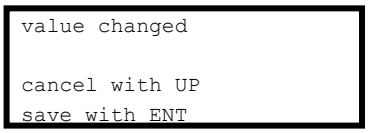
The procedure described above must be repeated for all positions of the time and date input.

The day of the week can not be set manually. The day of the week is set automatically on the base of the set date.

6.8 Language Selection and Switching

Basically the display texts are available at the device in 2 languages. The factory default is German and English. Other languages can be set up at the customer's request and thus made available on the device display by means of the parameterisation software.





Using the device parameterisation it is determined which language is the main language, and whether it is allowed to switch between the languages. The following options are adjustable:

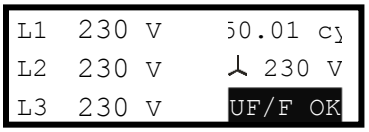
- only language 1 (German)
- only language 2 (English)
- language 1 or language 2 (German / English)
- language 2 or language 1 (English / German)

The switching between the two display languages can alternatively be carried out via the parameterisation software, DIL switch S3 or a parameterised input. If DIL switch S3 or the assigned input is closed, the language is switched according to the parameterisation, if the changeover is permitted.

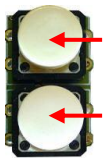
7 Operation

In the operation mode, the KNAE 3xx displays current measured values. Depending on the parameterisation, the values are shown, alternatively absolute (factory setting) or relative.

Measurement values



Frequency
Kind of grid / nominal voltage
Fault message



Using the Enter button, the displaying at the device can be switched between absolute and relative values. The menu is called up with the Up-button. After an adjustable view reset time, the display of the KNAE 3xx turns back from the sub menus to the main screen. The view reset time itself is reset with each keystroke. If the view reset time is adjusted at 0 s, the display remains within the actually shown menu, up to the next. In the following, the main menu level is shown.

7.1 Limit Values

7.1.1 Behaviour of the Limit Values

All limit values can be adjusted and assigned to a relay separately. A set and active limit value is displayed as a triggering message in the display, regardless of whether the limit value has been laid to a relay or to one of the fault messages. Each limit value message leads to the activation of the internal central fault message and can optionally be linked to the freely configurable central messages.

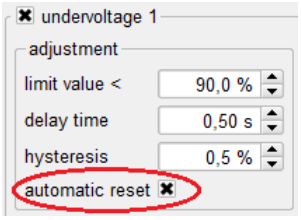
7.1.2 Tripping of Limit Values

The tripping is basically carried out when the respective measured value exceeds or falls short of the set limit value and the set delay time has elapsed. Each trigger value has its own delay time. The delay times are individually adjustable for each limit value in the range from 0.05 s to 999.9 s.

Switching back after a limit value tripping occurs when the respective measured value has again fallen below or exceeded the set limit value plus hysteresis.

The message duration can be set between 0.1 s and 6000.0 s for each relay in the configuration of the outputs. The set value causes the corresponding relay contact to remain accessed at least for the set time, even if the exceeding or shortfall of the limit value is of shorter duration.

7.1.3 Manually / Automatically Reset



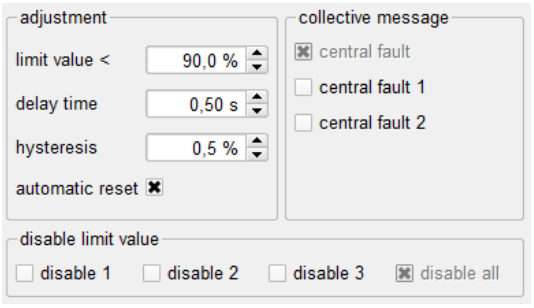
Ex factory all limit values are set to automatical reset. This automatical reset can be disabled for each individual limit value. If the autoreset is activated, the reset is carried out automatically as soon as the tripping condition no longer exists.

Limits for which the automatic reset is deactivated can only be reset by means of a correspondingly configured digital input (*see chap. 10.1*) or with the reset function of the Enter button (long actuating of the Enter button while the main screen is shown at the device display). The manual reset works edge-controlled and resets all limit messages for 1 s. If limit value messages are still pending, they are again indicated with the end of the reset time.

he automatic reset is basically deactivated for all parameterised limit value messages by closing the DIL switch S1 (ON).

Resetting the fault messages by means of the Enter key (hold pressed for 2 s) is only possible while the main screen is displayed.

7.1.4 Locking of Trippings



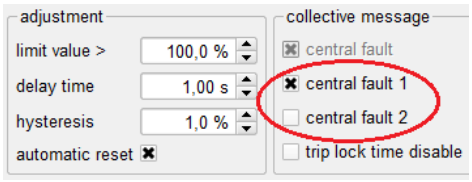
Individual or all limit value messages can be deactivated by means of the parameterisable digital inputs (*see chap. 10.1*). Up to 3 locking functions can be assigned to each limit value. The global lock function 'disable all' always deactivates all active limit messages. If the input is set, the corresponding limit value messages are suppressed. The following lock functions are available:

- disable all (Standard E1)
- disable 1
- disable 2
- disable 3

7.1.5 Central Fault

All limit value messages are entered into the central fault signal if the limit value message is activated, the limit value is exceeded respective fallen short of and the delay time has elapsed.

7.1.6 Central Fault 1+2



The device offers the possibility to form two independent central fault signals. These are composed of the individual limit values. The operator thus can configure a specific event himself.

By activating the corresponding assignment, each adjustable limit value can be added to the 'central fault 1' and/or 'central fault 2'.

Example:

- Limit value setting: at low voltage 1, low frequency 2 and vector jump 1
- [x] central fault 1
- Setting digital outputs: function relay 5:
- **22** = central fault 1

This combination of the settings causes the relay 5 to be energised when at least one of the 3 limit value events occurs.

7.1.7 Display First Fault

By means of parameterisation, the device can be specified to as whether there should only be a first value tripping (first fault), or also the tripping of subsequent faults. 'Display first fault only' means, that in the case of a tripping of e.g. the limit value Underfrequency 1 at a loss of one phase, an a tripping of e.g. Undervoltage 1, which is inevitably occurring as a result, no longer is evaluated. If 'display first fault only' is deactivated, all the trippings are displayed and stored in the internal fault memory in the order of occurrence.

7.2 Limit Value Settings

Each limit value can be set individually and is shown below: percentagewise adjustable limit values always refer to the respective configured nominal value.

7.2.1 Rotary Field Protection

Function	Range	Hysteresis	Delay time	Tolerance	
rotary field protection	left / right	10°	0.5 s	+/-1.0°	-0.01 / +0.02 s

The respective smallest or largest of the three phase angles is used as the trigger criterion for the rotary field protection. If it exceeds- or falls below 180 °, the signal 'rotary field fault' is generated and output. Thereby the KNAE 3xx differentiates according to the internal and external rotary field, in order to detect any faults in the wiring. The rotary field fault has no effect on the other fault signals. The monitoring can be adjusted on left or right rotary field by the parameterisation software. To the factory settings, the rotary field protection of the KNAE 3xx is not activated.

At the rotation field protection hysteresis and delay time are fixed preset and can not be adjusted.

7.2.2 Angle Protection

Function	Range	Hysteresis	Delay time	Tolerance	
Angle min.	-5.0 … -60.0°	1° … 20°	0.05 s … 999.99 s	+/-0.5°	-0.01 / +0.02 s
Angle max.	5.0 … 60.0°	1° … 20°	0.05 s … 999.99 s	+/-0.5°	-0.01 / +0.02 s

The angle protection is executed in two stages and checks the deviation of the phase angle of two successive phases L1-L2, L2-L3, L3-L1 from the normal case (120°). The amount of the deviation of 120° is used as limit value specification.

Example:

fault angle 1	
limit value >	15°
delay time	0.08 s
hysteresis	1°

If the phase angle L1-2 falls short of the value of 105° (120° - 15°) or if it exceeds the value of 135° (120° + 15°) for the duration of 0.08 s, the signal 'fault angle 1' is set.

Switching back occurs as soon, as the angle than again exceeds the value of 106° (120° - 15° + 1°), falls below of the value of 134°.

7.2.3 Voltage Tripping

Function	Range	Hysteresis	Delay time	Tolerance	
undervoltage 1	10.0…199.9 %	0.5 … 50.0 %	0.05 s… 999.99 s	+/-0.1 %	-0.01 / +0.02 s
overvoltage 1	10.0…199.9 %	0.5 … 50.0 %	0.05 s… 999.99 s	+/-0.1 %	-0.01 / +0.02 s
undervoltage 2	10.0…199.9 %	0.5 … 50.0 %	0.05 s… 999.99 s	+/-0.1 %	-0.01 / +0.02 s
overvoltage 2	10.0…199.9 %	0.5 … 50.0 %	0.05 s… 999.99 s	+/-0.1 %	-0.01 / +0.02 s

For the under- / overvoltage detection 2 different limit values are adjustable. Each limit value has its own triggering delay and minimum impulse duration.

Overvoltage 1	
limit value	90 %
delay time	0.08 s
hysteresis	0.5 %

Example: If the voltage of one phase falls short of 90,0 % (207 V at 230 V nominal voltage), the signal 'overvoltage 1' is set after 0.08 s.

The switching back occurs as soon as all phases have again exceeded the value of 90,5 % (208,2 V).

7.2.4 Voltage Asymmetric Tripping

Function	Range	Hysteresis	Delay time	Tolerance	
Asymmetric	1.0 … 100.0 %	0.5 … 50.0 %	0.05 s … 999.99 s	+/-0.1 %	-0.01 / +0.02 s

For the asymmetric monitoring, a limit value for the maximum permissible deviation of the voltage between two phases has to be entered in % of the nominal voltage. The voltage asymmetric limit is triggered as well on loss of a phase voltage.

Example:

Asymmetric	
limit value	10 %
delay time	0.05 s
hysteresis	1.0 %

If the voltage difference between two phases exceeds 10.0 % (L1 = 235 V, L2 = 211 V, L3 = 230 V at 230 V nominal voltage), the signal 'Voltage asymmetric is set after 0.05 s. The switching back occurs as soon as the difference becomes less than 9 % (10.0 % - 1.0 %).

7.2.5 Voltage average tripping

Function	Range	Hysteresis	Delay time	Tolerance	
Voltage average deviation	1.0 … 100.0 %	0.5…50.0 %	0.05 s…999.99 s	+/-0.1 %	-0.01 / +0.02 s

If deviation of average value is enabled, the KNAE 3xx monitors the average of the 3 external conductor voltages on fall short of the set limit value according to the following formula:

X % < ((U12 % + U23 % + U31 %) / 3)

Example:

Average limit	
limit value	90 %
delay time	1.00 s
hysteresis	1.0 %

If, at U12 = 91.0 %, U23 = 90.3 %, U31 = 78.7 %, the average value is 86.6 %, tripping is executed after 1.0 s. Die Switching back occurs as soon as the average value than again exceeds 91.0 %.

7.2.6 Voltage Quality

Function	Range	Hysteresis	Delay time	Tolerance	
Voltage quality	110.0 … 115.0 %	0.5…3.0 %	600 s	+/-0.1 %	-0.01 / +0.02 s

The KNAE 3xx controls the voltage quality in accordance to DIN VDE N 4105:2011 08. This function monitors the individual phase voltages on exceeding of a limit value, which can be adjusted in the range from 110.0 % up to 115.0 % of the nominal voltage, using a sliding average of values, which are measured over a time frame of 10 minutes (600 seconds).

Example:

Voltage quality	
limit value	110 %
delay time	600 s
hysteresis	0.5 %

If the measured value of one phase, e.g. L1, is for 600 s above of the adjusted limit value of 110 %, the triggering is executed. Switching back occurs as soon as this phase value lies below 109,5 % again. The past values hereby remain unchanged .

This function works independent of activation of the VDE4105 protective function. Its triggering delay time is fixed preset at 5 periods.

7.2.7 Frequency Triggering

Function	Range	Hysteresis	Delay time	Tolerance	
Underfrequency 1	35.00…65.00 Hz	0.05…2,00 Hz	0.05 s…999.99 s	+/-0.01 Hz	-0.01 / +0.02 s
Overfrequency 1	35.00…65.00 Hz	0.05…2,00 Hz	0.05 s…999.99 s	+/-0.01 Hz	-0.01 / +0.02 s
Underfrequency 2	35.00…65.00 Hz	0.05 …2,00 Hz	0.05 s…999.99 s	+/-0.01 Hz	-0.01 / +0.02 s
Overfrequency 2	35.00…65.00 Hz	0.05…2,00 Hz	0.05 s…999.99 s	+/-0.01 Hz	-0.01 / +0.02 s

For the under- / overfrequency detection, two different limit values are adjustable. Each limit value has its own triggering delay time.

Example:

Overfrequency 1	
limit value	51.20 Hz
delay time	0.08 s
hysteresis	0.10 Hz

If the frequency of one phase exceeds 51.20 Hz, the signal 'Overfrequency 1 is set after 0,08 s. The switching back occurs as soon as the frequency falls below 51.10 Hz again.

7.2.8 Vector Jump Tripping

Function	Range	Hysteresis	Delay time	Permissible deviation	
Vector jump 1	5.0 … 45.0°	-	0.03 s	+/-0.1°	-0.01 / +0.02 s
Vector jump 2	5.0 … 45.0°	-	0.03 s	+/-0.1°	-0.01 / +0.02 s

The vector jump detection takes place two staged and can be adjusted in various combinations. The input is done in angular degrees relative to a full-wave (period) with 360 °. The signal 'Vector jump' features a systematic delay of approximately 0,03 s.

Possible combinations are:

Example:

Vector jump 1	
limit value	8.0 °
combination	L1 and L2 and L3

No.	Function
0	L1 or L2 or L3
1	only L1
2	only L2
3	only L3
4	L1 and L2 and L3
5	L1 and L2 and L3 (differenced vector jump)

If a vector jump of at least 8.1° occurs at all 3 phases, the signal 'Vector jump 1' will be generated and output.

7.2.9 Delta f to Delta t (ROCOF)

Function	Range	Hysteresis	Delay time	Tolerance	
ROCOF 1	0.01 … 10.00 Hz/s	-	0.05 … 999.99 s	+/-0,01 Hz	-0.01 / +0.02 s
ROCOF 2	0.01 … 10.00 Hz/s	-	0.05 … 999.99 s	+/-0,01 Hz	-0.01 / +0.02 s

The as well two stage executed limit value function Δf/Δt (ROCOF - rate of change of frequency) offers the possibility to detect frequency changes alternatively or parallel to the vector jump detection.

Example:

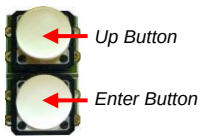
ROCOF 1	
limit value	0.50 Hz/s
delay time	0.10 s

The triggering occurs, when the frequency alters with a speed of 0,5 Hz/s for a minimum period of 0,1 s. In this example at an alteration of >0,05 Hz in 0,1 s.

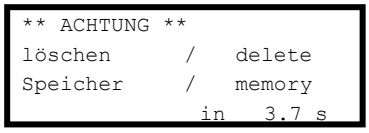
7.3 Tripping Memory

The KNAE 3xx stores the measured values for the respective limit value trippings. The fault memory can store the values of up to 52 tripping events. The tripping values are permanently stored in the flash memory of the device with the date and time and are retained even in case of loss of the auxiliary voltage. The number of detected trippings is stored in a counter (maximum 65,000, can not be erased, reset to 0 if exceeded). The tripping values can be read on the device.

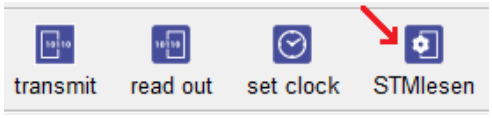
The output of the trippings on the device's graphic display is called up by closing the DIL switch S4 (*see chap. 5.1.2*) while in the operation mode the main screen is displayed. First, the last tripping is shown. Actuating the UP button (*for the function of the buttons see chap. 0*), the different values of the tripping can be viewed. Using the Enter button, one can scroll backwards through the stored trippings. When the oldest stored tripping is reached, the display returns back to the most recently stored tripping.



The stored tripping values are cleared by holding pressed down the UP button for approx. 10 seconds while the DIL switch S4 is closed (*display output figured right)*. Then all previously stored tripping values, but not the counter reading for all trippings (*refer above*), are erased.



7.3.1 Reading out the Tripping Memory



The tripping memory of the KNAE 3xx can be read out with the parameterisation software KuPa010 by clicking the corresponding button (figured left). In the window that appears thereupon, all stored fault messages are listed chronologically. The fault messages can be stored as plain text file (*.txt) on the PC system.

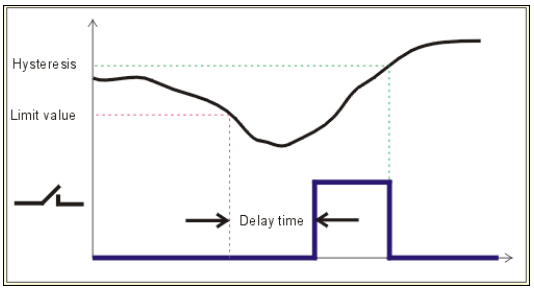
Datei

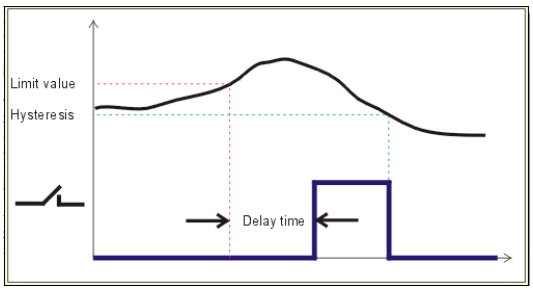
```
SFW-8 [V1.00] gespeicherte Meldungen.
gespeichert Do 08.12.2016 um 16:50:25
-------------------------------------------------
Datum   ; Zeit ; Freq ; L1N %; L2N %; L3N %; L12 %; L23 %; L31 %; L12°; L23°; L31°; Fehler
08.12.16; 16:47; 00.00; 000.0; 000.0; 000.0; 000.0; 000.0; 000.0; 0000; 0000; 0000; Umittel
08.12.16; 16:47; 00.00; 000.0; 000.0; 000.0; 000.0; 000.0; 000.0; 0000; 0000; 0000; U1 < X%
08.12.16; 16:47; 00.00; 000.0; 000.0; 000.0; 000.0; 000.0; 000.0; 0000; 0000; 0000; F1 < X%
08.12.16; 16:47; 00.00; 000.0; 000.0; 000.0; 000.0; 000.0; 000.0; 0000; 0000; 0000; BDEW
```

7.4 Programmable Switching Points

In addition to the adjustable limit values, the KNAE 3xx has 3 programmable switching points. Each switching point can be assigned to a selection of functions. Hereby switching behaviour, hysteresis and a deceleration time can be set. The following values are available:

No.	Function	Description
0	deactivated	Output is not active.
1	voltage L1-N	Voltage L1 scaled in xx.x % of the nominal voltage.
2	voltage L2-N	Voltage L2 scaled in xx.x % of the nominal voltage.
3	voltage L3-N	Voltage L3 scaled in xx.x % of the nominal voltage.
4	meanvolt L1/L2/L3-N	Average of the star point voltages in xx.x % of the nominal voltage.
5	voltage L1-L2	Voltage L12 scaled in xx.x % of the nominal voltage.
6	voltage L2-L3	Voltage L23 scaled in xx.x % of the nominal voltage.
7	voltage L3-L1	Voltage L31 scaled in xx.x % of the nominal voltage.
8	meanvolt L12/L23/L31	Average of the external conductor voltages in xx.x % of the nominal voltage.
9	frequency L1	Frequency L1 scaled in xx.xx Hz.





Each switching point can be assigned to a relay output (*see chap. 11.1 - Digital Outputs*) The output relay then switches according to the parameterisation when the respective measured value is exceeded or undershot. No messages are displayed.

Switching points are NOT considered in the fault message processing!

7.5 Voltage Indication / Transformer Factors

For the correct display of the primary sided system voltage of the switchgear, the voltage transformer ratio must be entered. The input format is transformer primary voltage / transformer secondary voltage. The depiction of numbers on the devices screen is adjustable via the setting of display format. The input with the parameterisation software KuPa010 is done via a selection field, directly at the device, the number of the designated display format must be entered. The setting of voltage indication has no effects on the tripping of limit values.

Number	Selection KuPa010	Display format
1	99.9 V	L1 57.6 V 50,01 Hz L2 57.4 V ⊥ 57,6 V L3 57.6 V UF/F OK
2	999 V	L1 230 V 50,01 Hz L2 213 V ⊥ 230 V L3 230 V UF/F OK
3	9.99 kV	L1 5.60 kV 50,01 Hz L2 5.61 kV ⊥ 5.60 kV L3 5.60 kV UF/F OK
4	99.9 kV	L1 56.2 kV 50,01 Hz L2 56.1 kV ⊥ 56.0 kV L3 56.0 kV UF/F OK
5	999 kV	L1 62 kV 50,01 Hz L2 61 kV ⊥ 60 kV L3 60 kV UF/F OK

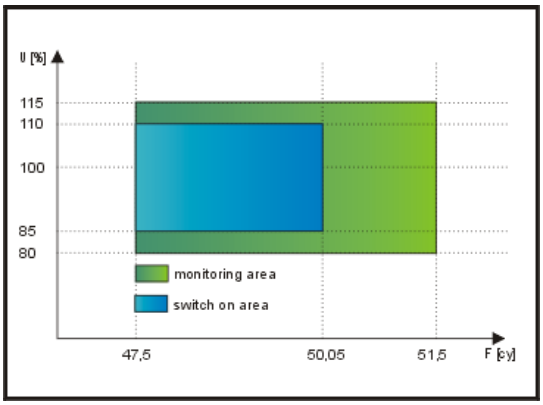
The KNAE 3xx can be configured for systems of up to 100,0 kV maximum.

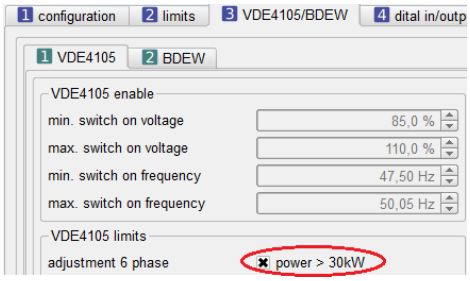
8 VDE-AR-N 4105:2011-08

The KNAE 3xx can be applied within a plant, which works in accordance to the norm VDE-AR-N 4105:2011-08. The following functions are supported:

- PIN protection activeatable
- Single fault security
- Input parameterisable for test button
- Internal fault memory for up to 52 messages
- Isolated operation grid detection by 3-phase voltage measurement and / or vector jump
- Monitoring of switching on 60 s, with short time interruption < 5 s
- Protective function U < 80 %, U > 110 %, U >> 115 %, F < 47,5 Hz and F > 51,5 %
- Assembly at meter board for systems > 30 kVA possible (2 x 3 voltages)
- Assembly as integrated NA-protection (grid- and system protection) <= 30 kVA

The monitoring functions according to VDE4105 are activated by means of a corresponding parameterisation of a relay contact with one of the output functions (*see chap. 11.1 - Digital Outputs, functions number 32 … 44*), which are labelled with 'VDE4105'. Parameterised with these settings, the KNAE 3xx fulfils the limit value- and connecting conditions according to DIN VDE-AR-N 4105:2011-08.





For systems with more than 30 kVA, the corresponding value must be activated in the parameterisation (*figured left*). The voltage monitoring then takes place both at the star-point voltage and at the external connector voltage.

8.1 Single-Fault Security

The single-fault security is, compliant to EN-ISO-13489, up to error category 3 ensured by

- B: Basic measures (e.g. compliance with quality criteria),
- 1: Proved components,
- 2: regular checks of the security function,
- 3: Fault tolerance (measuring amplifier failure, loss of frequency, CPU monitoring via internal and external watchdog).

For the single-fault safety in the switchgear, 2 contactors in series connection and return of the auxiliary contacts should be applied on one monitoring input.

8.2 VDE4105 Test Input

Using the input function 'VDE4105 test input' (*see chap. 10.1 - Digital Inputs, function number 8*), it is possible to perform a test of the monitoring function. (fault simulation). Activating of a corresponding parameterised input results in de-energising of the relays, which are configured for the monitoring, and in a newly start of the 60 s switching-on monitoring.

8.3 Isolated Operation Grid Detection

The isolated operation grid detection is performed according to the passive method (VDE-AR-N-4105:2011-08, 6.5.3 b and Annex D) by means of the 3-phase voltage monitoring. The tripping occurs as soon as one of the 3 external connector voltages falls short of 80 % - or exceeds 115 % of the nominal voltage.

Additionally the possibility is given to involve the 'Vector jump 1' in VDE4105 OK message. For this, the output function 'VDE-4105 OK + release with vectorjump 1' (*see chap. 11.1 - Digital Outputs, function number 35*) is used.

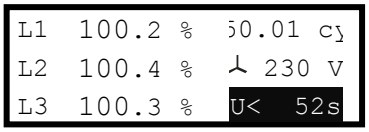
8.4 Monitoring of Switch-on

The relay function 'VDE4105 OK + release' (*see chap. 11.1 - Digital Outputs, function number 33*) is available. The output relay picks up, when the conditions listed below have been adhered to for at least 60 seconds. The shutdown occurs when the limit values listed below are undershot or exceeded, or the input 'VDE4105 test input' is set.

For monitoring of switch-on, the measured values of voltage and frequency shall be within the following limits for at least 60 seconds:

Function	Value	Hysteresis	Delay time	Tolerance	
U_{zu} < VDE 4105	85.0 %	0.5 %	< 0.1 s	+/- 0.5 %	-0.01 / +0.02 s
U_{zu} > VDE 4105	110.0 %	0.5 %	< 0.1 s	+/- 0.5 %	-0.01 / +0.02 s
F_{zu} < VDE 4105	47.50 Hz	0.05 Hz	< 0.1 s	+/- 0.01 Hz	-0.01 / +0.02 s
F_{zu} > VDE 4105	50.05 Hz	0.05 Hz	< 0.1 s	+/- 0.01 Hz	-0.01 / +0.02 s

These values cannot be changed!



If no fault messages are present, the remaining time until the switching-on is displayed in the main screen at the bottom right (*figured left*). The display also includes the condition to be maintained (U<, U>, F< or F>).

The relay function 'VDE4105 OK + release + enable' (*see chap. 11.1 - Digital Outputs, function number 34*) is identical, but requires additionally a parameterised input (*see chap. 10.1 - Digital Inputs, function number 7*), for the release of the switching-on. Thereby the input function is delayed by 0,5 s.

If short interruptions of less than 3 s occur after a switching-enable, the new switching-enable is issued after 5 s.

8.5 Protective Function

For the protective function, voltage and frequency are monitored to the following limit values:

Function	Value	Hysteresis	Delay time	Tolerance	
U < VDE 4105	80.0 %	0.5 %	< 0.1 s	+/- 0.5 %	-0.01 / +0.02 s
U > VDE 4105	115.0 %	0,5 %	< 0.1 s	+/- 0.5 %	-0.01 / +0.02 s
f < VDE 4105	47.50 Hz	0.05 Hz	< 0.1 s	+/- 0.01 Hz	-0.01 / +0.02 s
f > VDE 4105	51.50 Hz	0.05 Hz	< 0.1 s	+/- 0.01 Hz	-0.01 / +0.02 s
Note: The above listed values cannot be changed!					
additionally: voltage quality (average over 10 min. interval)					
U > VDE 4105 (110 %)	110.0 ... 115.0 %	0.5 %	600 s	+/- 0.5 %	-0.01 / +0.02 s

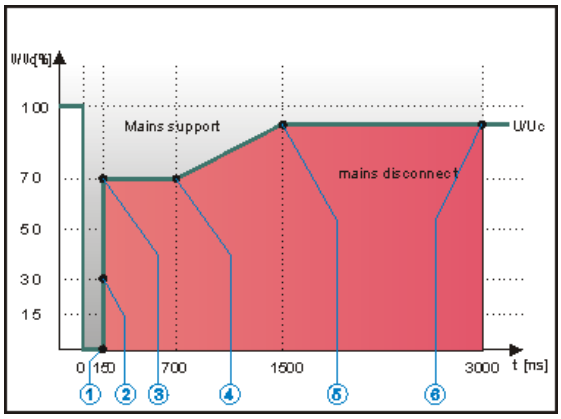
The Output function 'VDE4105 fault message' (*see chap. 11.1 - Digital Outputs, function number 32*) switches the corresponding parameterised relay as soon as one of the listed above limit values is undershot or exceeded.

To ensure intrinsic safety, this relay function must be parameterised with the switching behaviour 'open-circuit-principle'. In addition, the series connection of two relay contacts (recommended: relays 'A4' and 'A5'), which are assigned to this function is required (*an example of two in series connected relays, parameterised with the protective function according to VDE AR N 4105 and 2 in parallel controlled contactors without feedback: see chap. 14 – Connection Example*).

At activation of the according to 'VDE 4105 Protective Function with blocking Function' (*see chap. 11.1 - Digital Outputs, function number 37*), t is possible, to temporarily prevent the triggering at the appropriately parameterised relay by means of an input which is used with the function 'VDE4105 Lock Triggering' (*see chap. 10.1 -Digital Inputs, function number 9*.

9 BDEW dynamic Grid Support

According to the BDEW (Bundesverband der Energie- und Wasserwirtschaft) guideline 'Erzeugungsanlagen am Mittelspannungsnetz' (power generating plants at the medium voltage grid), chapter 2.5.1.2 ' Dynamische Netzstützung' (dynamic grid support), the KNAE 3xx can be applied in medium voltage systems for voltage monitoring. At this, the KNAE 3xx monitors the voltage curve according to the limit curve specified by the BDEW guideline. The limit values can be adjusted if necessary.



	Limit value	Time
Point 1 (1)	0 %	150 ms
Point 2 (2)	30 %	150 ms
Point 3 (3)	70 %	150 ms
Point 4 (4)	70 %	700 ms

This function is automatically activated, when one of the digital outputs (*see chap. 11.1 - Digital outputs*) is assigned to the function number 47 or 48. Like all other fault messages, the BDEW function can be configured by fault message coding (*see chap. 7.1.4 and 7.1.5*).

10 Inputs

10.1 Digital Inputs

The KNAE 3xx features 3 digital inputs, which can be assigned to one of the following functions:

No.	Function	Description
0	deactivated	Input is not active. Allocation of an output with the terminal of this input is however possible.
1	global disable	All limit value messages are suppressed as long as the input is active.
2	disable 1	All limit value messages, which are parameterised with disable 1 are suppressed as long as the input is active.
3	disable 2	All limit value messages, which are parameterised with disable 2 are suppressed as long as the input is active.
4	disable 3	All limit value messages, which are parameterised with disable 3 are suppressed as long as the input is active.
5	fault reset	Reset of limit value messages, which are not set to 'automatic reset'.

No.	Function	Description
6	change language	Changing of the display language depending on the parameter setting. The language switching can be deactivated.
7	switching enable	The relay output, which is assigned to the function 'VDE-4105 Ok + release' only picks up, when the VDE-4105 Ok signal and the input are active.
8	VDE-4105 test input	By setting this input function, an existing VDE-4105 OK message is reset and monitoring is restarted.
9	disable VDE-4105 limits	By setting this input function, the VDE-4105 is locked.
10	feedback O1 REL1 – KL8/ 9	Monitoring of the feedback of the contactor connected to O1. In the event of a fault, the 'central fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).
11	feedback O2 REL2 – KL8/ 10	Monitoring of the feedback of the contactor connected to O2. In the event of a fault, the 'central fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).
12	feedback O3 REL3 – KL8/ 11	Monitoring of the feedback of the contactor connected to O3. In the event of a fault, the 'central fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).
13	feedback O4 REL4 – KL8/ 12	Monitoring of the feedback of the contactor connected to O4. In the event of a fault, the 'collective fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).
14	feedback O5 REL5 – KL13/ 14/ 15	Monitoring of the feedback of the contactor connected to O5. In the event of a fault, the 'collective fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).
15	feedback O6 REL6 – KL26/ 27	Monitoring of the feedback of the contactor connected to O6. In the event of a fault, the 'collective fault' signal is set after 0.5 s (*see chap. 0 Monitoring of the Relay- (Contactor-)* feedback).

10.1.1 Monitoring of the Relay- (Contactor-) Feedback

If a digital input is assigned with the feedback function, the corresponding message and the central message are set after 0.5 s, if the feedback contact of the corresponding relay does not correspond to the state of the relay.

11 Outputs

11.1 Digital Outputs

The KNAE 3xx features 3 groups of digital outputs (A1 - A4, A5 and A6) with in total 6 relays, which can be assigned to one of the functions of the selection described in the following. For each output relay, a minimum pulse duration within the range from 0.1 s up to 6000 s is adjustable. 'Minimum

pulse duration' means, that the corresponding relay remains energised for at least the set time, even if the event which led to the tripping is of a shorter duration. If the event is longer than the set time, the relay de-energises without delay.

No.	Function	Description
0	deactivated	The output is deactivated. If the output is parameterised as per closed circuit principle, the relay is permanently energised.
1	operational	The corresponding relay is energised, when the KNAE 3xx is ready for operation.
2	central fault	The corresponding relay is energised, when the 'central fault' is set.
3	central fault 1	The corresponding relay is energised, when the 'central fault 1' is set.
4	central fault 2	The corresponding relay is energised, when the 'central fault 2' is set.
5	fault angle 1 (angle protection)	The corresponding output relay is activated, when the limit value 'fault angle 1' is exceeded and the delay time has elapsed (*see chap. 7.2.2*).
6	fault angle 2 (angle protection)	The corresponding output relay is activated, when the limit value 'fault angle 2' is exceeded and the delay time has elapsed (*see chap. 7.2.2*).
7	angle OK (angle protection)	The corresponding output relay is activated, when the limit values 'fault angle 1' and 'fault angle 2' are not active (*see chap. 7.2.2*).
8	rotary field fault (rotary field protection)	The corresponding output relay is activated if the rotary field contacted with the system does not match the parameterised (right or left) rotary field (*see chap. 7.2.1*).
9	undervoltage 1 (voltage triggering)	The corresponding output relay is activated when the limit value 'undervoltage 1' is undershot and the delay time has elapsed (*see chap. 7.2.3*).
10	overvoltage 1 (voltage tripping)	The corresponding output relay is activated when the limit value 'over-voltage 1' is exceeded and the delay time has elapsed (*see chap. 7.2.3*).
11	undervoltage 2 (voltage tripping)	The corresponding output relay is activated when the limit value 'undervoltage 2' is undershot and the delay time has elapsed (*see chap. 7.2.3*).
12	overvoltage 2 (voltage tripping)	The corresponding output relay is activated when the limit value 'over-voltage 2' is exceeded and the delay time has elapsed (*see chap. 7.2.3*).
13	voltage 1 OK (voltage tripping)	The corresponding output relay is activated, when the limit values 'undervoltage 1' and 'overvoltage 1' are not active (*see chap. 7.2.3*).

No.	Function	Description
14	voltage 2 OK (voltage tripping)	The corresponding output relay is activated, when the limit values 'undervoltage 2' and 'overvoltage 2' are not active (*see chap. 7.2.3*).
15	low voltage 1 or 2 (voltage tripping)	The corresponding output relay is activated, when one of the both limit values 'undervoltage 1' or 'undervoltage 2' is undershot and the delay time has elapsed (*see chap. 7.2.3*).
16	high voltage 1 or 2 (voltage triggering)	The corresponding output relay is activated, when one of the both limit values 'overvoltage 1' or 'overvoltage 2' is exceeded and the delay time has elapsed (*see chap. 7.2.3*).
17	asymmetric limit (tripping of voltage asymmetric)	The corresponding output relay is activated, when the limit value 'asymmetric limit' (*see chap. 7.2.4*) is exceeded and the delay time has elapsed.
18	average limit (tripping of voltage average deviation)	The corresponding output relay is activated, when the limit value 'average limit' (*see chap. 7.2.5*) is undershot and the delay time has elapsed.
19	voltage quality	The corresponding output relay is activated, when the limit value 'voltage quality' is exceeded and the delay time has elapsed (*see chap. 7.2.6*).
20	underfrequency 1 (frequency triggering)	The corresponding output relay is activated, when the limit value 'underfrequency 1' is undershot and the delay time has elapsed (*see chap. 7.2.7*).
21	overfrequency 1 (frequency tripping)	The corresponding output relay is activated, when the limit value 'overfrequency 2' is exceeded and the delay time has elapsed (*see chap. 7.2.7*).
22	underfrequency 2 (frequency tripping)	The corresponding output relay is activated, when the limit value 'underfrequency 2' is undershot and the delay time has elapsed (*see chap. 7.2.7*).
23	overfrequency 2 (frequency tripping)	The corresponding output relay is activated, when the limit value 'overfrequency 1' is exceeded and the delay time has elapsed (*see chap. 7.2.7*).
24	frequency 1 OK (frequency tripping)	The corresponding output relay is activated, when the limit values 'underfrequency 1 and overfrequency 1' (*see chap. 7.2.7*) are not active.
25	frequency 2 OK (frequency tripping)	The corresponding output relay is activated, when the limit values 'underfrequency 2 and overfrequency 2' (*see chap. 7.2.7*) are not active.
26	low frequency 1 or 2 (frequency tripping)	The corresponding output relay is activated, when one of the both limit values 'underfrequency 1' or 'underfrequency 2' is undershot and the delay time has elapsed (*see chap. 7.2.7*).

No.	Function	Description
27	high frequency 1 or 2 (frequency tripping)	The corresponding output relay is activated, when one of the both limit values 'overfrequency 1' or 'overfrequency 2' is exceeded and the delay time has elapsed (*see chap. 7.2.7*).
28	vector jump 1 (vector jump tripping)	The corresponding output relay is activated, when the limit value 'vector jump 1' is exceeded (*see chap. 7.2.8*).
29	vector jump 2 (vector jump tripping)	The corresponding output relay is activated, when the limit value 'vector jump 2' is exceeded (*see chap. 7.2.8*).
30	ROCOF 1 (delta f to delta t)	The corresponding output relay is activated, when the limit value 'ROCOF 1' is exceeded (*see chap. 7.2.9*).
31	ROCOF 2 (delta f to delta t)	The corresponding output relay is activated, when the limit value 'ROCOF 2' is exceeded (*see chap. 7.2.9*).
32	VDE-4105 fault (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values is exceeded respective undershot and the delay times have elapsed (*see chap. 0*).
33	VDE-4105 OK + release (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values (*see chap. 0*) is within the permissible range, and the conditions for switching-enable are fulfilled.
34	VDE-4105 + release + enable (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values (*see chap. 0*) is within the permissible range, the conditions for switching-enable are fulfilled and the corresponding parameterised release input is set.
35	VDE-4105 OK + release with vector jump 1 (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values (*see chap. 0*) is within the permissible range, the conditions for switching-enable are fulfilled and vector jump 1 is not pending.
36	VDE-4105 OK + release + enable with vector jump 1 (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values (*see chap. 0*) is within the permissible range, the conditions for switching-enable are fulfilled, vector jump 1 is not pending and the parameterised release input is set.
37	VDE-4105 fault with disable (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when one of the VDE-4105 limit values (*see chap. 0*) is exceeded resp. undershot, the delay times have elapsed and the parameterised locking input is not set.
38	VDE-4105 undervoltage (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 undervoltage limit value (*see chap. 0*) is undershot and the delay time has elapsed.
39	VDE-4105 overvoltage (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 overvoltage limit value (*see chap. 0*) is exceeded and the delay time has elapsed.

No.	Function	Description
40	VDE-4105 underfrequency (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 underfrequency limit value (*see chap. 0*) is undershot and the delay time has elapsed.
41	VDE-4105 overfrequency (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 overfrequency limit value (*see chap. 0*) is exceeded and the delay time has elapsed.
42	VDE-4105 overvoltage or voltage quality (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 overvoltage limit value is exceeded or the VDE-4105 voltage quality limit value is reached, and the delay time has elapsed (*see chap. 0 and 7.2.6)*.
43	VDE-4105 voltage fault or quality (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 overvoltage limit value is exceeded, the VDE-4105 undervoltage limit value is undershot, or the VDE-4105 voltage quality limit value is reached, and the delay time has elapsed (*see chap. 0 and 7.2.6)*.
44	VDE-4105 frequency fault (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the VDE-4105 overfrequency limit value is exceeded, the VDE-4105 underfrequency limit value is undershot and the delay time has elapsed (*see chap. 0)*.
45	VDE-4105 test input (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the, with 'VDE-4105 Test Button' (*see chap. 10.1 - Digital Inputs, function number 9*) parameterised input is set.
46	disable VDE-4105 limits (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated, when the, with 'disable VDE-4105 limits' (*see chap. 10.1 - Digital Inputs, function number 10*) parameterised input is set.
47	Dyn. Grid Support (BDEW OK) (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated as long as the grid voltage ranges above of the set limit value curve, described in chap. 9 - 'BDEW dynamic Grid Support'.
48	Dyn. Grid Support inverted (BDEW fault) (VDE-AR-N-4105:2011-08)	The corresponding output relay is activated as long as the grid voltage ranges below of the set limit value curve, described in chap. 9 - 'BDEW dynamic Grid Support'.
49	Input E1 - KL2	The corresponding output relay is activated, when the digital input E1 at terminal 2 (*see chap. 4.2.1 – Connection Diagram*) is closed.
50	Input E2 - KL3	The corresponding output relay is activated, when the digital input E2 at terminal 3 (*see chap. 4.2.1 – Connection Diagram*) is closed.
51	Input E3 - KL4	The corresponding output relay is activated, when the digital input E3 at terminal 4 (*see chap. 4.2.1 – Connection Diagram*) is closed.
52	fault reset (digital inputs)	The corresponding output relay is energised, if the 'fault reset' function via digital input or ENT button is activated (*see chap. 10.1*).

No.	Function	Description
53	global disable (digital inputs)	The corresponding output relay is energised, if the function 'global disable' via digital input (*see chap. 10.1*) is activated.
54	disable 1 (digital inputs)	The corresponding output relay is energised, if the function 'disable 1' via digital input (*see chap. 10.1*) is activated.
55	disable 2 (digital inputs)	The corresponding output relay is energised, if the function 'disable 2' via digital input (*see chap. 10.1*) is activated.
56	disable 3 (digital inputs)	The corresponding output relay is energised, if the function 'disable 3' via digital input (*see chap. 10.1*) is activated.
57	switching enable (digital inputs)	The corresponding output relay is energised, if the function 'switching enable' via digital input (*see chap. 10.1*) is activated.
58	feedback O1 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O1' via digital input (*see chap. 10.1*) is activated.
59	feedback O2 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O2' via digital input (*see chap. 10.1*) is activated.
60	feedback O3 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O3' via digital input (*see chap. 10.1*) is activated.
61	feedback O4 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O4' via digital input (*see chap. 10.1*) is activated.
62	feedback O5 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O5' via digital input (*see chap. 10.1*) is activated.
63	feedback O6 (digital inputs)	The corresponding output relay is energised, if the function ' feedback O6' via digital input (*see chap. 10.1*) is activated.
64	switch point 1 (programmable switching points)	The corresponding output relay is activated, when the function 'switch point 1' (*see chap. 7.4 - Programmable Switching Points*) has exceeded or undershot the set limit value and the delay time has elapsed.
65	switch point 2 (programmable switching points)	The corresponding output relay is activated, when the function 'switch point 2' (*see chap. 7.4 - Programmable Switching Points*) has exceeded or undershot the set limit value and the delay time has elapsed.
66	switch point 3 (programmable switching points)	The corresponding output relay is activated, when the function 'switch point 3' (*see chap. 7.4 - Programmable Switching Points*) has exceeded or undershot the set limit value and the delay time has elapsed.
67	logic 1 (logic functions)	The corresponding output relay is activated, if the function 'logic 1' (*see chap. 12 - Logic Functions*) has the output value 'true'.

No.	Function	Description
68	logic 2 (logic functions)	The corresponding output relay is activated, if the function 'logic 2' (*see chap. 12 - Logic Functions*) has the output value 'true'.
69	logic 3 (logic functions)	The corresponding output relay is activated, if the function 'logic 3' (*see chap. 12 - Logic Functions*) has the output value 'true'.
70	logic 4 (logic functions)	The corresponding output relay is activated, if the function 'logic 4' (*see chap. 12 - Logic Functions*) has the output value 'true'.
71	logic 5 (logic functions)	The corresponding output relay is activated, if the function 'logic 5' (*see chap. 12 - Logic Functions*) has the output value 'true'.
72	timer 1 (logic functions)	The corresponding output relay is activated, if the function 'timer 1' (*see chap. 12 - Logic Functions*) has the output value 'true'.
73	timer 2 (logic functions)	The corresponding output relay is activated, if the function 'timer 2' (*see chap. 12 - Logic Functions*) has the output value 'true'.
74	O1 REL1 KL8/ 9	The corresponding output relay is activated, when the output relay 1 is energised.
75	O2 REL2 KL8/ 10	The corresponding output relay is activated, when the output relay 2 is energised.
76	O3 REL3 KL8/ 11	The corresponding output relay is activated, when the output relay 3 is energised.
77	O4 REL4 KL8/ 12	The corresponding output relay is activated, when the output relay 4 is energised.
78	O5 REL5 KL13/ 14/ 15	The corresponding output relay is activated, when the output relay 5 is energised.
79	O6 REL6 KL26/ 27	The corresponding output relay is activated, when the output relay 6 is energised.

11.2 Analogue Outputs (optionally available)

The KNAE 3xx is available optionally with two analogue (1 x 0(2) ... 10 V, 1 x 0(2) ... 10 V/ 0(4) … 20 mA, switchable) outputs, which can be freely assigned to various functions, listed in the table below. The, in relation to the respective nominal value adjusted range of a measuring value, e.g. 'voltage L1 - N' = start value: 60%: to end value: 110% (each based on the set nominal voltage), is mapped to the voltage range of 0 (2) to 10 volts at the analogue output. To be observed: due to the system, the resolution of the signal at the analogue output decreases with adjusted measuring value-ranges of less than 100 percentage points.

Example:

- adjusted range from 10 to 100 %, value-range = 90 %, resolution: 0.1 %;
- adjusted range from 90 to 110 %, value-range = 20 %, resolution: 0.5 %;

The following function selection is available:

No.	Function	Description
0	deactivated	Output is deactivated.
1	voltage L1-N	Voltage L1 scaled in xx.x % of nominal voltage.
2	voltage L2-N	Voltage L2 scaled in xx.x % of nominal voltage.
3	voltage L3-N	Voltage L3 scaled in xx.x % of nominal voltage.
4	meanvolt L1/L2/L3-N	Average of the star-point voltages in xx.x % of nominal voltage.
5	voltage L1-L2	Voltage L1-L2 scaled in xx.x % of nominal voltage.
6	voltage L2-L3	Voltage L2-L3 scaled in xx.x % of nominal voltage.
7	voltage L3-L1	Voltage L3-L1 scaled in xx.x % of nominal voltage.
8	meanvolt L12/L23/L31	Average of the external conductor voltages in xx.x % of nominal voltage.
9	frequency L1	Frequency L1 scaled in xxx.xx Hz.

Each of the two outputs can be assigned to different working areas:

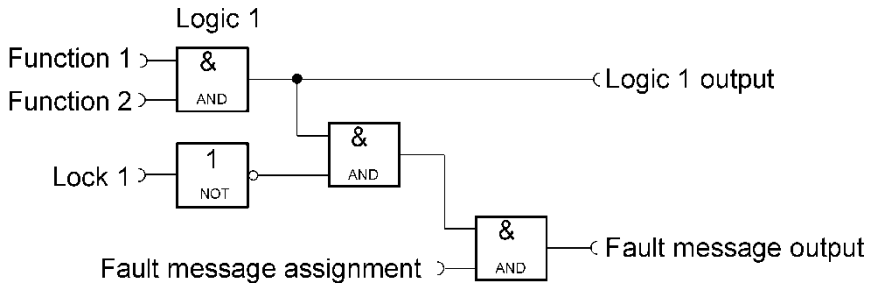
No.	Working area	Description
0	0 … 10 V	The output operates from 0 up to 10 V without limit.
1	2 … 10 V	The output operates from 2 up to 10 V without limit.
2	0 … 10 V max.	The output operates from 0 up to 10 V with limit at 10 V maximum output voltage.
3	min. 2 … 10 V max.	The output operates from 2 up to 10 V with limit at 2 V minimum, and 10 V maximum output voltage.

No.	Working area	Description
Only analogue output 1, reversible via parameterisation on 0(4)..20 mA		
4	0 … 20 mA	The output operates from 0 up to 20 mA without limit.
5	4 … 20 mA	The output operates from 4 up to 20 mA without limit.
6	0 … 20 mA max.	The output operates from 0 up to 20 mA with limit at 20 mA maximum output current.
7	min. 4 … 20 mA max.	The output operates from 0 up to 20 mA with limit at 4 mA minimum, and 20 mA maximum output current.

12 Logic Functions

The KNAE 3xx is equipped with 5 programmable logic modules. The following functions are available:

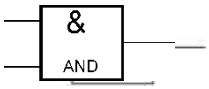
- AND gate (AND)
- OR gate (OR)
- EXCLUSIVE OR gate (XOR)
- AND NOT gate (NAND)
- OR NOT gate (NOR)
- EXCLUSIVE NOT OR gate (XNOR)
- Timer – pick up delayed
- Timer – drop out delayed



All logic and timer functions can be assigned to the fault message groups and to the collective fault. The available blocking functions are also available for all logic and timer functions. Each input function is invertible.

The output of each logic function can be set to an internal input flag. For a list of all available input functions see chap. 10.1 – Digital Inputs.

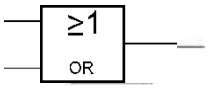
12.1 AND – Gate (1)



E1	E2	A
0	0	0
0	1	0
1	0	0
1	1	1

2 parameterisable inputs are logical 'AND' linked.

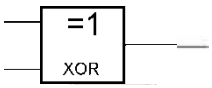
12.2 OR – Gate (2)



E1	E2	A
0	0	0
0	1	1
1	0	1
1	1	1

2 parameterisable inputs are logical 'OR' linked.

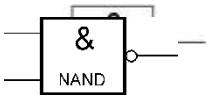
12.3 Exclusive OR – Gate (3)



E1	E2	A
0	0	0
0	1	1
1	0	1

2 parameterisable inputs are logical 'EXCLUSIVE OR' linked.

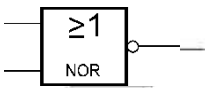
12.4 AND-Not – Gate (4)



E1	E2	A
0	0	1
0	1	1
1	0	1
1	1	0

2 parameterisable inputs are logical 'AND NOT' linked.

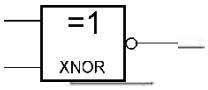
12.5 OR-Not – Gate (5)



E1	E2	A
0	0	1
0	1	0
1	0	0
1	1	0

2 parameterisable inputs are logical 'OR NOT' linked.

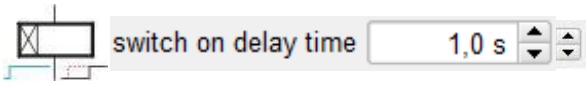
12.6 Exclusive Not-OR – Gate (6)



E1	E2	A
0	0	1
0	1	0
1	0	0
1	1	1

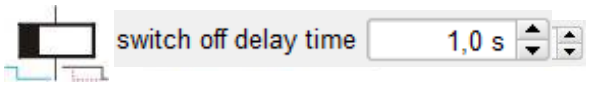
2 parameterisable inputs are logical 'EXCLUSIVE NOT OR' linked.

12.7 Timer – pick up delayed



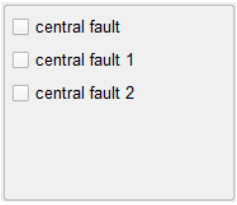
If the input signal is active, the output of the timer only switches after the set delay time has elapsed (*example figured left: 1,0 s*).

12.8 Timer – drop down delayed



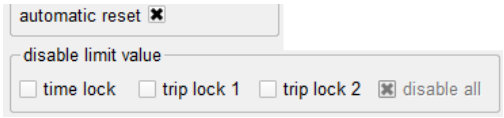
After drop out of the input signal, the output of the timer switches off only after the set delay time has elapsed (*example figured left: 1,0 s*).

12.9 Fault Message Assignment



All logic and timer functions can be assigned to the 'central fault', 'central fault 1' and 'central fault 2'.

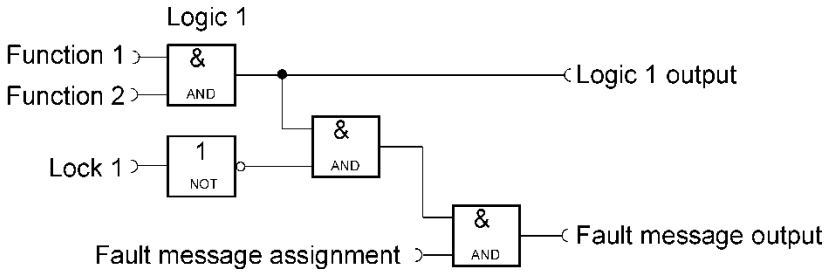
12.10 Locking Functions and Auto Reset



For all logic and timer functions, the fault messaging behavior can be set to automatc reset and the available locking functions can be activated in order to suppress a fault message if necessary. The logic and timer functions are executed independently of this.

12.11 Functions for the Logic Modules

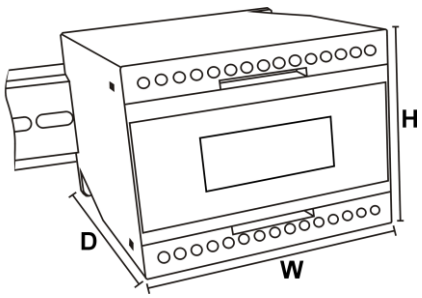
The digital output functions (*see chap. 11.1*) are available as input functions for all logic and timer functions.



13 Technical Data

Assembly and commissioning only by trained professionals
Connecting in compliance with VDE 0160

Auxiliary voltage	24 V DC (18 ... 36 V) optionally 230 V AC / 12 V DC
Power consumption	approx. 4 W at 24 V DC, approx. 6 VA at 230 V AC
Digital inputs	LowActive (contact voltage 12 V DC, 5 mA, opto-decoupled), cables not longer than 3 m
Relay outputs	230 V / 50 Hz / 2 A - 1 neutral changeover contact (A5) - 1 neutral normally open contact (A6) - 4 normally open contacts with common root (A1 – A4)
Analogue outputs (optionallly)	0 … 10 V DC +/- 0.05 V max. 10.5 V 0 … 20 mA +/- 0.1 mA max. approx. 21 mA R_{Load} >= 1kOhm (voltage output) / R_{Load} <= 400 Ohm (current output)
Voltage measuring range	approx. 20 up to 280 / 480 V AC, class 0.2 tolerance < 0,1 % of end value (270 / 480 V AC)
Frequency measuring range	15.0 Hz up to 100.0 Hz starts with approx. 10 V L-N / adjustable in 0.01 Hz steps, repeat accuracy < 0.01 Hz
Climatic conditions:	according to DIN EN 60204-1 (10-2014)
Ambient temperature	
in operation	-20 °C ... +55 °C
transport and storage	-25 °C ... +55 °C
Housing dimensions	W / H / D : 100 x 75 x 110 mm mounting on 35 mm top-hat rail



13.1 Triggering Values

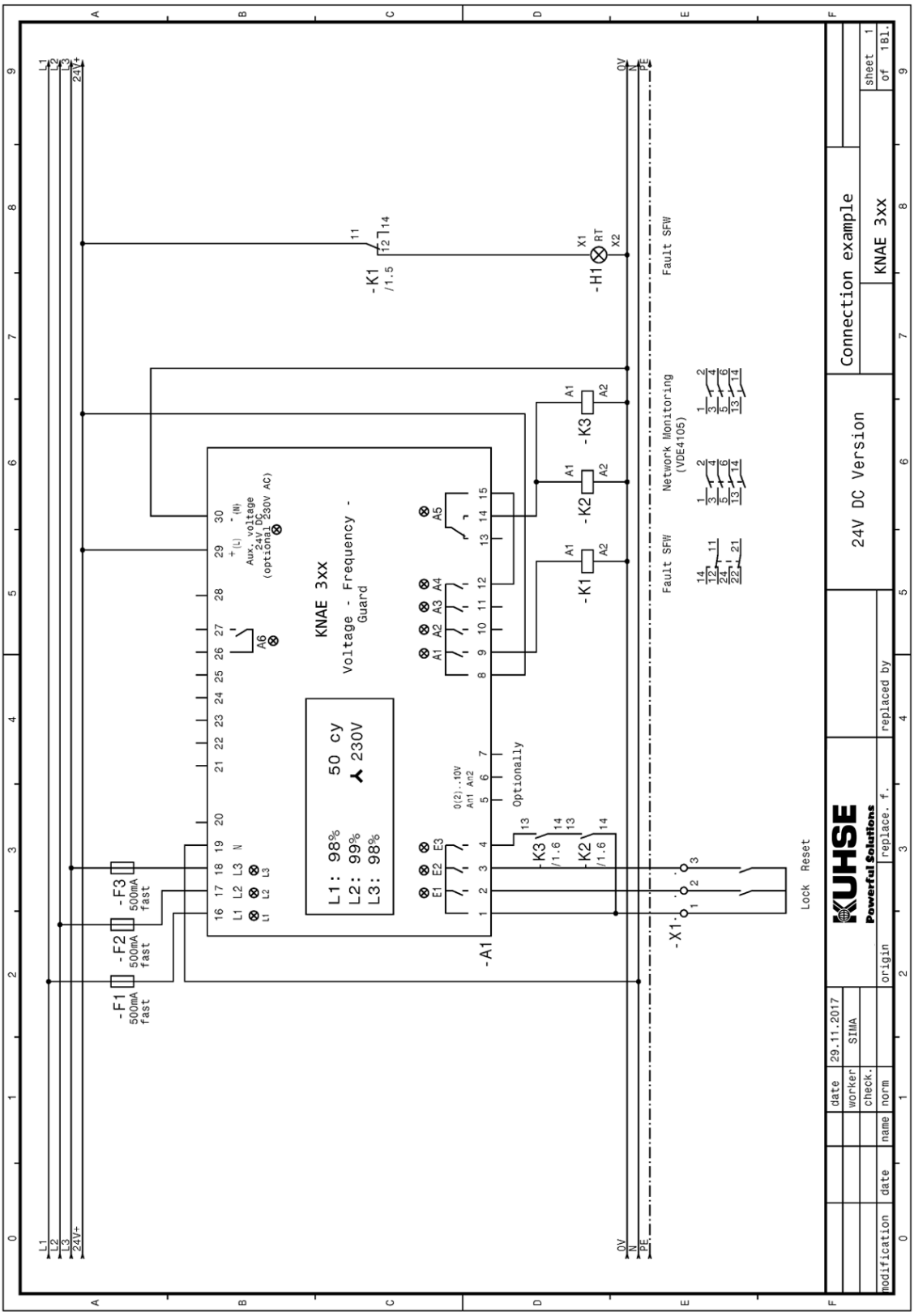
	Setting range	Resolution	Repeatability	Minimum triggering delay
Over- / Undervoltage	10 up to 199 % nominal voltage	0.1 %	< 0.1 %	< 60 ms, typ. 48 ms
Over- / Underfrequency	35.0 ... 65.0 Hz	0.01 Hz	< 0.01 Hz	< 60 ms, typ. 48 ms
Vector shift	5 ... 45°	0.1°	0.2°	60 ... 80 ms

13.2 Ordering Information

Voltage – Frequency Guard KNAE 3xx	**Part number**
100 / 400 V / 24 V DC:	**2W340UV000**
:	
other voltage	**on request**

Accessories	
Parameterisation cable USB A: USB Mini 1.5 m	**on request**
Parameterisation cable USB A: USB Mini 3.0 m	**on request**

14 Connection Example



15 Parameter Groups

15.1 Configuration (Konfig. / Config – Group 1)

The parameter group 1 contains two parameters per subgroup (*refer to chap. 6.6*). The following settings are available:

Parameter		Description	Setting range	Default
1.6.1 **1.6.2**	PIN protection	4-digit PIN Code activating of input PIN protection	0001 … 9999 1 / 0 (on / off)	0001 off (0)
1.9.1 **1.9.2**	rated voltage	Nominal voltage of the system in xxxxxx.x Volt (conductor voltage at 3-wire systems; string voltage at 3-wire+N systems) without function	50.0 … 100,000.0 V -	230.9 V 0
1.12.1 **1.12.2**	rated frequency	Nominal frequency of the system, 50 or 60 Hz without function	0 / 255 (50 / 60 Hz) -	50 Hz (0) 0
1.13.1 **1.13.2**	primary voltage	Primary voltage of the system in xxxxxx Volt without function	1 … 100,000 V -	230 V 0
1.14.1 **1.14.2**	secondary voltage	Secondary voltage of the system in xxxxxx Volt without function	1 … 100,000 V -	230 V 0
1.15.1 **1.15.2**	grid connection	3-wire system or 3-wire+N (4-wire-) system without function	0 / 255 (3- / 4-LN) -	3-LN (0) 0
1.16.1 **1.16.2**	first fault display	Activating of first fault display only (*see chap. 7.1.7)* without function	255 / 0 (on / off) -	off (0) 0
1.17.1 **1.17.2**	number format	Displaying of voltage values (*see chap. 7.5*) without function	0 … 5 (xx.x V - xxx kV) -	auto. (0) 0
1.18.1 **1.18.2**	default display	Displaying of absolute or relative values without function	1 / 2 (abs. / rel.) -	abs. (1) 0
1.19.1 **1.19.2**	return to default	Switching back to standard display in x sec. without function	0 … 600 sec. -	60 sec. 0
1.20.1 **1.20.2**	brightness max.	Maximum brightness of the lighting in % without function	50 … 100 % -	100 % 0

Parameter		Description	Setting range	Default
1.21.1 **1.21.2**	brightness min.	Minimum brightness of the lighting in % without function	0 … 50 % -	10 % 0
1.22.1 **1.22.2**	screensaver time	Time until activating brightness min. in x sec. without function	0 … 600 sec. -	60 sec. 0
1.23.1 **1.23.2**	Analogue output	Activating of functions for analogue output (required for devices with analogue output!) without function	255 / 0 (on / off) -	off (0) 0
1.24.1 **1.24.2**	system > 30 kW	Activating VDE4105 voltage evaluation LN + LL at systems > 30 kW (*see chap. 0*) without function	255 / 0 (on / off) -	off (0) 0
1.25.1 **1.27.2**	not assigned			

15.2 Limit Values (Grenzwerte / Limits – Group 4)

The parameter group 4 contains four parameters per subgroup (*refer to chap. 6.6*). The following settings are available:

Parameter		Description	Setting range	Default
4.1.1 **4.1.2** **4.1.3** **4.1.6**	undervoltage 1	Trigger switching point in xx.x % Switch-back Hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	10.0 … 199.9 % 0.5 … 50.0 % 0.05 … 999.99 sec. (*see chap. 6.6.3*)	90.0 % 0.5 % 0.50 sec. activated / auto-reset (1000000000001001)
4.2.1 **4.2.2** **4.2.3** **4.2.6**	overvoltage 1	Trigger switching point in xx.x % Switch-back Hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	10.0 … 199.9 % 0.5 … 50.0 % 0.05 … 999.99 sec. (*see chap. 6.6.3*)	110.0 % 0.5 % 0.50 sec. activated / auto-reset (1000000000001001)
4.3.1 **4.3.2**	undervoltage 2	Trigger switching point in xx.x % Switch-back Hysteresis in	10.0 … 199.9 % 0.5 … 50.0 %	80.0 % 0.5 % 0.05 sec.

Parameter		Description	Setting range	Default
4.3.3 **4.3.6**		xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	0.05 … 999.99 sec. (*see chap. 6.6.3*)	deactivated (1000000000001001)
4.4.1 **4.4.2** **4.4.3** **4.4.6**	overvoltage 2	Trigger switching point in xx.x % Switch-back Hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	10.0 … 199.9 % 0.5 … 50.0 % 0.05 … 999.99 sec. (*see chap. 6.6.3*)	120.0 % 0.5 % 0.05 sec. deactivated (1000000000001001)
4.5.1 **4.5.2** **4.5.3** **4.5.6**	Under-frequency 1	Trigger switching point in xx.xx Hz Switch-back Hysteresis in x.xx Hz Triggering delay in xx.xx sec. Coding of fault message behaviour	35.00 … 65.00 Hz 0.05 … 2.00 Hz 0.05 … 999.99 Sek. (*see chap. 6.6.3*)	49.20 Hz 0.50 Hz 0.30 sec. activated / auto-reset (1000000000001001)
4.6.1 **4.6.2** **4.6.3** **4.6.6**	Over-frequency 1	Trigger switching point in xx.xx Hz Switch-back Hysteresis in x.xx Hz Triggering delay in xx.xx sec. Coding of fault message behaviour	35.00 … 65.00 Hz 0.05 … 2.00 Hz 0.05 … 999.99 Sek. (*see chap. 6.6.3*)	50.80 Hz 0.50 Hz 0.30 sec. activated / auto-reset (1000000000001001)
4.7.1 **4.7.2** **4.7.3** **4.7.6**	Under-frequency 2	Trigger switching point in xx.xx Hz Switch-back Hysteresis in x.xx Hz Triggering delay in xx.xx sec. Coding of fault message behaviour	35.00 … 65.00 Hz 0.05 … 2.00 Hz 0.05 … 999.99 Sek. (*see chap. 6.6.3*)	48.00 Hz 0.50 Hz 0.08 sec. deactivated (1000000000001001)
4.8.1 **4.8.2** **4.8.3** **4.8.6**	Over-frequency 2	Trigger switching point in xx.xx Hz Switch-back Hysteresis in x.xx Hz Triggering delay in xx.xx sec. Coding of fault message behaviour	35.00 … 65.00 Hz 0.05 … 2.00 Hz 0.05 … 999.99 Sek. (*see chap. 6.6.3*)	52.00 Hz 0.50 Hz 0.08 sec. deactivated (1000000000001001)
4.9.1 **4.9.3** **4.9.6**	vector jump 1	Trigger switching point in xx.x ° Function (*see chap. 7.2.8*)	5.0 … 45.0 ° 0 … 5 (*see chap.*	8.0 ° L1+L2+L3 (4) activated / auto-reset (1000000000001001)

Parameter		Description	Setting range	Default
		Coding of fault message behaviour	*7.2.8*) (*see chap. 6.6.3*)	
4.10.1 **4.10.3** **4.10.6**	vector jump 2	Trigger switching point in xx.x ° Function (*see chap. 7.2.8*) Coding of fault message behaviour	5.0 … 45.0 ° 0 … 5 (*see chap. 7.2.8*) (*see chap. 6.6.3*)	12.0 ° L1 or L2 or L3 (0) deactivated (1000000000001001)
4.11.1 **4.11.3** **4.11.6**	ROCOF 1	Trigger switching point in x.xx Hz/s Triggering delay in xx.xx Sek. Coding of fault message behaviour	0.10 … 10.00 Hz/s 0.05 … 999.99 sec. (*see chap. 6.6.3*)	1.00 Hz/s 1.00 sec. deactivated (1000000000001001)
4.12.1 **4.12.3** **4.12.6**	ROCOF 2	Trigger switching point in x.xx Hz/s Triggering delay in xx.xx Sek. Coding of fault message behaviour	0.10 … 10.00 Hz/s 0.05 … 999.99 sec. (*see chap. 6.6.3*)	2.00 Hz/s 1.00 sec. deactivated (1000000000001001)
4.13.1 **4.13.2** **4.13.3** **4.13.6**	fault angle 1	Trigger switching point in xxx ° Switch-back hysteresis in xx ° Triggering delay in xx.xx sec. Coding of fault message behaviour	1 … 60 ° 1 … 20 ° 0.05 … 999.99 sec. (*see chap. 6.6.3*)	10 ° 1 ° 1,00 sec. deactivated (1000000000001001)
4.14.1 **4.14.2** **4.14.3** **4.14.6**	fault angle 2	Trigger switching point in xxx ° Switch-back hysteresis in xx ° Triggering delay in xx.xx sec. Coding of fault message behaviour	1 … 60 ° 1 … 20 ° 0.05 … 999.99 sec. (*see chap. 6.6.3*)	20 ° 1 ° 0,50 sec. deactivated (1000000000001001)
4.15.1 **4.15.2** **4.15.3** **4.15.6**	voltage asymmetric	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	1.0 … 100.0 % 0.5 … 50.0 % 0.05 … 999.99 sec. (*see chap. 6.6.3*)	10,0 % 5.0 % 0.05 sec. deactivated (1000000000001001)
4.16.1 **4.16.6**	rotary field protection	Rotary field right or left Coding of fault message behaviour	1 / 0 (left / right) (*see chap. 6.6.3*)	right (0) deactivated (1000000000001001)

Parameter		Description	Setting range	Default
4.17.1 **4.17.2** **4.17.3** **4.17.6**	voltage average deviation	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	1.0 … 100.0 % 0.5 … 50.0 % 0.05 … 999.99 sec. (*see chap. 6.6.3*)	90.0 % 5.0 % 1.00 sec. deactivated (1000000000001001)
4.18.1 **4.18.2** **4.18.3** **4.18.6**	voltage quality	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	110.0 … 115.0 % 0.5 … 3.0 % 600 sec. (*see chap. 6.6.3*)	110.0 % 2.0 % 600 sec. deactivated (1000000000001001)
4.19.1	not assigned			
4.20.1 **4.20.2** **4.20.3** **4.20.7**	switch point 1	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	0.1 … 199.0 % 0.5 … 3.0 % 600 sec. (*see chap. 6.6.3*)	100.0 % 1.0 % 1.00 sec. deactivated
4.21.1 **4.21.2** **4.21.3** **4.21.7**	switch point 2	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	0.1 … 199.0 % 0.5 … 3.0 % 600 sec. (*see chap. 6.6.3*)	100.0 % 1.0 % 1.00 sec. deactivated
4.22.1 **4.22.2** **4.22.3** **4.22.7**	switch point 3	Trigger switching point in xx.x % Switch-back hysteresis in xx.x % Triggering delay in xx.xx sec. Coding of fault message behaviour	0.1 … 199.0 % 0.5 … 3.0 % 600 sec. (*see chap. 6.6.3*)	100.0 % 1.0 % 1.00 sec. deactivated
4.23.1 **…** **4.24.6**	not assigned			

15.3 Analogue Outputs

Parameter		Description	Setting range	Default
5.1.1 **5.1.2** **5.1.3** **5.1.5**	analogue 1	working range start value (at 0 resp. 2 V) end value (at 10 V) function assignment	0 .. 3 (*see chap. 11.2*) -150.0 … 150.0 % -150.0 … 150.0 % 0 .. 9 (*see chap. 11.2*)	1 (2 .. 10 V) 0.0 % 100.0 % 0 (without function)
5.2.1 **5.2.2** **5.2.3** **5.2.5**	analogue 2	working range start value (at 0 resp. 2 V) end value (at 10 V) function assignment	0 .. 3 (*see chap. 11.2*) -150.0 … 150.0 % -150.0 … 150.0 % 0 .. 9 (*see chap. 11.2*)	1 (2 .. 10 V) 0.0 % 100.0 % 0 (without function)

15.4 Digital Outputs (Digi. Ausg. / OUT – Group 6)

The parameter group 6 contains three parameters per subgroup (*refer to chap. 6.6.2*). The following settings are available:

Parameter		Description	Setting range	Default
6.1.1 **6.1.2** **6.1.3**	O1 / Relay 1, terminals KL8/ 9	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	undervoltage 1 (9) open circuit principle (0) 2.0 sec.
6.2.1 **6.2.2** **6.2.3**	O2 / Relay 2, terminals KL8/ 10	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	overvoltage 1 (10) open circuit principle (0) 2.0 sec..
6.3.1 **6.3.2** **6.3.3**	O3 / Relay 3, terminals KL8/ 11	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	underfrequency 1 (20) open circuit principle (0) 2.0 sec..
6.4.1 **6.4.2** **6.4.3**	O4 / Relay 4, terminals KL8/ 12	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	overfrequency 1 (21) open circuit principle (0) 2.0 sec..
6.5.1 **6.5.2** **6.5.3**	O5 / Relay 5, terminals KL13-15	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	vector jump 1 (28) open circuit principle (0) 2.0 sec..
6.6.1 **6.6.2** **6.6.3**	O6 / Relay 6, terminals KL26/ 27	function switching behaviour pulse duration (min.)	0 … 47 (*see chap. 11.1*) 1 / 0 (closed / open circuit principle) 0.1 … 6.000,0 sec.	central fault (2) closed circuit principle (1) 2.0 sec..

15.5 Digital Inputs (Digi. Eing. / IN – Group 7)

The parameter group 7 contains two parameters per subgroup (*refer to chap. 6.6.2*). The following settings are available:

Parameter		Description	Setting range	Default
7.1.1 **7.1.2**	E1 / terminal KL 2	function switching behaviour	0 .. 16 (*see chap.10.1*) 1 / 0 (closed / open circuit principle)	global disable (1) open circuit principle (0)
7.1.1 **7.1.2**	E2 / terminal KL 3	function switching behaviour	0 .. 16 (*see chap.10.1*) 1 / 0 (closed / open circuit principle)	disable 1 (2) open circuit principle (0)
7.1.1 **7.1.2**	E3 / terminal KL 4	function switching behaviour	0 .. 16 (*see chap.10.1*) 1 / 0 (closed / open circuit principle)	fault reset (5) open circuit principle (0)

15.6 BDEW Settings (BDEW – Group 8)

The parameters of the BDEW settings are activated by assignment of a corresponding function of the digital outputs (*see chap. 9 and 11.1*). The relevant settings are pre-set according to the 'Technischen Richtlinie Erzeugungsanlagen am Mittelspannungsnetz – Richtlinie für Anschluss und Parallelbetrieb von Erzeugungsanlagen am Mittelspannungsnetz' (technical directive on the generation plants at the medium-voltage network - directive for the connection and parallel operation of generation plants at the medium-voltage network), issue June 2008 and can be adapted as required.

Parameter		Description	Setting range	Default
10.1.1 **10.1.3** **10.1.6**	setpoint 1	limit value in xx.x % delay time in xx.xx sec. coding of fault message behaviour	0.0 … 115.0 % 0.15 … 5.00 sec. (*see chap. 6.6.3*)	0.0 % 0.15 sec. activated / auto-reset (1000000000001001)
10.2.1 **10.2.3**	setpoint 2	limit value in xx.x % delay time in xx.xx sec.	0.0 … 115.0 % 0.15 … 5.00 sec.	0.0 % 0.15 sec.
10.3.1 **10.3.3**	setpoint 3	limit value in xx.x % delay time in xx.xx sec.	0.0 … 115.0 % 0.15 … 5.00 sec.	70.0 % 0.15 sec.
10.4.1 **10.4.3**	setpoint 4	limit value in xx.x % delay time in xx.xx sec.	0.0 … 115.0 % 0.15 … 5.00 sec.	70.0 % 0.70 sec.
10.5.1 **10.5.3**	setpoint 5	limit value in xx.x % delay time in xx.xx sec.	0.0 … 115.0 % 0.15 … 5.00 sec.	90.0 % 1.50 sec.
10.6.1 **10.6.3**	setpoint 6	limit value in xx.x % delay time in xx.xx sec.	0.0 … 115.0 % 0.15 … 5.00 sec.	90.0 % 3.00 sec.

15.7 VDE4105 Settings (VDE4105 – Group 9)

The parameters of the VDE4105 monitoring are activated by assignment of a corresponding function of the digital outputs (*see chap. 0 and 11.1*). The relevant settings are subject to the provisions of the VDE4105 and cannot be changed. For the sake of completeness, the values are reproduced below:

Parameter		Description	Default
9.1.1	U < VDE4105	VDE 4105 undervoltage in % of the nominal voltage	80.0 %
9.2.1	U > VDE4105	VDE 4105 overvoltage in % of the nominal voltage	115.0 %
9.3.1	F < VDE4105	VDE 4105 underfrequency (frequency < x)	47.50 Hz
9.4.1	F < VDE4105	VDE 4105 overfrequency (frequency > x)	51.50 Hz
9.5.1	U to >	VDE 4105 switch-on voltage in % nom-U (U > x)	85.0 %
9.6.1	U to <	VDE 4105 switch-on voltage in % nom-U (U < x)	110.0 %
9.7.1	F to >	VDE 4105 switch-on frequency (frequency > x)	47.50 Hz
9.8.1	F to <	VDE 4105 switch-on frequency (frequency < x)	50.05 Hz

15.8 Logic Functions (Logik – Group 10)

The parameter group 10 contains six respectively five parameters per subgroup (*refer to chap. 12)*. The following settings are available:

Parameter		Description	Setting range	Default
11.1.1	logic 1	function E1	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.1.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.1.3		function E2	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.1.4		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.1.5		logic functions	0 … 6 (*see chap. 12*)	0 (deactivated)
11.1.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.1.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.2.1	logic 2	function E1	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.2.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.2.3		function E2	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.2.4		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.2.5		logic functions	0 … 6 (*see chap. 12*)	0 (deactivated)
11.2.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.2.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.3.1	logic 3	function E1	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.3.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)

Parameter		Description	Setting range	Default
11.3.3		function E2	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.3.4		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.3.5		logic functions	0 … 6 (*see chap. 12*)	0 (deactivated)
11.3.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.3.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.4.1		function E1	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.4.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.4.3		function E2	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.4.4	logic 4	1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.4.5		logic functions	0 … 6 (*see chap. 12*)	0 (deactivated)
11.4.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.4.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.5.1		function E1	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.5.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.5.3		function E2	0 or 1 (*see chap. 10.1*)	0 (deactivated)
11.5.4	logic 5	1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.5.5		logic functions	0 … 6 (*see chap. 12*)	0 (deactivated)
11.5.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.5.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.6.1		function input	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.6.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.6.5		timer function (pick-up/drop-out delay)	0 or 1 (*see chap. 12*)	1 (pick-up delay)
11.6.6	timer 1	timer switch on delay time	0 … 6,000 sec.	1.0 sec.
11.6.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.6.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)
11.7.1		function input	0 … 47 (*see chap. 10.1*)	0 (deactivated)
11.7.2		1 / 0 (inverse / normally)	0 or 1	0 (normally)
11.7.5		timer function (pick-up/drop-out delay)	0 or 1 (*see chap. 12*)	1 (pick-up delay)
11.7.6	timer 2	timer switch on delay time	0 … 6,000 sec.	1.0 sec.
11.7.7		coding of fault message behaviour	(*see chap. 6.6.3*)	auto-reset (1000000000001001)
11.7.8		internal function	0 … 15 (*see chap. 10.1*)	0 (deactivated)

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