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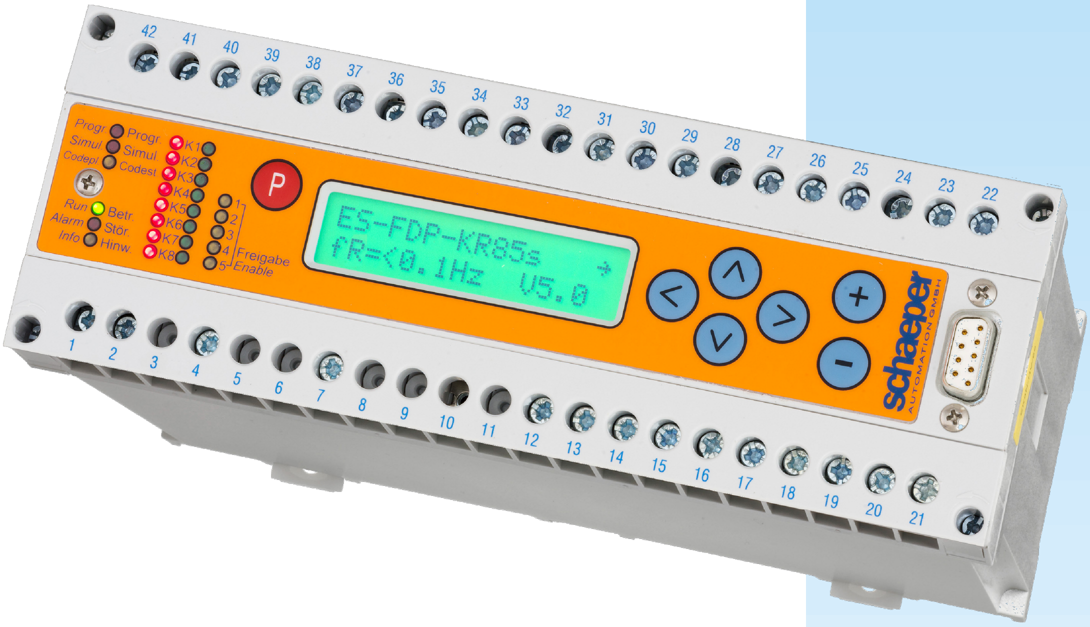
ES-FDP-KR85s

Digital Crane Frequency Control

Operating Instructions



1 Important information about the manual

1.1 Signal word

Actions that could endanger persons are indicated in this manual by the signal word.

1.1.1 Meaning of the signal word

Warning: Endangerment with a medium level of risk which, if not avoided, may result in death or serious injury.

1.1.2 Presentation in the manual

Signal word

Type and cause of the endangerment

1.2 Symbol Attention

The Symbol Attention is used

- together with the signal word for identification of endangerment
- also without signal word for useful hints and tips

Note:

This document has been translated with the greatest of care and expertise. We would like to categorically point out, however, that only the information contained in the German version is binding! This version has been enclosed or can be found at www.schaeper.com

These operating instructions are for the crane frequency control system *ES-FDP-KR85s* as the device stands in May 2018. The current software version is **V5.0. Subject to alterations.**

2 Safety instructions

2.1 General remarks

These operating instructions must be read, understood and observed by all persons entrusted with installation, installation, commissioning and plant operation. This document must be kept in a complete and legible condition for future reference and must be accessible to the persons named.

If you have any questions or need further information, please contact schaeper AUTOMATION GMBH.

2.2 Target group

These operating instructions apply to specialists who work in the areas of plant design, installation, commissioning and plant operation. Skilled workers are persons who have knowledge and experience in accordance with their scope of duties and know the applicable standards and regulations in order to assess the work to be carried out and to be able to identify possible dangers.

2.3 Intended use

The device may only be used within the operating conditions specified in the technical data.

2.3.1 Application

- The device may only be operated in commercial or industrial plants.
- Operation in potentially explosive areas is prohibited.
- **Due to the high voltage applied to the rotor, the device must only be used in electrical operating rooms which are accessed exclusively by suitably trained specialists.**
- **ATTENTION! The device is currently only available without CE marking!**

Use in a dirty environment, especially with conductive contamination, is only permitted when installed in an additional protective housing that reliably prevents contamination from the device.

2.3.2 Electrical installation

The device may only be installed and connected by qualified personnel with knowledge and experience in the installation of electrical switchgear or by instructed persons under the supervision of a specialist who observes the valid accident prevention regulations, standards and guidelines.

Warning:

Between adjacent contacts of the terminal strips there is only functional separation or basic insulation (for overvoltage category III and pollution degree 2) for mains voltage. If both mains voltage and non-contact extra-low voltages are to be connected to the device terminals, then 1 relay must remain unconnected between them!

2.3.3 Commissioning

The device may only be put into operation by specialists with knowledge and experience in the commissioning of electrical systems or by instructed persons under the supervision of a specialist who observes the valid accident prevention regulations, standards and guidelines.

Warning:

Touching the device is only permissible if it is ensured that no rotor voltage is applied, since there is a risk of electric shock. The clearances and creepage distances to the rotor clamping terminals are not sufficient for a secure contact protection because of the high possible rotor voltage!

2.4 Operational safety

For a high degree of operating safety, the unit has a **Watchdog**, an **EEPROM and Flash-EPROM with software write protection** in order to prevent a change of the programmed parameters with strong external interferences. Since the use of the new processor systems in the versions KR85n and KR85s, we have not known about any changes in the programmed values.

However, one hundred percent safety can not be achieved with a one-processor system. The system must therefore have a redundant system for safety-orientated use.

The danger of a change of the programmed data due to extreme external interferences is minimised if the code plug is removed during the operation of the device.

2.5 Maintenance and repair

The relay contacts in the device have a limited lifespan due to the switching of inductive loads. This can be influenced by interference protection of the contactors by a damping circuit, by the use of auxiliary contactors, as well as by avoiding unnecessary switching operations by designing the plant circuit and the programming of the device. If gluing of the relay contacts occurs as a result of heavy burnup, the relays must be replaced.

Otherwise, the device is maintenance-free.

Defective devices may only be repaired by schaeper AUTOMATION GMBH.

3 Differences between the device versions

3.1 Differences between the device versions ...KR85s and ...KR85n

The devices ES-FDP-KR85n and ES-FDP-KR85s differ essentially by the new front panel with membrane keyboard. The arrangement of the operating elements is slightly different, and with the new ES-FDP-KR85s version, additionally the states of the enable inputs are indicated by LEDs. The LED for the programming mode is now located on the front outside the programming button.

The devices are connection- and function-compatible, all programmable parameters as well as the programming procedure are unchanged.

3.2 Differences to the Device Versions ...KR85ℓ resp. ...KR85ℓx

The device versions ES-FDP-KR85n and –KR85s are designed with new, up-to-date microcontrollers. The immunity to interference could be increased considerably again through this.

The texts on the display can alternatively be displayed in German or English.

The programming of the display contrast is eliminated because the up-to-date display is readable well from a wide viewing angle.

At programmed window functions the passing through the window will be recognized even if there is no measurement inside the window (example: a measurement above the window, the next below the window, cf. chapter 7.5.8, page 18).

The acknowledgment of error numbers in the display self-test is not made by the key ⊳ any more but by pressing the keys Ⓟ and ⊖ simultaneously (applies since software version V4.1).

Since the **software V4.1** the device offers the following new functions:

- The programming of the device can be protected by a password in addition to the code plug.
- The operating time of the device is recorded and can be read on the display.
- The number of operating cycles is recorded one by one for every output relay and can be read on the display.

Since the **software V4.2** the device offers the following new functions:

- Possibility of programming self-holding for the switching functions
- New window switching functions especially for counter operation
- The programming button Ⓟ flashes when the programming mode is activated

Since the **software V4.3** the device offers the following new functions:

- There are special new switching functions with a programmed maximum time to switch the relay (if the programmed switching frequency is not reached)

All switching and monitoring functions as well as the allocation of the terminals have remained the same. Devices of the version KR85ℓ and KR85ℓx can be replaced by the versions KR85s or KR85n without wiring changes.

3.3 Important Differences to the versions ES-FDP-KR85a and -KR85e

There are some differences between the crane frequency controls ES-FDP-KR85s (or ES-FDP-KR85n) and the first versions ES-FDP-KR85a or ES-FDP-KR85e, in particular in the terminal assignment of the enable inputs, which must be observed during a conversion. See Chap. 18: “Appendix: Differences to the Device Versions ES-FDP-KR85a, ES-FDP-KR85e and ES-FDP-KR85e/n”.

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Other versions of the device:

- **Frequency and slip monitor, ES-FDP-FS...,** frequency range 0,1 ... 4000 Hz, frequency ratios programmable

- **Signal pre-processor, ES-SV11,** supplementary device for use with the digital slip- and frequency monitor **ES-FDP-FS...,** includes sensor supply, rotational direction recognition by evaluation of 2 phase signal, open circuit monitoring.

- **Digital Synchronization monitor ES-SVGL2,** for monitoring synchronization. Includes sensor supply, rotational direction recognition by evaluation of 2 phase signal, open circuit monitoring.

- **Drive Monitor ES-FDP-AW1,** for monitoring position, speed, synchronisation, shaft break, gear break …

5 Application

Type KR85s is a version of the frequency and speed monitor ES-FDP especially for cranes (for other versions see page 8). The device can be used to carry out all the usual frequency controlled crane switching operations for the lifting/lowering gear and also the slewing and travelling gear. Other versions of the KR85n, e.g. without time delay for the relays, are also available.

These are devices with the following **general characteristics**

- Extremely space-saving
- Easy to programme due to a large LC-display with backlight
- Display with plain text, alternatively German or English-language
- Switching frequencies programmable within the range 0.1 ... 99.9 Hz
- Protection from unauthorised programming by means of a code plug
- Light-emitting diodes for the indication of the operating state
- Double-LED display (red/green) for relay status
- 8 relay outputs (optional triac or transistor outputs)
- Programmable time delay for the switching outputs
- 5 enable inputs with programmable time delays can be assigned to the relay outputs arbitrarily (exception: two-step mode of operation)
- Normal or two-step operation programmable
- Simulation mode for function test (including conter simulation)
- Electrically isolated input for rotor voltage (max. 1000 V_{eff})
- Open circuit monitoring
- Fix-programmed channels for safety functions, e.g. 49/51 Hz (option)
- Flash-EPROM and EEPROM for programmable values (no batteries required), with software write protection for extremely high data safety
- High noise immunity (watchdog, redundant data storage for automatic error recognition)
- Service friendly with **removable screw-on terminal strip, thus enabling the devices to be changed quickly without the danger of wiring errors**

6 Displays and Operation

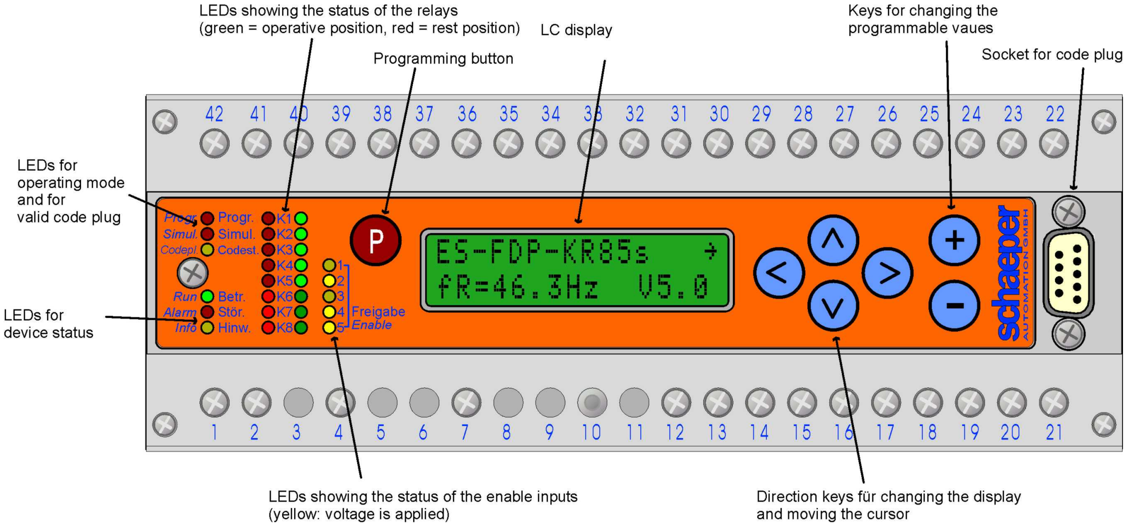


Fig. 1: Operating elements of the device

Warning:

Touching the device is only permissible if it is ensured that no rotor voltage is applied, since there is a risk of electric shock. The clearances and creepage distances to the rotor clamping terminals are not sufficient for a secure contact protection because of the high possible rotor voltage!

6.1 LED Indicators

Run (green) Mains voltage is connected and the self-test is finished.

Alarm (red) The program flow has been disturbed by external influences (e.g. considerable interference from switched lines, EMP) or due to an internal error in the device in such a manner that the device can not function properly. After the automatic error correction has been finished the LED is switched off, the LED **Info** remains on up to reading the error number (see chapter 8). If no automatic error correction is possible the LED **Alarm** remaines on permanently. Measures for the resumption of operation are described in chapter 8 (Device Errors, see page 21).

Info (yellow) This LED indicates disturbing influences which only occur temporarily, thus enabling preventative measures to be taken. The LED lights up after occurrence of an error, however does not go out until acknowledged or until the interruption of the supply voltage. To acknowledge: see chapter 8 (page 21).

K1 to K8 (green and red) The status of the 8 frequency channels or the relays allocated to them
red → rest position
green → operative position

Enable 1 to 5 State of the enable inputs. Lights up when power is applied to the corresponding enable input.

Simul. (red) The device is in simulation mode (simulated operation, instead of fR, fT appears in the display)

Progr. (red) LED flashes when the device is in programming mode.

Codeplug (yellow) Valid code plug is connected
Programming possible

6.2 LC-Display

6.2.1 Back-lighting

For better readability with poor light conditions, the LC-Display is equipped with back-lighting. The lighting is activated with the press of any key and automatically goes out approx. 3 minutes after the last key is pressed.

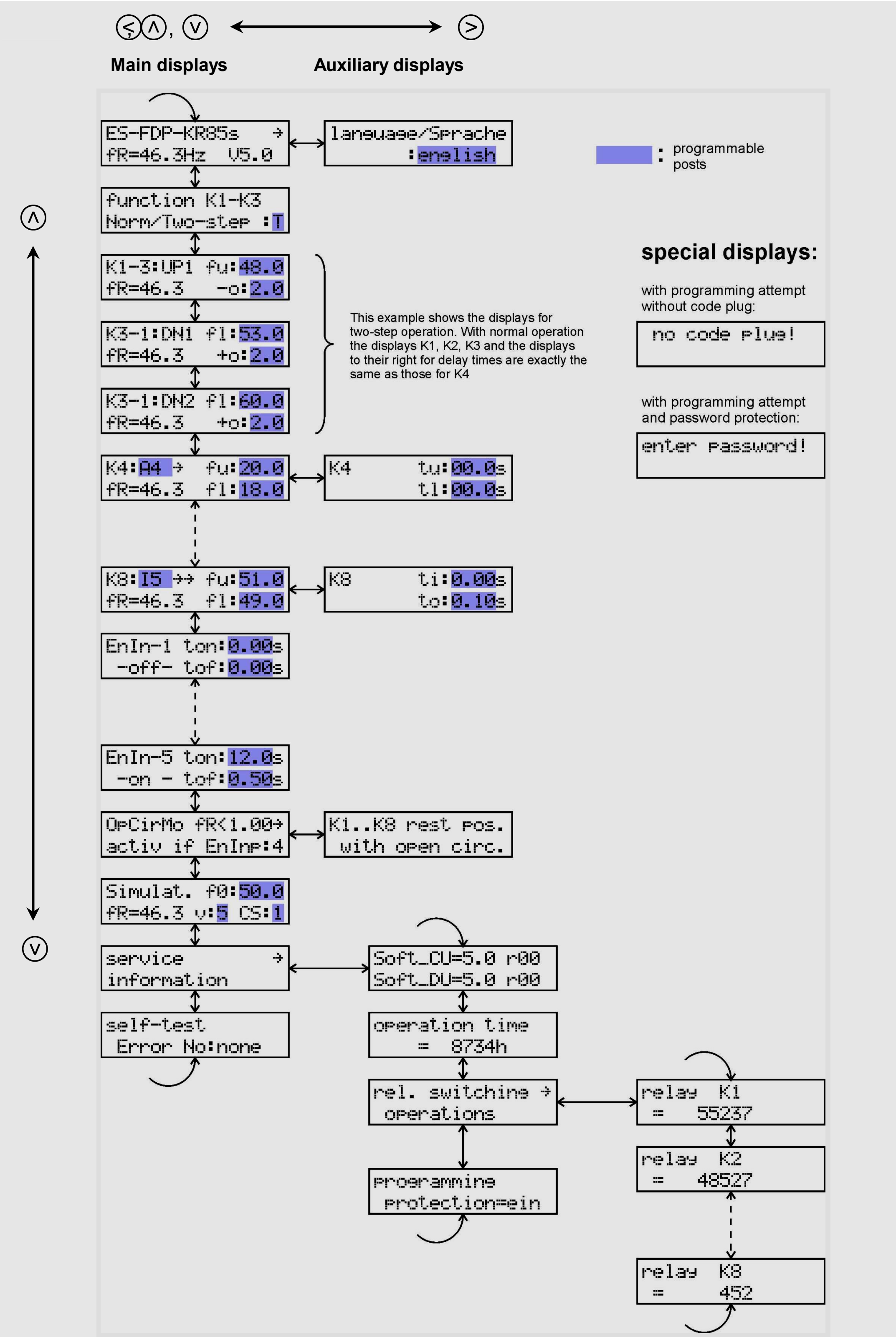


Table 1: Sequence of the displays

ES-FDP-..	Device specification	**EnIn-..**	Enable input
V..	Software version	**ton:..**	Response time delay for enabling (s)
language/Sprache	Programming of the display language	**tof:..**	Drop-off time delay for enabling (s)
K..	Frequency channel	**-on -**	Signal to enabling input
K1-3	Frequency channels 1 to 3	**-off-**	No signal to enabling input
Norm (N)	Normal-operation (see **Table 8** and **Table 11**, page 25)	**OpCirMo**	Open circuit monitoring
Two-step (T)	Two-step operation (see **Table 14**, page 31)	**..activ**	Open circuit monitoring is active
UP1	Lifting 1 (enable input 1)	**OpCi**	Appears in display instead of measured frequency when the open circuit monitoring has responded
DN1	Lowering 1 (enable input 2)	**EnInp:..**	Allocated enabling input
DN2	Lowering 2 (enable input 3)	**Simulat.**	Simulation mode
fu:..	upper switching frequency; with two-step operation: basic frequency for lifting	**f0:..**	Initial-frequency
fl:..	lower switching frequency; for two-step operation: basic frequency for lowering	**v:..**	Speed with which the values of the test oscillator change
tu:..	Relay switching delay at upper switching value for hysteresis switching function	**CS:..**	Type of operation of the test oscillator (crane simulation on/off)
tl:..	Relay switching delay at lower switching value for hysteresis switching function	**service infor-mation**	Service information: Operating time, Software-revision numbers, Operating cycles of the relays.
ti:.., to:..	Relay switching delays for window switching function (I..Q)	**Soft_CU**	Software revision of the central unit.
fR=..	Measurement frequency from input	**Soft_DU**	Software revision of the display processor.
fT=..	Simulated frequency in simulation mode	**→**	Indication of an auxiliary display
+o:..	Positive frequency offset	**→→**	A time delay has been programmed for this output
-o:..	Negative frequency offset	**PRGM**	Programming mode

Table 2: Significance of the display texts

6.2.2 Basic Display and Software-Version

After the power supply has been connected, the device responds by giving its type identification in the upper line. The value of the rotor frequency **fR** and the version-No. **V** of the software will be shown in the lower line.

```
ES-FDP-KR85s   →
fR=****Hz  V5.0
```

****: current rotor frequency

6.2.3 Selecting the Displays

The sequence of the displays is shown in **Table 1** (page 11). The left column shows the **main displays**. There is a main display for every function of the device. There is an **auxiliary display** (right column in the table) when not all the information fits into one display. The arrow → in the main displays indicates the existence of an auxiliary display.

The displays are selected using the cursors (∧, ∨, <, >). The main displays are obtained using the keys ∧ and ∨ (for sequence see **Table 1**). The key > calls up the auxiliary display belonging to the current main display (if available). The keys < and ∧ or ∨ bring back the respective main display. An exception is the area of the service information, here only the key < leads back to the respective main display, since the keys ∧ or ∨ are used to access the associated sub-displays.

6.2.4 Display of the Measured Values

The values measured for the rotor frequency are superimposed in the basic displays **ES-FDP-..** and in the switching channel displays **K1...K8** bottom left in the form `fR=.....` The text `OPCi` instead of the current frequency indicates that the open circuit monitoring has responded. If the open circuit monitoring is not active and for approx. 10 seconds no input signal is recognized the display will show `fR=<0.1Hz`. The display changes from `fR=` to `fT=` during simulated operation.

In the displays **EnIn-1** ... **EnIn-5** a superimposed `-on-` or `-off-` shows whether there is a voltage applied to the enable input.

7 Programming (PRGM)

Warning:

Programming the device is only permissible if it is ensured that no rotor voltage is applied, since there is a risk of electric shock. The clearances and creepage distances to the rotor clamping terminals are not sufficient for a secure contact protection because of the high possible rotor voltage!

7.1 Code Plug

A code plug is needed to programme the device. This is plugged into the socket on the front panel (cf. figure 1, page 10). The plug may only be removed after the programming procedure has been finished (when `PRGM` is no longer shown in the display).

If the key Ⓟ is pressed without the code plug connected, the following will appear:

```
no code plug!
```

7.2 Programming Sequence

The significance of the programmable parameters in the individual displays is explained in the respective chapters below. The sequence for the programming is always the same and is carried out as shown in **Table 3**. It is not possible to change a value unintentionally because two keys must be pressed at the same time. Even if the programming key Ⓟ is pressed accidentally, the programming mode can be left simply by following step 6.

Only values which have been defined can be programmed. Therefore, the number of an enable input allocated to a particular switching channel can only be set at a number between 1 and 5. When programming the time delays and the open circuit monitoring the decimal point can also be moved.

The decimal point cannot be moved to the front for time delays. **Table 4** shows the values which can be programmed.

Warning: The device should only be programmed when the main plant is switched off, because the outputs can switch in an undefined way during the programming procedure.

	the key to be used
1. Select required display	Ⓐ, Ⓥ, <, >
2. Switch on programming mode K4:A1 → fu:20.0 PRGM fl:18.0 (The LED **Progr.** flashes and in the display "PRGM" and the mark "_" will appear)	Ⓟ
3. Move the mark to the value which is to be adjusted	Ⓐ, Ⓥ, <, >
4. Set the desired value (separate for each digit) (a flashing mark fills the whole character field)	Ⓟ and ⊕ (simultaneously) or Ⓟ and ⊖ (simultaneously)
5. Repeat steps 3. and 4. until all values in the display have been set	
6. Programming of the values and leaving programming mode	⊕ and ⊖ (simultaneously) (do not press Ⓟ!)

Table 3: Programming sequence

Switching function	- A B C D E F G H I K L M N O P Q
Adjunct to the switching function	(blank) s k
Number of an enable input	0 1 2 3 4 5 , with open circuit monitoring also ÷
Digits for switching values and delay times	0 1 2 3 4 5 6 7 8 9 , with times also .
Type of function (normal/two-step)	N T
Language	deutsch english

Table 4: Permissible values for programming

7.3 Display Language

Here the language of the display texts can be switched over between German and English:

```
language/Sprache
        :english
```

The display texts, which appear if the German language is selected, are described in the German-language version of the operating instructions.

7.4 Mode of Operation (Normal-/Two-Step)

When operating in normal operation mode the switching behaviour of each of the frequency channels can be programmed individually. In two-step mode the first three frequency channels offer an extra function to enable a load-dependant control with reduced speed fluctuations. This special switching behaviour can be seen in **Table 14**. **K1** to **K3** switch with an offset of the programmable frequency **o**, whereas the switching frequencies depend on the applied enable signal lifting 1, lowering 1, or lowering 2.

The frequency channels **K4** ... **K8** only operate in normal mode.

When the display **Funktion K1-K3** is selected the function of the switching channels **K1** ... **K3** can be changed from normal operation N to two-step operation T and vice-versa. The selected function is shown on the outside right in the lower line:

```
function K1-K3
Norm/Two-step :T
```

7.5 Switching Channels in Normal Operating Mode

In normal operating mode, the switching behaviour of each of the 8 frequency channels can be programmed individually. This is determined by programming a switching function, the allocation of an enable input, by the switching frequencies and, if required, also with programmed time delays (**Table 5**).

Main display and auxiliary display for a switching channel (the programmable parameters have been underlined)
 	
`K1:A4s→→ fu:22.5` / `PRGM fl:18.5`
`K1 tu:0.05s` / `PRGM tl:00.0s`
	K1:	first frequency channel selected

	PRGM	programme mode is switched on
	→→	Indication of a programmed delay time in auxiliary display
		Main display:
	A	selected switching function
	4	enable input 4 has been allocated
	s	self-holding (latching)
	22.5	upper switching frequency **fu** in Hz
	18.5	lower switching frequency **fl** in Hz
		Auxiliary display:
	Ø.Ø5	Delay time **tu** programmed at Ø.Ø5s
	ØØ.Ø	no delay time **tl** programmed

Table 5: Programmable parameters for a switching channel in normal operation mode

7.5.1 Switching Function

The frequency channel is shown on the left of the upper line of the display. The letter after the colon indicates the switching function. It is possible to programme **hysteresis switching functions A ... H** (**Table 8**, page 25) and **window switching functions I ... Q** (**Table 11**, page 28). Furthermore, the switching functions can be programmed specifically for self-holding or counter operation.

Hysteresis switching functions A ... H: Because two switching values **fu** and **fl** can be programmed this gives a switching hysteresis (**fu** - **fl**). This enables the relay to be kept in a stable condition.

Window switching function I ... Q: Window functions can be used, e.g., for standstill monitoring (**fu**: 51 Hz **fl**: 49 Hz). The relay switches if the rotor frequency moves out of the programmed window. The window functions operate without switching hysteresis.

Function "–": is programmed if the switching channel is not needed. The relay will remain permanently in the rest position, independent of the rotor signal.

7.5.2 Enabling Allocation

The digit after the switching function represents the number of the enabling input which is allocated to the frequency channel. If here the digit `0` is programmed in then the respective switching channel is always activated, i.e. an enable signal is not necessary.

7.5.3 Special switching functions with self-holding

The programming of such a special function takes place directly behind the digit for the assignment of the enable input. By default, a space „ “ is programmed here.

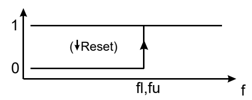
If an „s“ is programmed instead, the programmed switching function operates with self-holding (see Table 10 for hysteresis switching functions, or Table 12 for window switching functions). Programming is only possible if an enable input is assigned because a reset of the switching channel must be possible via this.

Since the resetting of the switching channels after latching is not dependent on the frequency but via a reset pulse, the significance of the hysteresis is eliminated in the case of the switching functions **A(s) ... H(s)**. The device therefore automatically sets **fl** to the value of **fu** during programming in order to avoid ambiguities with regard to the switching frequency.

Example of self-holding: *The switching channel is programmed as follows:*

K3:A4s→ fu:40.0 fR=**** fl:40.0	K3 tu:0.00s tl:0.00s

Switching function **A** *with programmed latching is defined as follows (see Table 10):*

Switching function	enable on	enable off	
A (s)			(With switching function **A (s)** the reset occurs if no signal is present at the corresponding enable input)

As long as the enable signal is switched off, the relay is in any case in rest position (reset state). After applying an enable signal, the relay remains in rest position as long as the programmed frequency of 40.0Hz is not exceeded. Once it has been exceeded, the relay switches to the working position and remains there until a reset takes place by interrupting the enable signal.

Attention! After the end of the reset state (application of enable), the relay remains in rest position only if the frequency has already been less than 40.0Hz for at least the programmed time **tl**. *Therefore,* **tl** *must be programmed to 0 for most applications (see chapter 7.5.7).*

7.5.4 Special window switching functions for counter operation

Special window switching functions are available for counter operation. The programming of such a special function takes place directly behind the digit for the assignment of the enable input. By default, a space „ “ is programmed here.

If, together with a window function, a „k“ is programmed after the enable assignment, then the relay only switches within the window if the frequency enters the window from above (falling frequency) and not when the frequency enters the window from below (increasing frequency). The corresponding switching functions are shown in Table 13. This is useful for switching operations that should only occur during the countering. **ATTENTION! For switching, it must be ensured that the upper window frequency has been exceeded before!**

7.5.5 Special switching functions with programmable maximum times until switching

There are special switching functions with programmable maximum times tp until switching, i.e. the switching channel switches even if the programmed switching frequency is not reached. This function is useful, for example, for outdoor gantry cranes, if otherwise they can not accelerate to the predetermined switching frequency if the wind load is too high.

The programming of such a special function takes place directly behind the digit for the assignment of the enable input. By default, a space „ “ is programmed here.

If a „t“ is programmed instead, the times programmed in the right side display change their meaning. The secondary display changes its appearance, instead of **tu** and **tl**, a parallel time **tp** must be programmed:

K3:A4t→→ fu:40.0 fR=**** fl:40.0	K3 tp:5.00s

When the enable input is activated, the channel switches when the programmed switching frequency is reached, but at the latest after the programmed time **tp**.

Programming a parallel time **tp** is only possible for hysteresis switching functions. Furthermore, an enable input must be assigned, because it triggers the expiration of the time. The corresponding switching functions are shown in Table 9.

The switching functions show that frequency-dependent switching occurs only during the expiration of **tp**. If **tp = 0** is programmed, the switching channel operates as a pure time relay with the delay times **ton** and **tof** programmed for the assigned enable input (see chapter 7.7).

7.5.6 Switching Frequencies

On the right in the upper line the upper frequency **fu** is shown, and directly underneath the lower frequency **fl**. The two values **fu** and **fl** determine the switching hysteresis (switching functions **A...H**) or the switching window (switching functions **I...Q**).

In the standard version of the device the switching frequencies can be programmed to any value for all channels. As an optional extra the device can be fitted with fix-programmed channels for safety functions.

7.5.7 Time Delay for the Outputs

In the standard version of the device all switching channels which do not function in two-step operation can be programmed to switch the outputs with a time delay of 0 ... 65 seconds. A double arrow →→ in the main display of the switching channel indicates that the respective output has a time delay (when a time delay has not been programmed a single arrow → indicates the existence of an auxiliary display, cf. chapter: **6.2. LC-Display**, page 11). The delay times are programmed in the auxiliary displays.

K3:C4 →→ fu:40.0 fR=**** fl:38.0	K3 tu:0.05s tl:0.70s

K4:I5 → fu:20.0 fR=**** fl:18.0	K4 ti:0.00s to:0.00s

With the switching functions **A - H** (hysteresis) the delay time **tu** is effective when the upper frequency **fu** is exceeded, when the lower frequency **fl** is gone under the time **tl** is effective.

With the switching functions **I - Q** (window) the delay time **ti** is effective if the measurement value, **fR** enters <u>i</u>nto the window range. The time **to** is effective when the measured value, **fR** leaves the window area. It is completely irrelevant whether the measured value is increasing or decreasing when it enters or leaves the window range (cf. fig. 2).

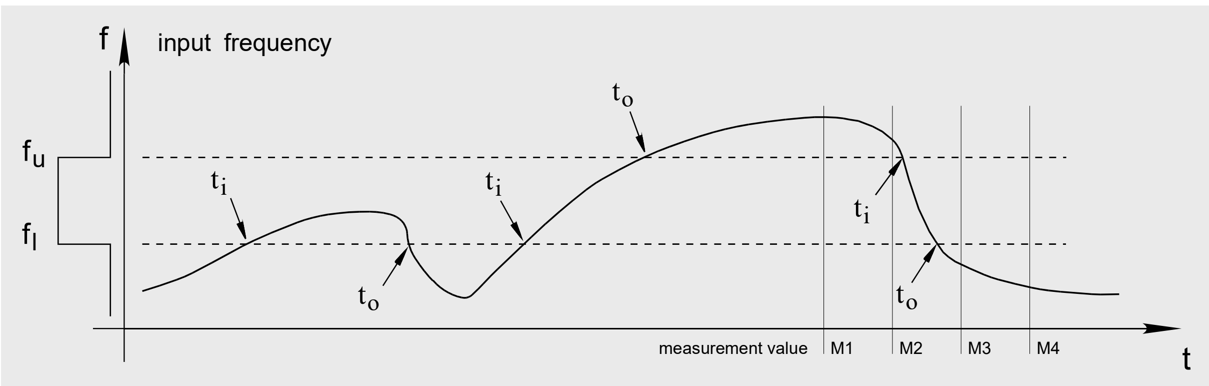


Fig. 2: Time delays for the relays with the window switching functions I-Q

The following applies to the switching functions with self holding **A(s) ... Q(s)**: Delay times for the response of the switching channel are the same as for all other switching functions. However, the respective times for the reset should be programmed to 0, because the resetting of the switching channels after latching is not frequency-dependent, but via a reset pulse. Otherwise a reset of the switching channel is only possible after the programmed time has expired.

7.5.8 Programming of the Switching Delay for Recognizing a Window for certain

For fast frequency changes and switching windows tolerated narrowly it can happen that when passing through the window no measurement lies in the switching window. In the example (cf. **Fig. 2**) the measurement M2 is above the switching window, the following measurement M3 already below the window. In order to get switched the accompanying relay nevertheless, a time delay **to** must be programmed and **ti** must be set to 0. The time **to** may not be chosen too short due to the relay delay times and the response times of the post-connected equipment so that passing through the window can be evaluated for certain.

```
K4:I5 →→ fu:51.0 | K4      ti:0.00s
fR=****  fl:49.0 |         to:0.20s
```

****: current value

7.6 Switching Channels K1 ... K3 in Two-Step Operation

The special switching functions of the channels **K1** ... **K3** when in two-step operation is shown in **Table 14** (page 31). The device switches at the respective allocated rotor frequencies, depending on the enable signals lifting 1, lowering 1, and lowering 2. **K1** to **K3** switch with an offset of the programmable frequency difference **o**. The value of the frequency difference **o** is also the switching hysteresis for the channels **K1** to **K3** (**Table 14**, page 31).

The frequency of the first channel is programmed directly for lifting 1. In the display the **-o** indicates the drop in switching frequency from **K1** to **K3** (in the example 2 Hz).

```
K1-3:UP1 fu:48.0
fR=****   -o:2.0
```

****: current rotor frequency

For lowering 1 and lowering 2 the frequency of the third channel is programmed directly. The switching frequencies increase from **K3** to **K1** respectively by the value **+o** (in the example by 1,5 Hz).

```
K3-1:DN1 fl:53.0
fR=****   +o:1.5
```

```
K3-1:DN2 fl:60.0
fR=****   +o:1.5
```

****: current rotor frequency

In the master controller positions lifting 1, lowering 1, and lowering 2 the drive runs, depending on the load, in one of the frequency ranges and switches within this range.

The allocation of the enable inputs 1 to 3 in two-step operation has been set as follows:

Enable input 1 → lifting 1
Enable input 2 → lowering 1
Enable input 3 → lowering 2

7.7 Enable Delay Times

It is possible to programme an operate delay time **ton** and a drop-off delay time **tof**, each between 0 and 65 seconds for every enable input. The respective displays are **EnIn-1** to **EnIn-5:**

```
EnIn-1 ton:0.00s
 -off- tof:0.00s
```

Fig. 3 shows the validity of the times **ton** and **tof.** LEDs on the front panel show whether signals are applied to the enable inputs, additionally appears an `-on-` or `-off-` in the display of the corresponding enable input.

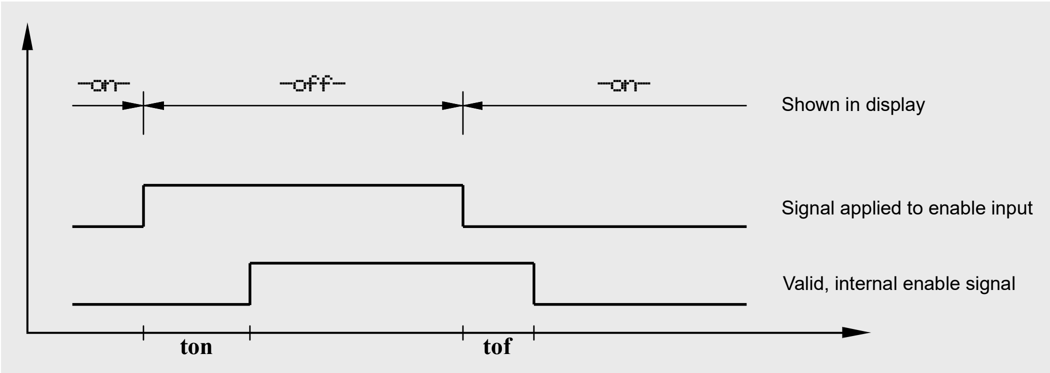


Fig. 3: Delay times for enabling

7.8 Open Circuit Monitoring

This function enables all switching outputs **K1** to **K8** to be switched to the rest position if the frequency goes below a minimum.

```
OpCirMo fR<1.00→
aktiv if EnInp:4
```

```
K1..K8 rest pos.
 With open circ.
```

The frequency is programmed after `fR<`. There is no point in programming values less than 0,1 Hz because smaller frequencies than this are evaluated internally as 0 (the open circuit monitoring reacts in this case at 0,1 Hz). If the frequency is programmed at 0 Hz then the open circuit monitor does not respond at all, because frequencies < 0 Hz are not possible.

When the open circuit monitor responds then all switching outputs go to the rest position, irrespective of the switching function which has been programmed for normal operation.

In order to bypass the starting up procedure of the engine, an enable input can be used to activate this function. The digit after `EnInp:` can be programmed and indicates the allocated enable input. The digit `0` indicates that the open circuit monitoring is always activated.

```
OpCirMo fR
    with EnInp:÷
```

If, instead of a digit, a "`÷`" is programmed then the open circuit monitoring is deactivated and after the programming has been completed the display changes as follows. To re-activate simply re-programme with a digit.

```
K3:C4 →  fu:40.0
fR=OpCi  fl:38.0
```

If the open-circuit monitor has responded then `fR=OpCi` will appear in the displays instead of the input frequency.

Warning: The frequency must be programmed at a value under the lowest frequency which can occur during regular operation **fR**.

The open circuit monitoring responds if the rotor voltage goes under the input sensitivity of the device (near synchronous operation).

7.9 Simulation mode

A special feature of the crane frequency control is the simulation function. With this function, it is possible to simulate an applied rotor voltage in the switchgear with the motor disconnected and thus to test and optimise the entire control system – in a kind of slow motion.

The procedure is as follows: The motor is disconnected. The master switch is operated as if the crane was to be put into operation. Now the simulation mode is started on the device and thus an applied rotor voltage is simulated, which corresponds to the starting of the crane. This means that starting with the standstill frequency (generally 50 or 60Hz) the frequency decreases. The desired speed of the frequency change is programmable and it is possible to stop at any frequency to check the correct position of all contactors in the switchgear.

Note: The code plug is required to activate the simulation. Activation is possible if no rotor voltage has been detected at the measurement input for approx. 10 seconds. The device automatically switches off the simulation if there is a rotor voltage at the measuring input or if the code plug is removed.

The simulation parameters are programmed in the following display:

```
Simulat. f0:50.0
fR=**** v:5 CS:1
```

****: current rotor frequency

The initial frequency f0 for the start of a simulation is shown in the top right of the display. The speed of the frequency changes is determined by the value v which is programmed with values v:0, slow, to v:9, fast.

The simulation mode can be set for a counter-simulation. To do this the value CS is set to CS:1. When a frequency of 5 Hz is reached the simulation will now jump to a frequency of 95 Hz, enabling counter operation to be simulated. CS:0 indicates normal operation without counter-simulation.

The simulation mode is activated and deactivated by pressing the keys ⊕ and ⊖ simultaneously. The activation is indicated by the LED **Simul** on the front panel.

When the simulation mode is activated a changement of the frequency can be caused using the keys ⊕ (frequency increases) or ⊖ (frequency decreases). The speed of the frequency depends on the programmed value of v. The frequency range of the simulation is from 0.1 to >100 Hz.

For safety reasons the simulation mode should only be activated when no current is applied to the power circuit!

7.10 Password Programming Protection

For safety reasons against an unauthorized change of the programmed parameters a password-programming protection can be activated in addition to the code plug. If the password-programming protection is active and a programming attempt is made by pressing the button Ⓟ (with inserted code plug) the following display appears:

```
enter password!
```

On request the operator of the device will get information about the activation of the password-programming protection by request of an additional data sheet.

8 Device Errors

8.1 Self-test

During operation the device permanently executes a self-test. At occurring errors the LEDs **Info** and possible **Alarm** on the front light up. The **Alarm** LED indicates a serious error which prevents the correct operation of the device. In this case all relays are switched to idle state. The device usually eliminates the error automatically and resumes the normal operation. The **Info** LED lights on until acknowledgment. The current error number can be read in the display **self-test**.

```
self-test
 Error No:***
```

***: current error number

If several error numbers are stored, these are called after each other by pressing the button (>) repeatedly. To acknowledge the error number displayed currently press the keys (P) and (−) simultaneously with the code plug connected. This is to do repeatedly until the word none appears instead of an error no. For the purpose of a later fault analysis the error nos. should be noted down. An interruption of the mains voltage also leads to deleting stored error numbers and resetting the **Info** LED.

If after a serious disturbance no error correction is possible, the **Alarm** LED lights permanently. This occurs for example if extreme disturbing influences have changed the programmed parameters in the EEPROM or in the flash memory. The essential measures are described in the subsequent chapters.

8.2 Meaning of the Error Messages

Extreme external disturbing influences may cause faults in the program flow or in the stored data. The device recognizes these by the self-test and executes the corresponding corrections. The faults tracked down and the measures of the correction are characterized by the error numbers (cf. **Table 6**). So the error number indicates respectively the effect of the disturbance; the causes, (i.e. the interference sources) cannot be recognized by a test program.

In the column "location of the fault" in **Table 6** there are listed, where the fault has appeared:

- **CU** = central unit, responsibly for the evaluation of the input signals and the combination with the programmed parameters
- **DU** = display unit, responsible for the operating of the controls and for driving the LEDs and the LC-display.

8.3 Data-Error of the stored Parameters in the Flash-Memory

The programmable parameters of the device are stored in the flash memory of the display unit. A change of the programmed data is very improbable. A storage of faulty data is e. g. possible if directly during the completion of a programming the power supply breaks down. If the device detects faulty data in the flash memory at the self-test the red **Alarm** LED lights and at selecting of the main display for the self-test the following message is shown:

```
self-test
 data error    →
```

Pressing the button (>) directly leads to the display in which the error has appeared. The programming mode is selected, all programmed values have to be checked for correctness and corrected if necessary. After that the programming must be completed normally by pressing the buttons (+) and (−) simultaneously.

Error-Number	Location of the Fault	Meaning	Required Measures (cf. Table 7)
001	DU, CU	Incompatible software in central unit and display unit	1
002	CU	Data in the EEPROM and in the front plate are not corresponding	2
003	CU	Forbidden data in the EEPROM	2
009	CU	Watchdog timer has had effect and has triggered Reset	3
010	CU	Reset was triggered because of low voltage	4
011	CU	Other forbidden Reset condition appeared	3
012	CU	Cycle time wasn't kept to	3
017	CU	Forbidden values in switching registers	3
018	CU	Forbidden values in registers for the data interchange control	3
019	CU	Wrong values in registers for the Capture control (frequency recording)	3
020	CU	Reserved	3
021	CU	Reading the EEPROM couldn't be executed correctly, possible because a forbidden write operation was still active	3
022	CU	Fault appeared at a parameter reprogramming (Differences in more than 2 parameter blocks)	3
023	CU	Data in the RAM do not correspond to the values transmitted by the display unit	2
025	CU	No i2c bus connection to the display unit	3
026	CU	Bus collision at i2c data transmission appeared	3
027	CU	No Acknowledge of the I2c slave	3
028	CU	Received i2c data have check sum errors	3
029	CU	Reserved	3
033	DU	Display unit does not receive any data of the central unit	3
034	DU	Check sum error at received data	3
035	DU	Data error of the stored parameters in flash memory (cf. chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**)	3
036	DU	Error of the i2c slave state machine	3
037	DU	Reserved for tests	3
038	DU	Error at the recording of the relay-switching cycles	3
039	DU	Error at the recording of the service data	3
041	DU	Watchdog timer has had effect and has triggered Reset	3
042	DU	Reset was triggered because of low voltage	4
043	DU	Other forbidden Reset condition appeared	3
044	DU	Forbidden interrupt occured	3

Table 6: Error numbers of the self-test

Required Measure	
1	Interrupt power supply and switch on again. If furthermore the error appears, the device must be sent in for repair to the manufacturer. Otherwise note down error number and inform the manufacturer.
2	Interrupt power supply and switch on again. If furthermore the error appears, programmed parameters are changed by extreme disturbing influences. This is recognized by redundant storage. Select an arbitrary programmable display, switch on the programming mode and finish normally. Parameters do not have to be changed to this. The device corrects all perhaps faulty data to permissible values. Perhaps further info messages will be reported which have to be acknowledged. **Attention: A following check of all programmed data is absolutely required.** Note down error number and inform the manufacturer.
3	Acknowledge error, note down error number and inform the manufacturer.
4	Acknowledge error, remove external cause for undervoltage or short-time voltage drops at the operational location.

Table 7: Required measures after appearance of errors

If furthermore “data-error“ appears after calling of the self-test display, then the programmed parameters of another display are faulty and the process must be repeated until when selecting the self-test display the error number 035 will be displayed. This is triggered by the faulty data in the flash memory and must be acknowledged certainly now.

8.4 External Error Messages

A disturbance which results in the red disturbance LED lighting up also causes all the switching channels to be switched to rest position for the duration of the disturbance. This function can be used to provide an external error message using one or several relays.

8.5 Wiring of the Enable Inputs

In some cases the cause of a disturbance can be an extreme switching over-voltage at an enable input. **An external wiring with varistors or load resistances can help in this case.**

Example for enable control with 230V, AC: Suitable are load resistances R=10kΩ/10W or varistors for 275V which are suitable for operating directly at line voltage.

8.6 Wear of Relay Contacts at inductive Loads

If the output relays switch inductive loads (e. g. contactors) they should be protected by a damping circuit. Otherwise the generated arc when switching off may cause high wear of the contacts and may lead to unit faults in awkward cases (the yellow **Info** – LED will light).

With contactors with 230VAC control voltage RC circuits bring good results, but varistor circuits decrease the arc only insignificantly. For the dimensioning the wirings suggested by the contactor manufacturers should be used, since these are particularly co-ordinated with the respective types.

Pay attention that each damping circuit of the contactors can entail an increase of the switch-off delay time.

8.7 Blown Fuse

The device fuse is soldered onto the printed circuit board next to the transformer. To change it, the terminal strips should be unscrewed and removed and the head-plate loosened with a screw-driver as shown on the picture on page 34. Now the plugged-in circuit boards can be removed from the housing.

A SMD fuse, 100mA slow, type SIBA 160000 / 0.1A (or compatible) must be soldered in. Replacing the fuse should only be done by trained technicians.

Care must be taken when re-assembling that the plug contacts are seated correctly!

9 Service-Informations

Information about the device state is summarized under the main display service-information. The operating time of the device as well as the number of the operating cycles of the relay contacts can be seen here. Furthermore it is shown here, whether the password programming-protection of the device is active.

9.1 Software-Revision Numbers

The revision numbers of the software of the device are listed in the first side display of the service information.

```
Soft_CU=********
Soft_DU=********
```

********: Revision numbers of the operational software

Soft_CU= describes the software version of the central unit, Soft_DU= describes the software version of the display processor.

9.2 Operating time

This display gives information about the operating time of the device (= mains voltage on).

```
operating time
    =******h
```

******: Operating time in hours

The accumulated operating time is stored in the permanent memory every 10 minutes only. Due to this procedure there will be accumulated too little operating time at every power-on period of the device up to 10 minutes. A correct recording therefore presupposes that the normal power-on period of the device is respectively several hours.

9.3 Operating Cycles of the Relays

The operating cycles of the individual output relays K1..K8 are shown in the side displays of this display.

```
rel. switching →
 operations
```

```
relay  K1
 =********
```

```
relay  K2
 =********
```

:

********: operating cycles of the relays

These values are also stored in the permanent memory every 10 minutes only. Exactly as in the case of the operating time the part of the cycles that arises at every power-on period of the device up to 10 minutes will not be taken into account. Again a correct recording therefore presupposes a respectively long power-on period of the device.

9.4 Programming Protection

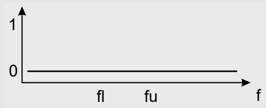
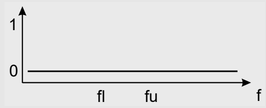
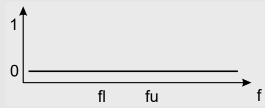
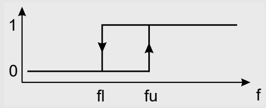
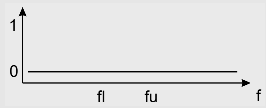
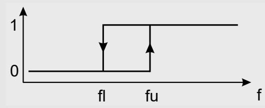
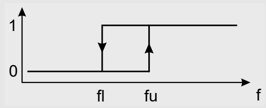
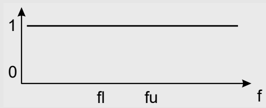
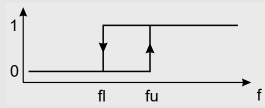
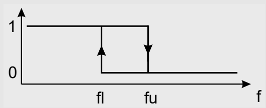
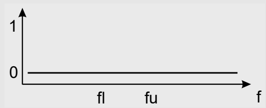
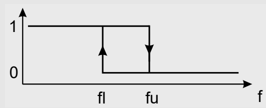
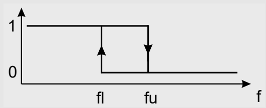
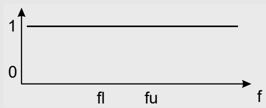
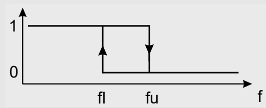
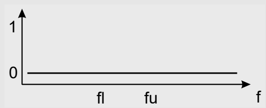
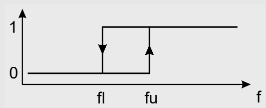
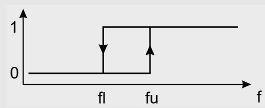
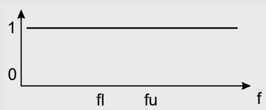
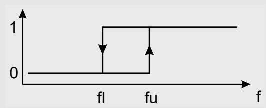
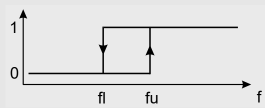
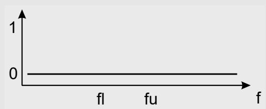
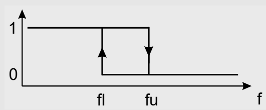
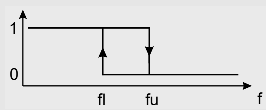
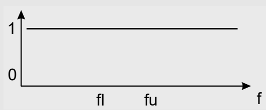
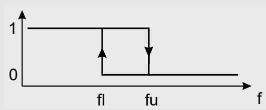
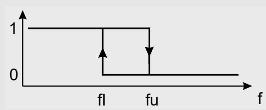
This display shows, whether the password programming-protection of the device is active. The operator of the device will receive infos to the password programming-protection on request in form of a separate data sheet.

```
programming
 protection=off
```

or

```
programming
 protection=on
```

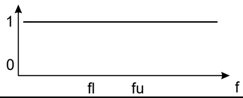
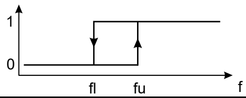
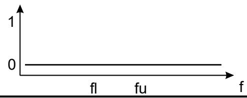
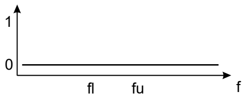
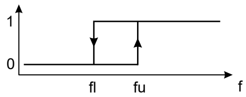
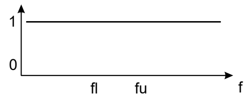
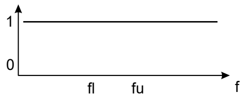
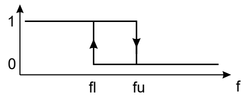
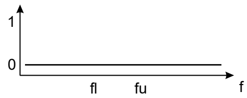
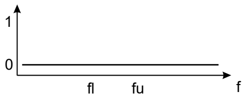
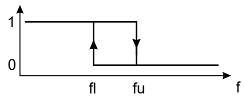
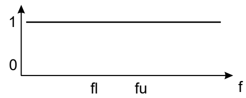
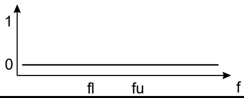
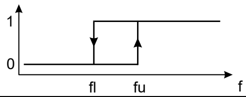
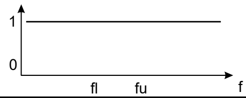
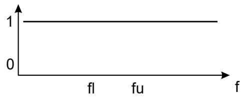
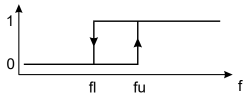
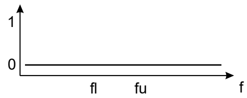
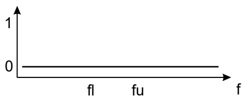
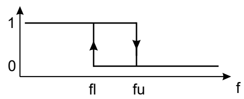
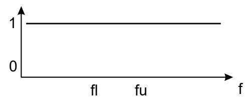
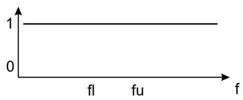
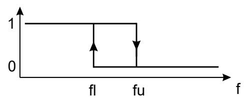
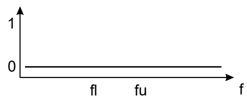
10 Switching Functions for the Relays

	Programming of the associated enable inputs		
	1,2,3,4, or 5		∅
programmed switching function	Relay status when the signal to the associated enable input is:		Relay status (independent of the enable signal)
	switched on	switched off	
-			
A			
B			
C			
D			
E			
F			
G			
H			

1: Operative position
0: Rest position

fu: programmed upper switching frequency
fl: programmed lower switching frequency

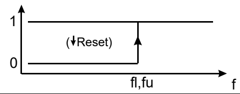
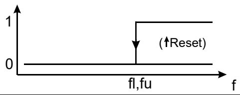
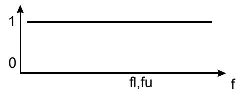
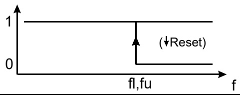
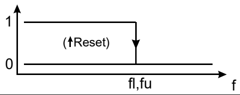
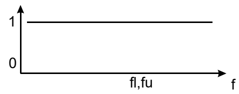
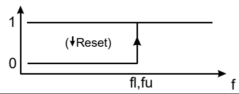
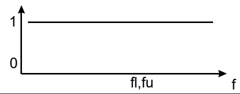
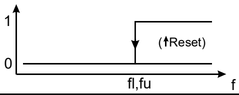
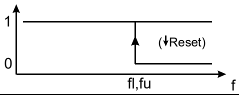
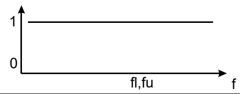
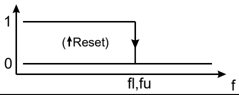
Table 8: Programmable hysteresis switching functions for the relays and their dependency on the enable signal

	Programming of the associated enable inputs 1,2,3,4, or 5		
programmed switching function	Relay status when the signal to the associated enable input is:		
	switched on, and tp has expired	switched on, while tp is running	switched off
A (t)			
B (t)			
C (t)			
D (t)			
programmed switching function	Relay status when the signal to the associated enable input is:		
	switched on	switched off, while tp is running	switched off, and tp has expired
E (t)			
F (t)			
G (t)			
H (t)			

1: Operative position
0: Rest position

fu: programmed upper switching frequency
fl: programmed lower switching frequency

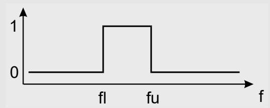
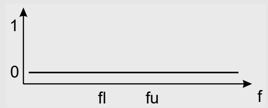
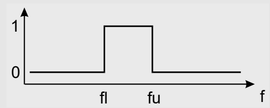
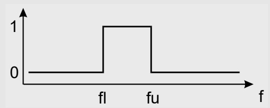
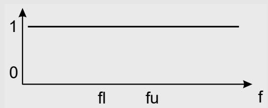
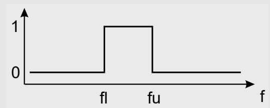
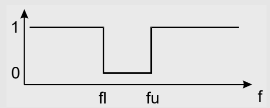
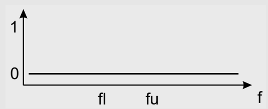
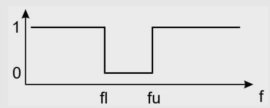
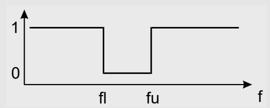
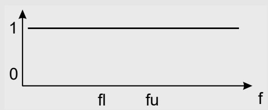
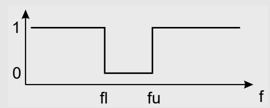
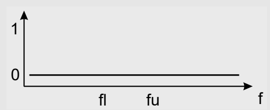
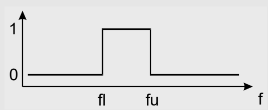
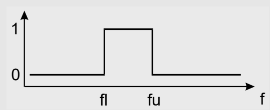
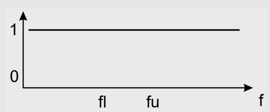
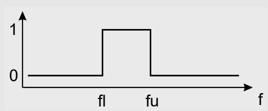
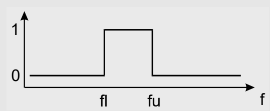
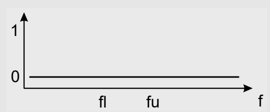
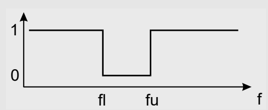
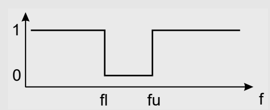
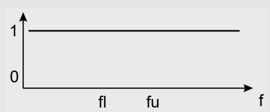
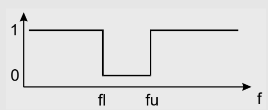
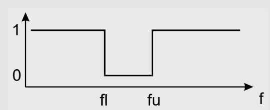
Table 9: Hysteresis switching functions with programmed maximum time until the relays switch and their dependence on the enable signal

	Programming of the associated enable (reset-) input		
	1,2,3,4, or 5 (∅ not possible with self-holding switching function)		
programmed switching function	Relay status when the signal to the associated enable input is:		
	switched on	switched off	
A (s)			Reset takes place if **no signal** is present at the associated reset input
B (s)			
C (s)			
D (s)			
E (s)			Reset takes place when applying a signal at the associated reset input
F (s)			
G (s)			
H (s)			

1: Operative position
0: Rest position

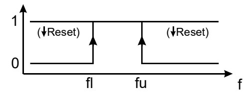
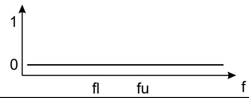
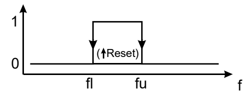
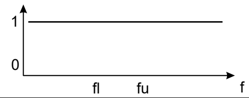
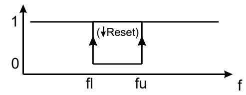
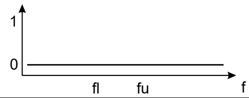
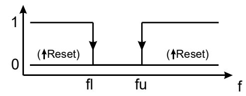
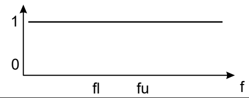
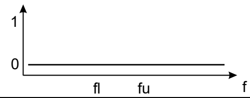
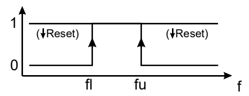
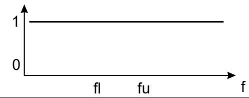
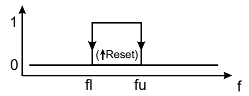
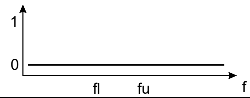
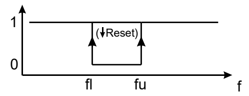
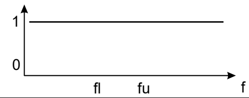
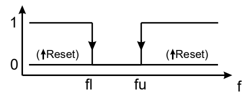
fu, fl: programmed switching frequency
with the switching functions A(s) .. H(s) it holds that fl = fu
(only 1 switching frequency)

Table 10: Hysteresis switching functions with programmed self-holding (latching)

	Programming of the associated enable inputs		
	1,2,3,4, or 5		Ø
programmed switching function	Relay status when the signal to the associated enable input is:		Relay status (independent of the enable signal)
	switched on	switched off	
I			
K			
L			
M			
N			
O			
P			
Q			

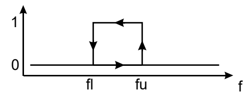
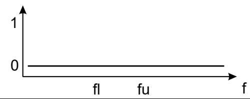
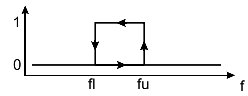
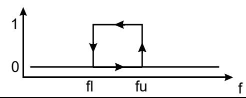
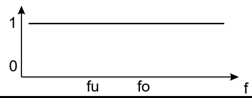
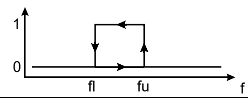
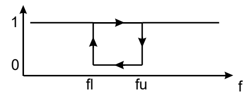
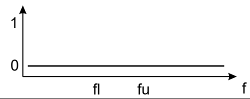
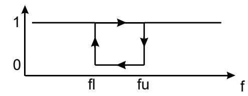
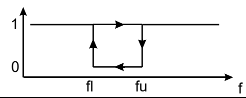
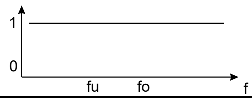
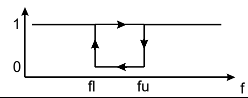
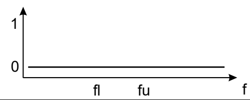
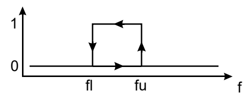
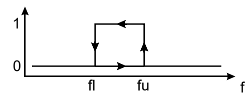
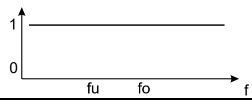
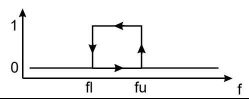
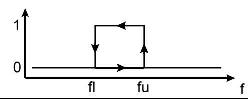
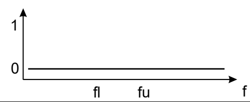
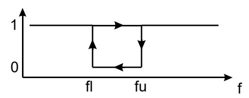
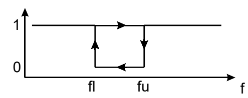
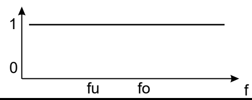
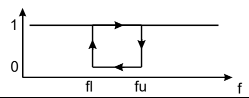
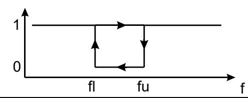
1: Operative position
0: Rest position
fu: programmed upper switching frequency
fl: programmed lower switching frequency

Table 11: Programmable window switching functions for the relays and their dependency on the enable signal

programmed switching function	Programming of the associated enable (reset-) input: 1,2,3,4, or 5 (∅ not possible with self-holding switching function) Relay status when the signal to the associated enable input is: switched on	switched off	
I (s)			Reset takes place if **no signal** is present at the associated reset input
K (s)			
L (s)			
M (s)			
N (s)			Reset takes place when applying a signal at the associated reset input
O (s)			
P (s)			
Q (s)			

1: Operative position
0: Rest position
fu: programmed upper switching frequency
fl: programmed lower switching frequency

Table 12: Window switching functions with programmed self-holding (latching)

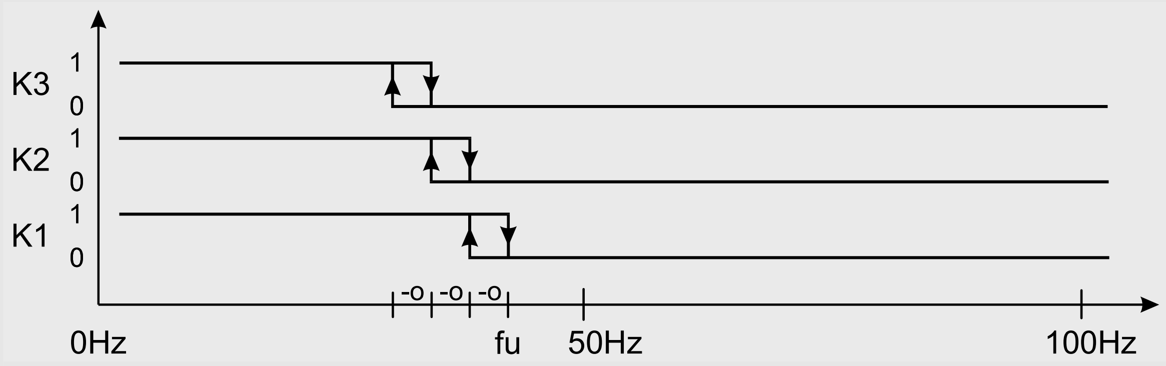
	Programming of the associated enable inputs		
	1,2,3,4, or 5		∅
programmed switching function	Relay status when the signal to the associated enable input is:		Relay status (independent of the enable signal)
	switched on	switched off	
I (k)			
K (k)			
L (k)			
M (k)			
N (k)			
O (k)			
P (k)			
Q (k)			

1: Operative position
0: Rest position

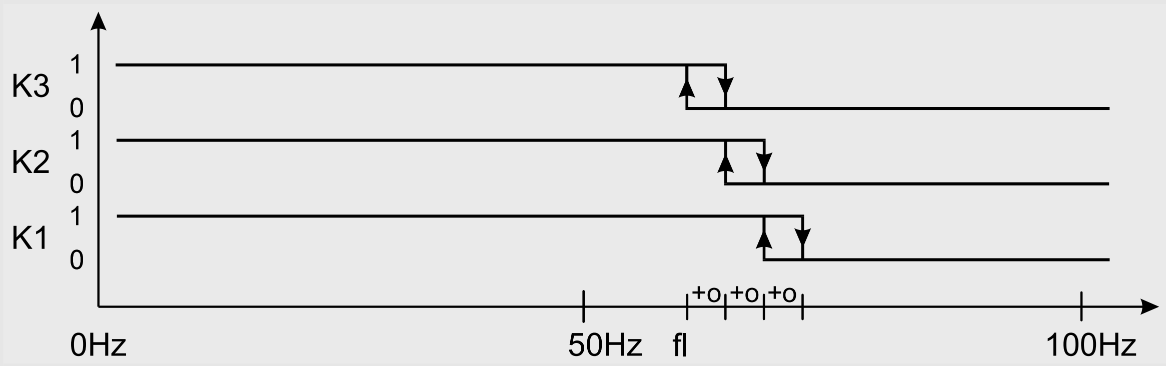
fu: programmed upper switching frequency
fl: programmed lower switching frequency

Table 13: Special window switching functions for counter operation

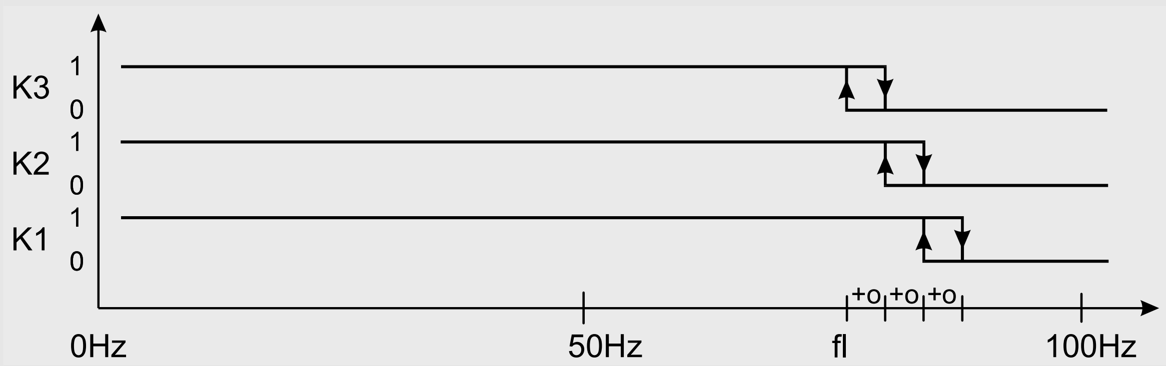
Lifting 1: Enable 1 active



Lowering 1: Enable 2 active



Lowering 2: Enable 3 active



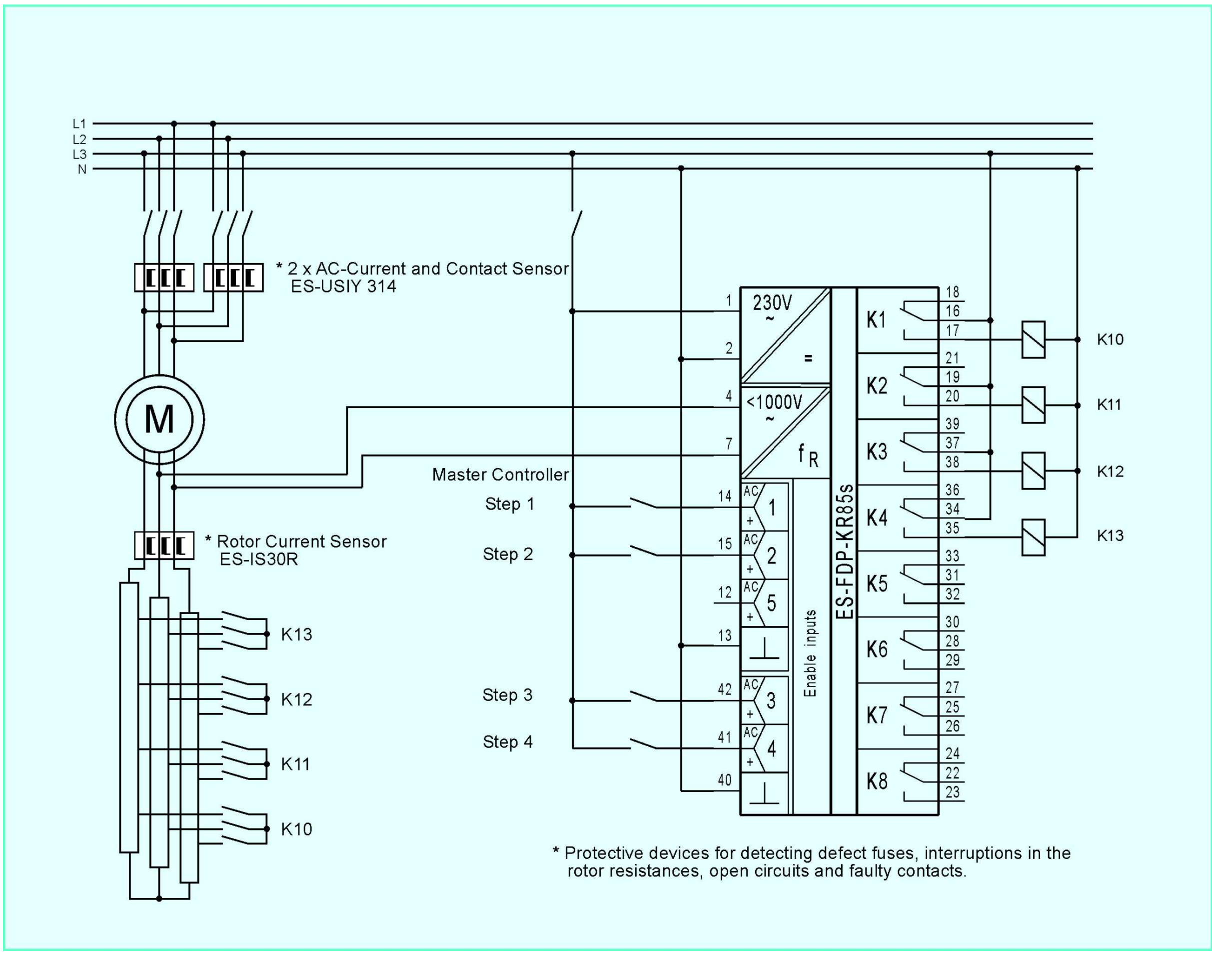
1: Operative position
0: Rest position

fu: programmed basic frequency for lifting
fl: programmed basic frequency for lowering

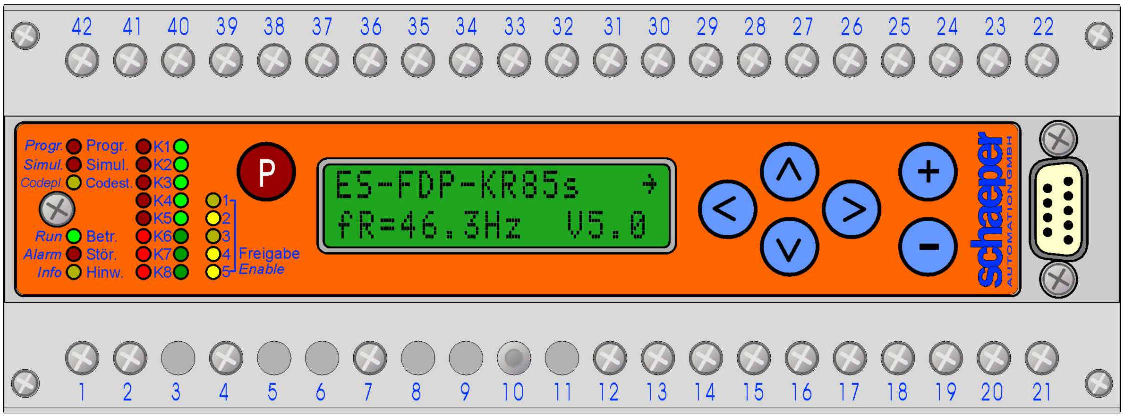
-o: switching hysteresis for lifting
+o: switching hysteresis for lowering

Table 14: Switching functions of the frequency channels K1, K2 and K3 in two-step operation

11 Connection Example



12 Terminal Allocation

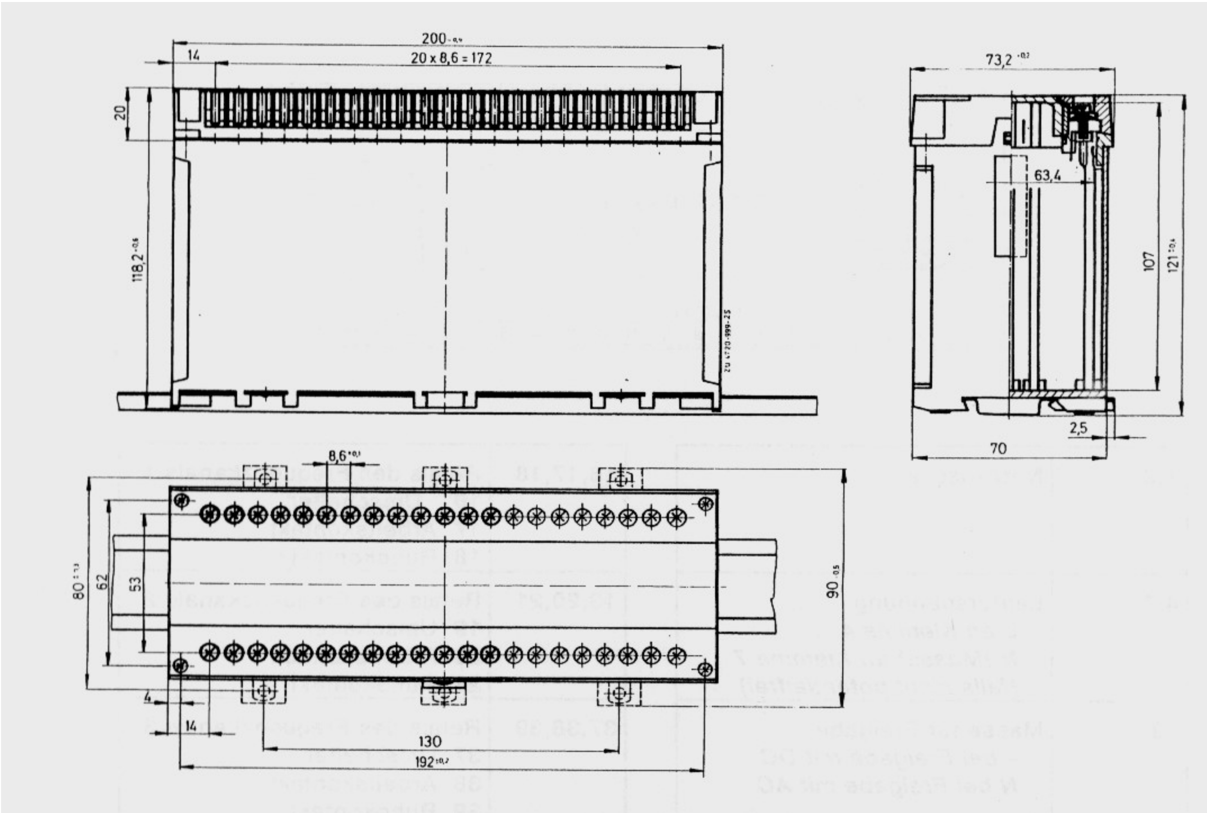


1,2	Power supply
4,7	Rotor voltage ***L** to terminal 4* ***N** (earth) to terminal 7* *(if not potential-free)*
14	Enable-input 1 (two-step operation: lifting 1) ***+** for enable with DC* ***L** for enable with AC*
15	Enable-input 2 (two-step operation: lowering 1) ***+** for enable with DC* ***L** for enable with AC*
12	Enable-input 5 ***+** for Enable with DC* ***L** for Enable with AC*
13	Earth for enable-inputs 1,2,5 ***–** for enable with DC* ***N** for enable with AC*
42	Enable-input 3 (two-step operation: lowering 2) ***+** for enable with DC* ***L** for enable with AC*
41	Enable-input 4 ***+** for enable with DC* ***L** for e-enable with AC*
40	Earth for enable-inputs 3,4 ***–** for enable with DC* ***N** for enable with AC*

16,17,18	Relay for the frequency channel 1 16 change-over switch 17 make contact 18 rest contact
19,20,21	Relay for the frequency channel 2 19 change-over switch 20 make contact 21 rest contact
37,38,39	Relay for the frequency channel 3 37 change-over switch 38 make contact 39 rest contact
34,35,36	Relay for the frequency channel 4 34 change-over switch 35 make contact 36 rest contact
31,32,33	Relay for the frequency channel 5 31 change-over switch 32 make contact 33 rest contact
28,29,30	Relay for the frequency channel 6 28 change-over switch 29 make contact 30 rest contact
25,26,27	Relay for the frequency channel 7 25 change-over switch 26 make contact 27 rest contact
22,23,24	Relay for the frequency channel 8 22 change-over switch 23 make contact 24 rest contact

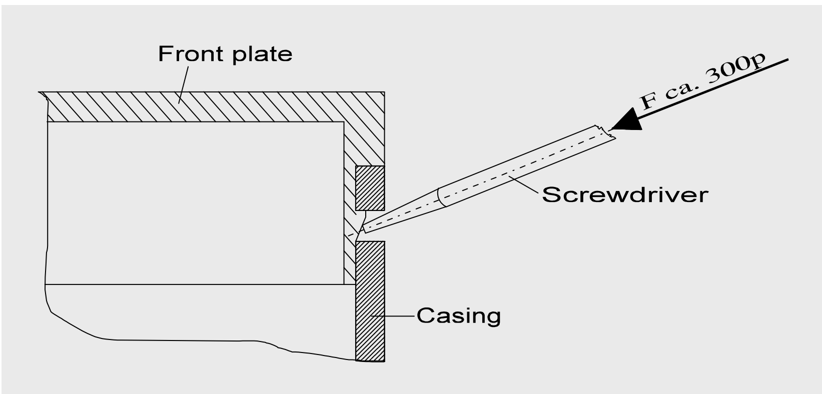
Connections should not be made to terminals not listed.

13 Housing Measurements



Removing the terminal strip: The terminal strip is loosened and removed from the device by unscrewing the two outer fastening screws. When changing the device the connector blocks are simply attached to the replacement device and screwed on. It is immediately ready for operation without any wiring work being necessary.

Removing the front plate: Both terminal strips must be removed before the front plate can be removed from the cover. This is then carried out as follows: place a screwdriver with a size of max. 0,6 x 4,5 DIN 5264 in one of the two recesses on the side, a light pressure is used to turn it to the left or right, thus unlatching the projection on the front plate from the casing. The same procedure must be carried out on the opposite side. The front plate can then be removed from the casing.



14 General Technical Data

Measurement input (U_{eff}): Terminals (4) and (7)	< 300 V continuous operation permissible < 500 V 1 min. ON / 1 min. OFF < 750 V 1 min. ON / 2 min. OFF < 1000 V 1 min. ON / 3 min. OFF (values are valid for 40°C ambient temperature) sensitivity: 1,5 V for input frequency <5 Hz 0,3 V/Hz for input frequency >5 Hz (low-pass behaviour for interference suppression) The measurement input is galvanically isolated.
Measurement error:	< 0,1 % (within the permissible ambient temperatures)
Measurement principle	Period-duration measurements with evaluation of the zero crossings
Enable inputs Terminals (12) to (15), (40) to (42)	230 V~, ±15%, ~ or =, other input voltages on request
Outputs Terminals (16) to (39)	8 relays, 1U, 260V~, 5A electrical contact life: 1,0 x 10^5 switching cycles at 250V~, 5A / 30V=, 5A and resistive load 3,5 x 10^4 switching cycles at 250V~, 5A and cos φ = 0,4 2,0 x 10^5 switching cycles at 250V~, 2A and cos φ = 0,4
Supply voltage Terminals (1) and (2)	230 V~, ±15%, 50 ... 60 Hz **Attention: the build-in Varistor for protection against voltage transients is not fuse-protected internally!**
Power consumption	ca. 15 VA
Fuses	soldered SMD fuse, 100mA slow, type SIBA 160000 / 0.1A
Ambient temperature:	-10 ... +50°C (operation) -20 ... +70°C (storage)
Housing measurements:	L = 200 mm, W = 75 mm, H = 126 mm with screw and snap-on mounting (DIN 46277, 35 mm rail)
Behaviour in fire:	according to UL: V-0 or VDE0304: stage I (housing and keys)
Connection terminals:	removable connector block with self lifting BI-slotted screws for 2x2,5mm^2; including terminal cover with protection against accidental contact according to VBG 4 and VDE 0106 part 100
Creep resistance :	Insulation group C250VE/300VG (creep distance 4 mm) according to DIN57110 and VDE0110
Protective system:	IP40
Weight:	approx.. 1300g

(Subject to changes)

15 Programming Reference Material for Normal Operation

ES-FDP-KR85s → fR=****Hz V5.0	language/Sprache :english
function K1-K3 Norm/Two-step :N	
K1:___→ fu:__._ fR=**** fl:__._	K1 tu:____s tl:____s
K2:___→ fu:__._ fR=**** fl:__._	K2 tu:____s tl:____s
K3:___→ fu:__._ fR=**** fl:__._	K3 tu:____s tl:____s
K4:___→ fu:__._ fR=**** fl:__._	K4 tu:____s tl:____s
K5:___→ fu:__._ fR=**** fl:__._	K5 tu:____s tl:____s
K6:___→ fu:__._ fR=**** fl:__._	K6 tu:____s tl:____s
K7:___→ fu:__._ fR=**** fl:__._	K7 tu:____s tl:____s
K8:___→ fu:__._ fR=**** fl:__._	K8 tu:____s tl:____s
EnIn-1 ton:____s -***- tof:____s	
EnIn-2 ton:____s -***- tof:____s	
EnIn-3 ton:____s -***- tof:____s	
EnIn-4 ton:____s -***- tof:____s	
EnIn-5 ton:____s -***- tof:____s	
OpCirMo fR<____→ aktiv if EnInp:_	K1..K8 rest pos. with open circ.
Simulat. f0:__._ fR=**** v:_ CS:_	
service- → information	...
self-test Error No:***	

Device-No.:

Date:

Place of assembly:

Construction-No.:

..: current values

16 Programming Reference Material for Two-Step Operation

Device-No.:

Date:

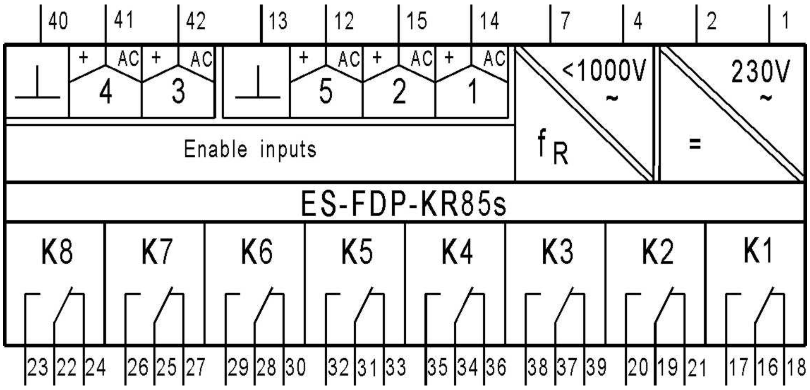
Place of assembly:

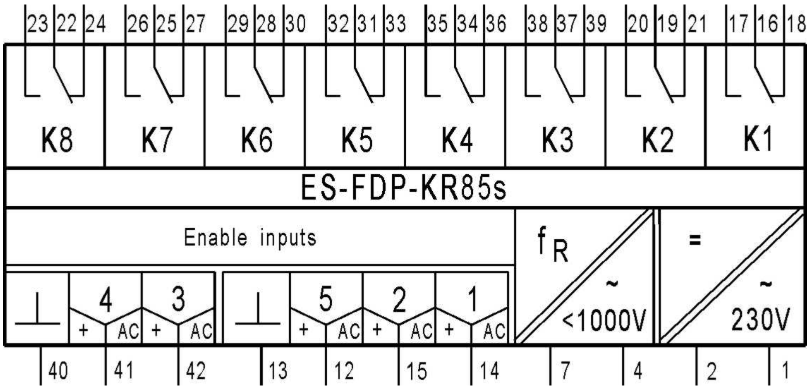
Construction-No.:

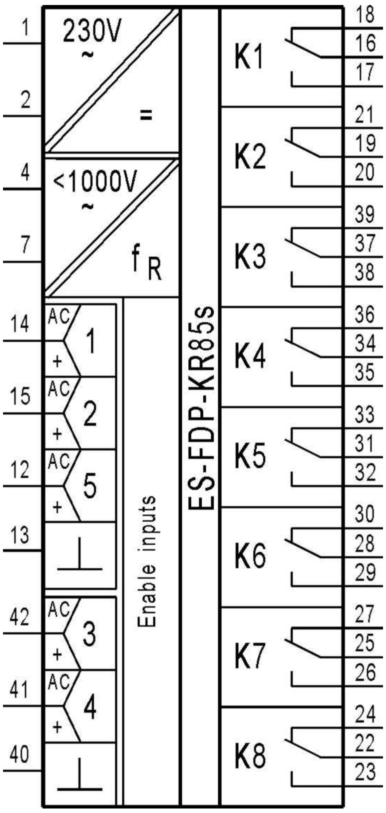
ES-FDP-KR85s → fR=****Hz V5.0	language/Sprache :english
funktion K1-K3 Norm/Two-step :T	
K1-3:UP1 fu:__._ fR=**** -o:_._	
K3-1:DN1 fl:__._ fR=**** +o:_._	
K3-1:DN2 fl:__._ fR=**** +o:_._	
K4:___→ fu:__._ fR=**** fl:__._	K4 tu:____s tl:____s
K5:___→ fu:__._ fR=**** fl:__._	K5 tu:____s tl:____s
K6:___→ fu:__._ fR=**** fl:__._	K6 tu:____s tl:____s
K7:___→ fu:__._ fR=**** fl:__._	K7 tu:____s tl:____s
K8:___→ fu:__._ fR=**** fl:__._	K8 tu:____s tl:____s
EnIn-1 ton:____s -***- tof:____s	
EnIn-2 ton:____s -***- tof:____s	
EnIn-3 ton:____s -***- tof:____s	
EnIn-4 ton:____s -***- tof:____s	
EnIn-5 ton:____s -***- tof:____s	
OpCirMo fR<____→ aktiv if EnInp:_	K1..K8 rest pos. with open circ.
Simulat. f0:__._ fR=**** v:_ CS:_	
service- → information	...
self-test Error No:***	

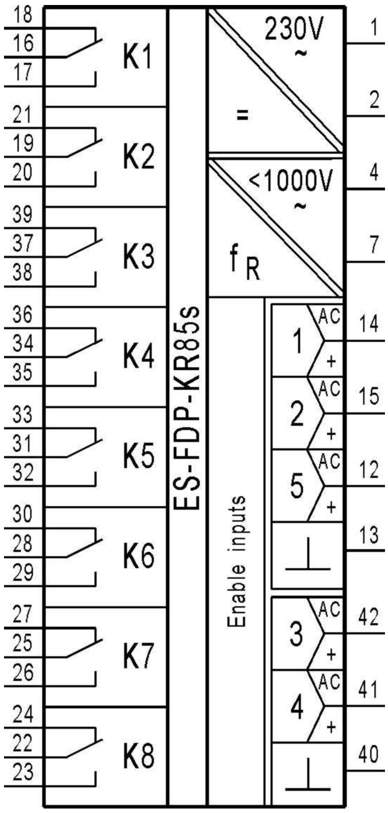
..: current Values

17 Wiring Symbol









18 Appendix: Differences to the Device Versions ES-FDP-KR85a, ES-FDP-KR85e and ES-FDP-KR85e/n

With the device version ES-FDP-KR85ℓ a modification of the hardware, compared to the older versions, was carried out in 1995 in order to achieve a higher interference immunity. This concerns the terminal assignment of the terminals 12, 13, and 40 for the enable inputs, as well as the required voltage level for the enable inputs.

The differences are shown in the following table:

	Devices before 1995: **ES-FDP-KR85a,** **ES-FDP-KR85e,** **ES-FDP-KR85e/n**	Devices since 1995: **ES-FDP-KR85s,** **ES-FDP-KR85n,** **ES-FDP-KR85ℓ** **ES-FDP-KR85ℓx**
Terminal assignment for the enable inputs	**Terminal 13:** Common ground for all enable inputs **Terminal 40:** Enable input 5 **Terminal 12:** Not connected	**Terminal 13:** Ground for enable inputs 1, 2 and 5. **Klemme 40:** Ground for enable inputs 3 and 4. **Klemme 12:** Enable input 5
Voltage range of the enable inputs	Wide range enable inputs (for 24 ... 250 V~ or 20 ... 250 V=). Due to the large voltage range, there is a high risk of interfe-rence.	Enable inputs designed for a voltage of 230V ± 15% (optional 24V ± 15%), this reduces the risk of interference.
Circuit diagram