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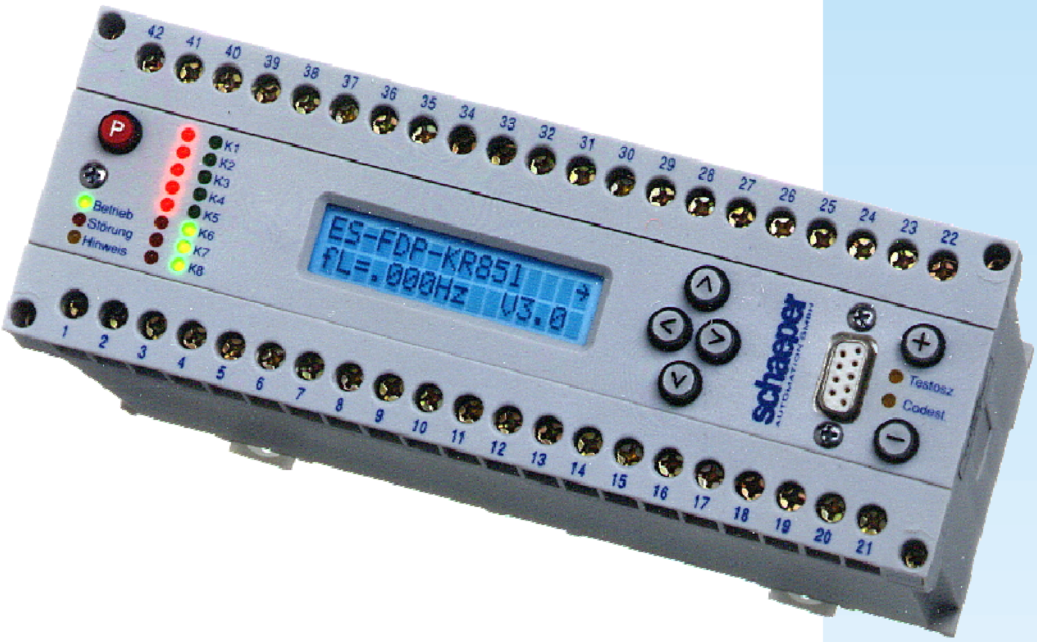
ES-FDP-KR85ℓ

Digital Crane Frequency Control

Operating Instructions



Important differences to ES-FDP-KR85e

The crane frequency control ES-FDP-KR85l is a revised version of the ES-FDP-KR85e so that it is possible to achieve even better interference immunity. Furthermore, the display was provided with back-lighting for better readability with poor light conditions.

With exchange of an ES-FDP-KR85e (or ES-FDP-KR85a) for an ES-FDP-KR85l, the following differences should be noted:

1. Terminal assignment:
The **enable input 5** is no longer at terminal 40 (upper terminal strip), but at **terminal 12** (lower terminal strip). **Terminal 40** is now the **enable ground** for the enable inputs 3 und 4.

2. Enable voltage:
In order to reduce the danger of interference, the **voltage range of the enable inputs** is now restricted to **230V ± 15%.** Enable inputs for an expanded voltage range or for low voltages are available on request.

Differences between the types ...KR85ℓ und ...KR85ℓx

Since the beginning of 2003 the digital crane frequency controls ES-FDP-KR85ℓ are equipped with a new processor pcb, which exhibits again clearly improved interference protection in relation to the old version.

Since all functions remained alike, the unit type and the part code in the context of this measure did not change.

Outwardly the two versions are perceptible by the fact that the new version during supply with mains voltage announces in the basic display KR85ℓx in place of KR85ℓ. Furthermore on the small label for the software-version at the side of the new unit is written ES-FDP-KR85ℓx in place of ES-FDP-KR85ℓ.

Important:

For a high degree of operating safety, the unit has a **Watchdog**, an **EEPROM with software write protection** in order to prevent a change of the programmed parameters with strong external interferences, as well as software expanded with a **safety program. 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.**

Other versions of the device:

- Frequency and speed monitor, ES-FDP-F..., Frequency range 0,001 ... 2 000 Hz

- Shaft break and slip monitor, ES-FDP-S...., also frequency ratios other than 1

- Resolver and position detector, ES-FDP-P..., for monitoring position and speed

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 requested.

These operating instructions are for the crane frequency control system *ES-FDP-KR85L* as the device stands in June 2004. The current software version is **V3.2. Subject to alterations.**

Application

Type KR85l is a version of the frequency and speed monitor ES-FDP especially for cranes (for other versions see page 4). 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 KR85l, e.g. without time delay for the relays, are also available.

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

- extremely large space savings
- especially easy to programme using large L.C.-Display with back-lighting
- switching frequencies programmable within the range 0,.1 .....99.9 Hz
- protection from unauthorised programming by means of a code plug
- light diodes which show operating status
- 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 delay) which can be allocated to the switching channels as required (exception: two-step operation)
- normal or two-step operation
- internal test oscillator for function test (including crane 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)
- EEPROM for programmable values (no batteries required), with software write protection for extremely high data safety
- high noise immunity (watchdog, special data coding for automatic error recognition)
- easy to service with **removable screw-on terminal strip, thus enabling the devices to be changed quickly without the danger of wiring errors**

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1 Displays and Operation

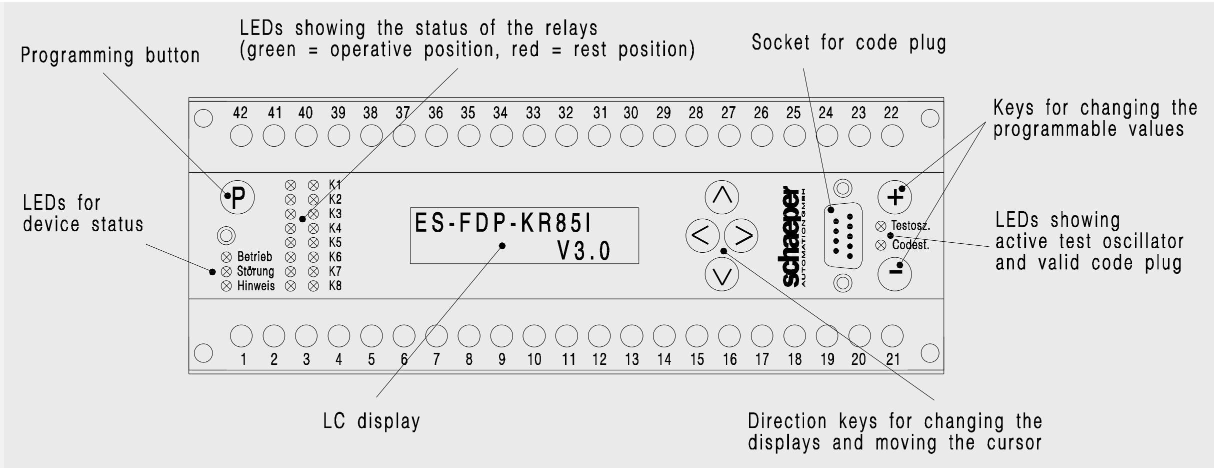


Fig. 1: Operating elements of the device

1.1 Light Diode Displays

Betrieb *(operation)* **(green)**
Mains voltage is connected and the self-test is finished.

Störung *(error)* **(red)**
The programme flow has been disturbed by external influences (e.g. considerable interference from connected line, EMP) or due to an internal error in the device. The LED is switched on when a error is detected and remains on for approx. 1 s after the automatic error correction has been completed. Errors which occur very frequently result in this light being on permanently.

Hinweis *(information)* **(yellow)**
The use of microprocessors in the device enables information to be given regarding disturbing influences which only occur temporarily, thus enabling preventative measures to be taken. The LED lights up at the same time as the error LED, however does not go out until it has been acknowledged. To acknowledge: the display **Selbsttest** *(self-test)* is selected. The respective error number will appear. With the code plug connected, the key > should be pressed repeatedly until, instead of an error number, the word "**keine**" *(none)* appears. The error numbers should be noted so that an error analysis can be carried out at a later point in time.

```
Selbsttest
Fehler-Nr:***
```

(self test error number:)
***: current error No..

If the code plug is not connected the key > does not switch off the LED, but simply shows the error numbers.

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

Testosz. *(test oscillator)* **(yellow)**
Test oscillator is on (simulated operation, instead of **fL - fT** appears in the display)

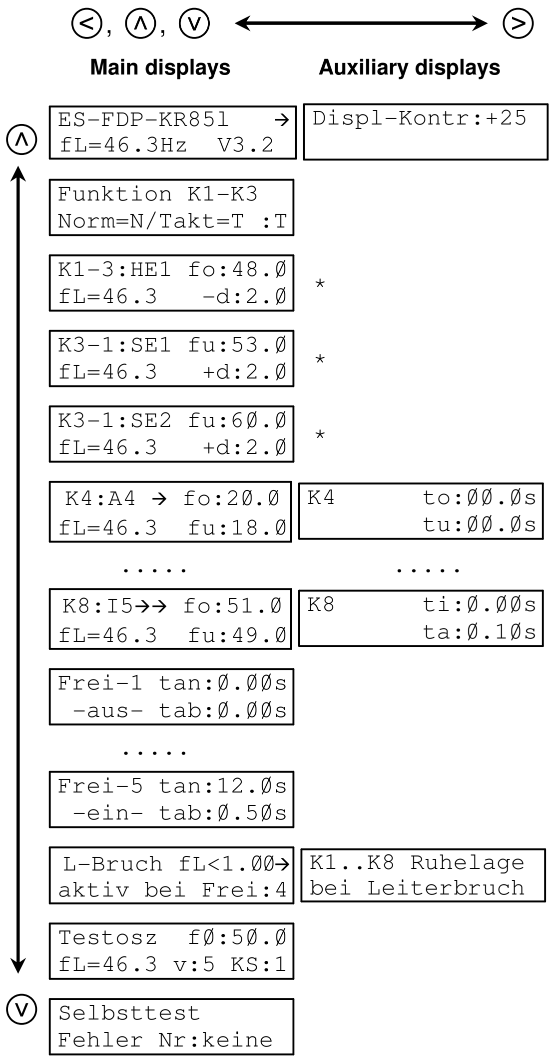
Codest. *(code plug)* **(yellow)**
Valid code plug is connected
Programming possible (**PRGM**)

1.2 LC-Display

1.2.1 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.

ES-FDP-..	Device specification
V..	Software version
K..	Frequency channel
K1-3	Frequency channels 1 to 3
Norm (N)	Normal-operation (see tables 6 and 7, page 18)
Takt (T)	Two-step operation (see table 8, page 20)
HE1	Lifting 1 (enable input 1)
SE1	Lowering 1 (enable input 2)
SE2	Lowering 2 (enable input 3)
fo:..	upper switching frequency; with two-step operation: basic frequency for lifting
fu:..	lower switching frequency; for two-step operation: basic frequency for lowering
to:..	Relay switching delay at upper switching value for hysteresis switching function
tu:..	Relay switching delay at lower switching value for hysteresis switching function
ti:.., ta:..	Relay switching delays for window switching function (I..Q)
fL=..	Measurement frequency from input
fT=..	Measurement frequency from internal test oscillator
+d:..	Positive frequency offset
-d:..	Negative frequency offset
Frei-..	Enable input
tan:..	Response time delay for enabling (s)
tab:..	Drop-off time delay for enabling (s)
-ein-	Signal to enabling input
-aus-	No signal to enabling input
L-Bruch	Open circuit monitoring
..aktiv	Open circuit monitoring is active
..aus	No open circuit monitoring programmed
L-Br	Appears in display instead of measured frequency when the open circuit monitoring has responded
Frei:..	Allocated enabling input
Testosz	Test oscillator
fØ:..	Initial-frequency
v:..	Speed with which the values of the test oscillator change
KS:..	Type of operation of the test oscillator (crane simulation on/off)
	Indication of an auxiliary display
	A time delay has been programmed for this output
PRGM	Programming mode



*: This example shows the displays for two-step operation. With normal operation the displays **K1**, **K2**, **K3** and the displays to their right for delay times are exactly the same as those for **K4**.

Table 1: Sequence of the displays and the significance of the display texts

1.2.2 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 version-No. **V** for the software will be shown in the lower line.

```
ES-FDP-KR85l  →
fL=****Hz  V3.2
```

****: current rotor frequency

1.2.3 Selecting the Displays

The sequence of the displays is shown in table 1 (page 9). 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.

1.2.4 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 **fL=.....** The text **L-Br** instead of the current frequency indicates that the open circuit monitoring has responded. The display changes from **fL** to **fT** during simulated operation using the test oscillator.

In the displays **Frei-1** ... **Frei-5** a superimposed "**-ein-**" *(on)* or "**-aus-**" *(off)* shows whether there is a voltage applied to the enable input.

2 Programming (PRGM)

	the key to be used
1. Select required display	∧, ∨, <, >

2. Switch on programming mode
`K4:A1 → fo:20.0`
`PRGM     fu:18.0`
(In the display **PRGM** and the mark "_" will appear)
	P

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)	P and + (simultaneously) or P 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 P!)

Table 2: Programming sequence

Switching function	[–] [A] [B] [C] [D] [E] [F] [G] [H] [I] [K] [L] [M] [N] [O] [P] [Q]
Number of an enable input	[Ø] [1] [2] [3] [4] [5] , with open phase also [÷]
Digits for switching values and delay times	[Ø] [1] [2] [3] [4] [5] [6] [7] [8] [9] , with times also [.]
Display-contrast	[–99] ... [+99]
Type of function (normal/two-step)	[N] [T]

Table 3: Permissible values for programming

2.1 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 8). 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:

```
PROGRAMMIERUNG
GESPERRT
```

(programming not possible)

2.2 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 2. 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 3 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.

2.3 Display Contrast

The value can be programmed anywhere between -99 to +99. Changes in the value take immediate effect, allowing the LC-display to be easily adjusted to give the best contrast for any angle of vision.

```
Displ-Kontr:+15
```

2.4 Type 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 8. **K1** to **K3** switch with an offset of the programmable frequency **d**, 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:

```
Funktion K1-K3
Norm=N/Takt=T :T
```

(Normal = N/Two-step = T)

Warning: when changing the programming from normal to two-step operation or vice-versa the data for the frequency channels **K1** to **K3** change automatically.

2.5 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 4).

Main display and auxiliary display for a switching channel (the programmable parameters have been underlined)
 	
`K1:A4→→ fo:22.5` / `PRGM     fu:18.5`
`K1       to:Ø.Ø5s` / `         tu:ØØ.Øs`
	`K1:` first frequency channel selected
	`PRGM` programme mode is switched on
	→→ Indication of a programmed delay time in auxiliary display
	
	<u>Main display:</u>
	`A` selected switching function
	`4` enable input 4 has been allocated
	`22.5` upper switching frequency **fo** in Hz
	`18.5` lower switching frequency **fu** in Hz
	
	<u>Auxiliary display</u>
	`Ø.Ø5` Delay time **to** programmed at Ø.Ø5s
	`ØØ.Ø` no delay time **tu** programmed

Table 4: Programmable parameters for a switching channel in normal operation mode

2.5.1 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 6, S. 18) and **window switching functions I ... Q** (Table 7, S. 19).

Hysteresis switching functions A ... H: Because two switching values **fo** and **fu** can be programmed this gives a switching hysteresis (**fo** - **fu**). 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 (**fo**: 51 Hz **fu**: 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.

2.5.2 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 **Ø** is programmed in then the respective switching channel is always activated, i.e. an enable signal is not necessary.

2.5.3 Switching Frequencies

On the right in the upper line the upper frequency **fo** is shown, and directly underneath the lower frequency **fu**. The two values **fo** and **fu** 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.

2.5.4 Time Delay for the Outputs

In the standard version of the device all switching channels which do not function in two-step operation the main display of the switching channel indicates that the respective output has a time of an auxiliary display, cf. chapter:. LC-Display, page 9). The delay times are programmed in the auxiliary displays.

```
K3:C4→→  fo:4Ø.Ø | K3        to:Ø.Ø5s
fL=****  fu:38.Ø |           tu:Ø.7Øs

K4:I5 →  fo:2Ø.Ø | K4        ti:ØØ.Øs
fL=****  fu:18.Ø |           ta:ØØ.Øs
```

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

With the switching functions **I** - **Q** (window) the delay time **ti** is effective if the measurement value, **fL** enters into the window range. The time **ta** is effective when the measured value, **fL** 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).

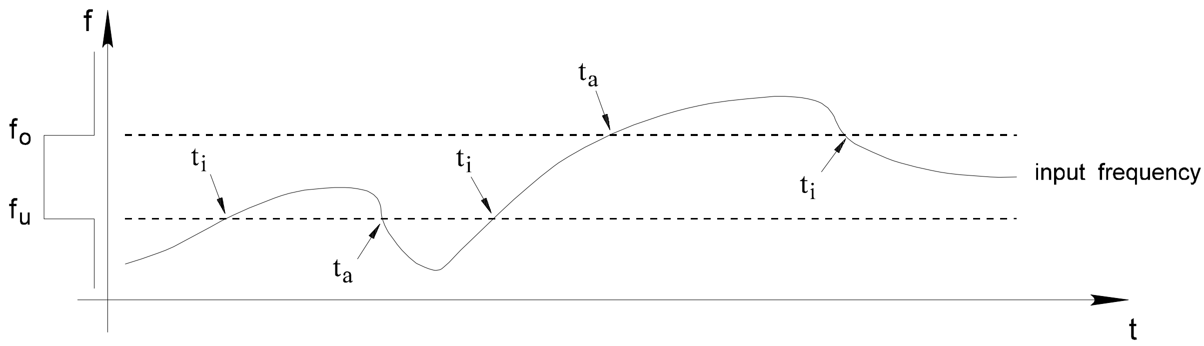


Fig. 2: Time delays for the relays with the window switching functions I-Q

2.6 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 8 (page 20). 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 **d**. The value of the frequency difference **d** is also the switching hysteresis for the channels **K1** to **K3** (table 8, page 20).

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

```
K1-3:HE1 fo:48.Ø
fL=****   -d:2.Ø
```

****: 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 **+d** (in the example by 1,5 Hz).

```
K3-1:SE1 fu:53.Ø
fL=****   +d:1.5
```

```
K3-1:SE2 fu:6Ø.Ø
fL=****   +d: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

2.7 Enable Delay Times

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

```
Frei-1 tan:Ø.ØØs
 -aus- tab:Ø.ØØs
```

Fig. 3 shows the validity of the times **tan** and **tab.** An **-ein-** (on) or **-aus-** (off) in the display indicates whether a signal is applied to the enable input.

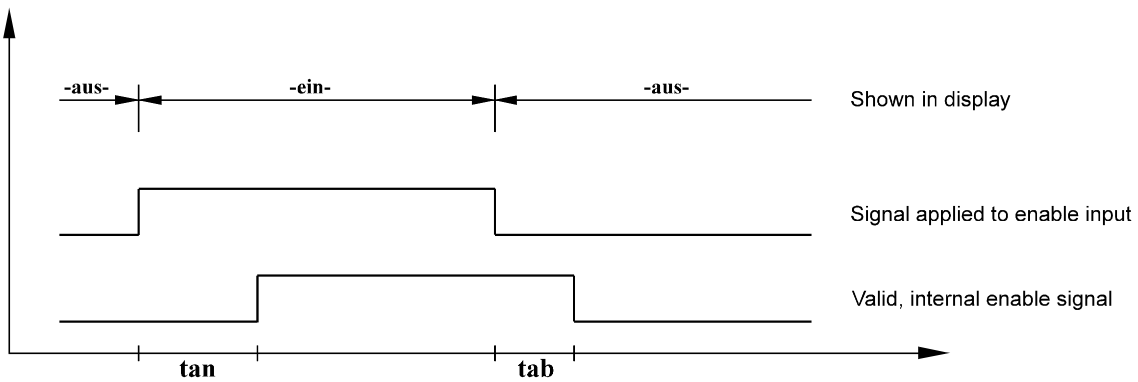


Fig. 3: Delay times for enabling

2.8 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.

```
L-Bruch fL<1.ØØ→  K1...K8 Ruhelage
aktiv bei Frei:4  bei Leiterbruch
```

(Open circuit active with enable 4) (Rest position with open circuit)

The frequency is programmed after **fL<**. 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, an enable input can be used to activate this function. The digit after **Frei:** can be programmed and indicates the allocated enable input. The digit **Ø** indicates that the open circuit monitoring is always activated.

If, instead of a digit, a "÷" is programmed then the open circuit monitoring is deactivated and the word "**aus**" *(off)* will appear in the upper right hand side of the display after the programming has been completed.

```
L-Bruch fL aus
     bei Frei: ÷
```

To reactivate simply re-program with a digit.

If the open-circuit monitor has responded then "**fL=L-Br**" will appear in the display instead of the input frequency.

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

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

2.9 Test Oscillator

The test oscillator serves to simulate the switching functions of the device without a rotor frequency being applied.

```
Testosz  fØ:5Ø.Ø
fL=**** v:5 KS:1
```

****: current rotor frequency

The initial frequency with which the test oscillator begins at the start of a simulation is shown in the top right of the display. When the test oscillator is activated (only possible with the code plug connected), the direction of the frequency changes can be determined using the keys ⊕ (frequency increases) or ⊖ (frequency decreases). The speed that the frequency changes is determined by the value **v** which is programmed with values (**v:Ø**), slow, to (**v:9**), fast.

The test oscillator is activated and deactivated by pressing the keys ⊕ and ⊖ simultaneously. The frequency range of the test oscillator is from 0.1 to >100 Hz.

Note: the test oscillator can only be activated if the rotor frequency is below 0.1 Hz. The device turns the test oscillator off automatically if a voltage is applied to the measurement input or the code plug is removed.

The test oscillator can be set for crane simulation. To do this the value **KS** is set to **1**. When a frequency of 5 Hz is reached the oscillator will now jump to a frequency of 95 Hz, enabling counter operation to be simulated. **KS** = **0** indicates normal operation.

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

3 Device Errors

3.1 Self-test

All the time it is in operation, the device carries out a continual self-test. If an error occurs the LEDs **Hinweis** *(info)* and **Störung** *(error)* light up on the front of the device. At the same time all relays are switched to the rest position. The device will usually eliminate the error automatically and will then return to normal operation. The **Störung-**LED will remain on for approx. ca. 1 sec after the error has been eliminated (to enable it to be read more easily) and then goes out; the **Hinweis**-LED will continue to be lit until it is acknowledged. The current error number can be read in the display **Selbsttest**. Acknowledgement is carried out as described on page 8. An interruption in the voltage supply also deletes the error numbers and resets the **Hinweis**-LED.

```
Selbsttest
Fehler-Nr:***
```

(self-test error number:)
***: current error number

If external interference has caused a change in the data programmed in the EEPROM then the following message is shown in the **Selbsttest**-display:

```
Selbsttest
Daten-Fehler:***
```

(self-test data error)
***: current error number

In this case, the red error-LED remains permanently lit and all relays stay in the rest position. To restart, the **Selbsttest**-display is selected and then the Ⓟ key is pushed. The message **Neuprogrammierung** *(re-programming)* will appear in the display. When the keys ⊕ and ⊖ are pressed (simultaneously) the device will correct all faulty data to permissible values.

Warning: All programmed data <u>must</u> then be checked.

3.2 Meaning of the Error Messages

Extreme external interference can cause errors in the programme flow or in the stored data. The device recognizes this by means of the self-test and undertakes the respective correction. The errors found and the corrective measures are shown by error numbers (cf. table 5). The error number, therefore, indicates the influence of the error. However, the cause (i.e. the source of the disturbance) cannot be recognized by the test program.

Error number	Significance
001...015	Error in programme flow
016...063	Data error in internal processor register
064...095	Data error in programme control register
096...127	Data error in switching register for crane control
128...143	Data error in RAM
144...159	Check sum error in EEPROM
160...223	Unallowed values in EEPROM
240...242	Data error in RAM

Table 5: Error numbers of the self-test

3.3 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.

3.4 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.

3.5 Wear of Relay Contacts at inductive Loads

If the output relays switch inductive loads (e. g. relays) 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 **Hinweis** – 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.

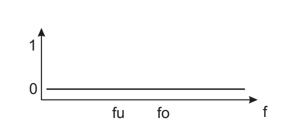
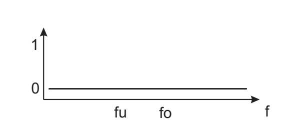
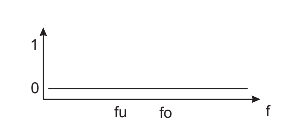
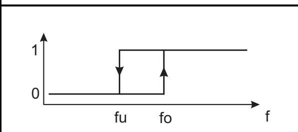
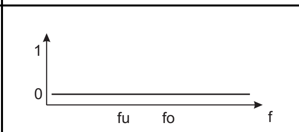
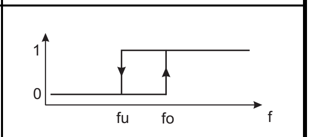
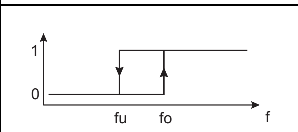
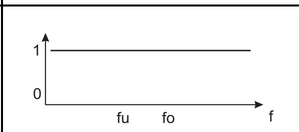
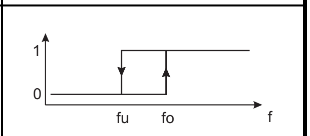
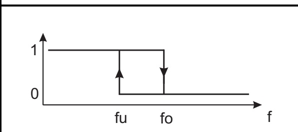
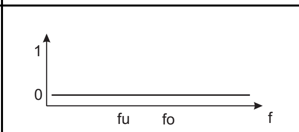
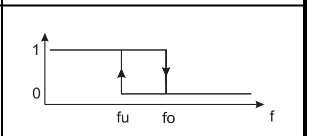
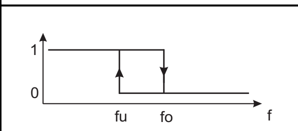
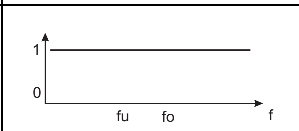
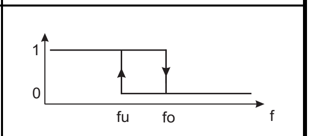
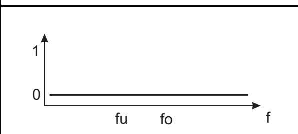
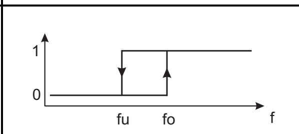
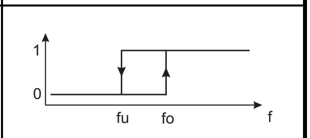
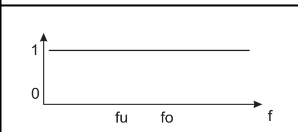
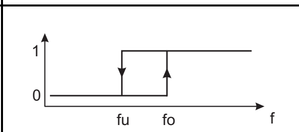
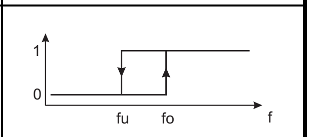
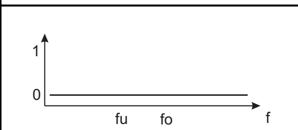
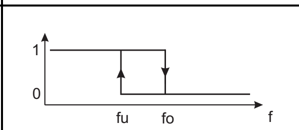
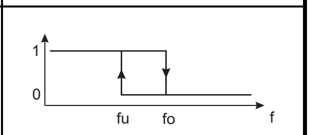
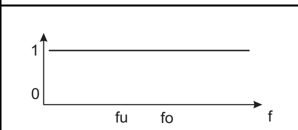
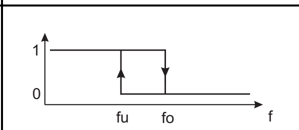
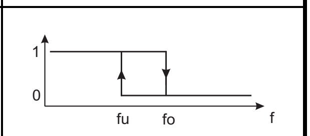
Pay attention that each damping circuit of the contactors can entail an increase of the switch-off delay time.

3.6 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 24. Now the plugged-in circuit boards can be removed from the housing.

A fuse of the type **TR5 100 mA/250 V, slow-blow** should be soldered in. Care must be taken when re-assembling that the plug contacts are seated correctly!

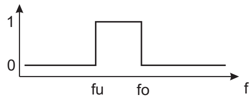
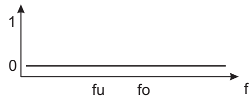
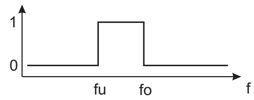
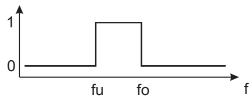
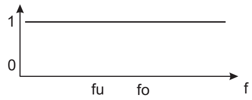
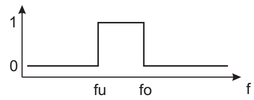
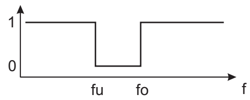
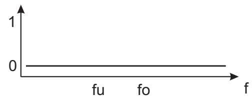
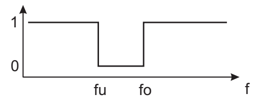
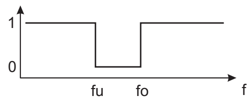
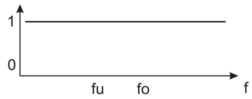
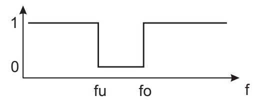
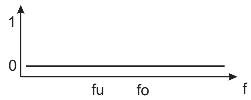
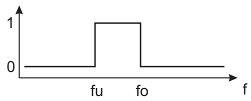
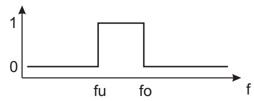
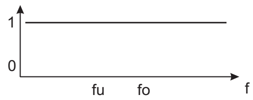
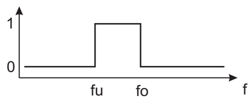
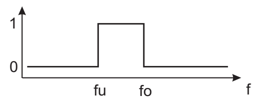
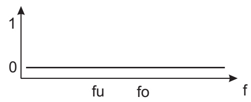
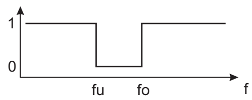
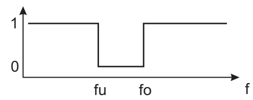
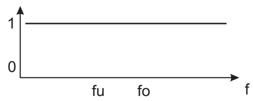
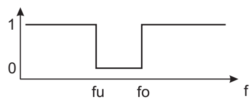
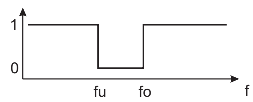
4 Switching Functions for the Relays

	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	
-			
A			
B			
C			
D			
E			
F			
G			
H			

1: Operative position
0: Rest position

fo: programmed upper switching frequency
fu: programmed lower switching frequency

Table 6: Programmable hysteresis switching functions for the relays and their dependency on the enable signal

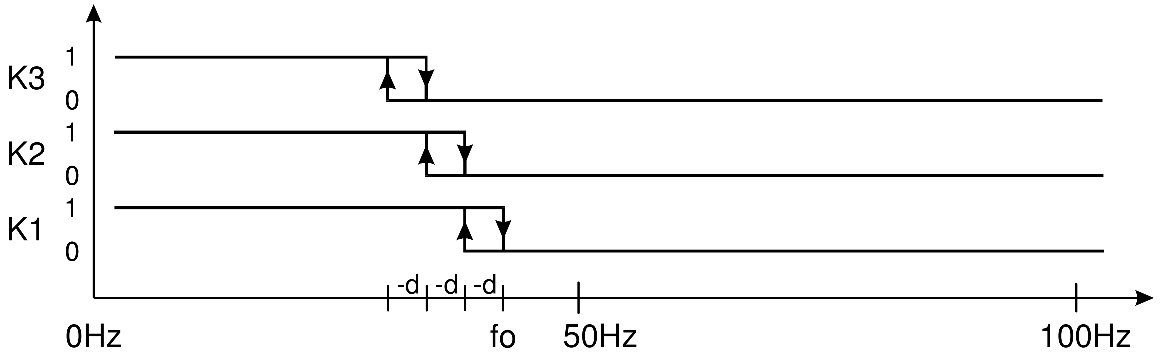
	Programming of the associated enable inputs		
	1,2,3,4, or 5		Ø
programmed switching function	Relay status when the signal to the associated enable input is:		Relay status (independent of the enable signal)
	switched on	switched off	
I			
K			
L			
M			
N			
O			
P			
Q			

1: Operative position
0: Rest position

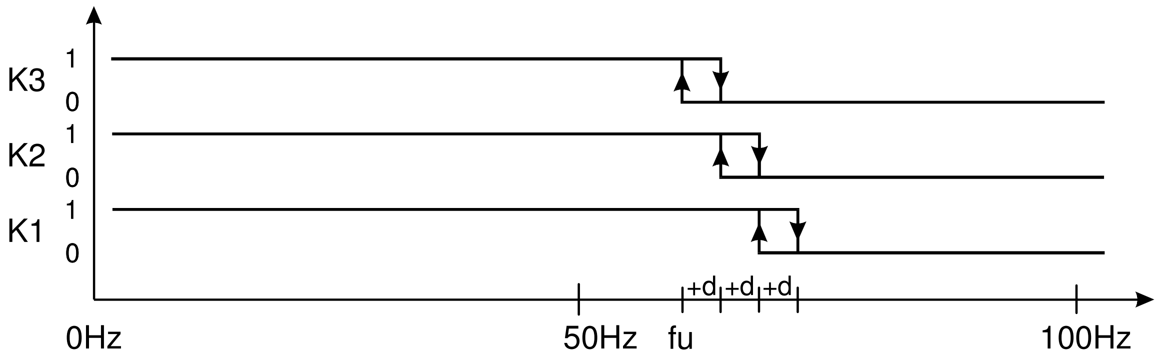
fo: programmed upper switching frequency
fu: programmed lower switching frequency

Table 7: Programmable window switching functions for the relays and their dependency on the enable signal

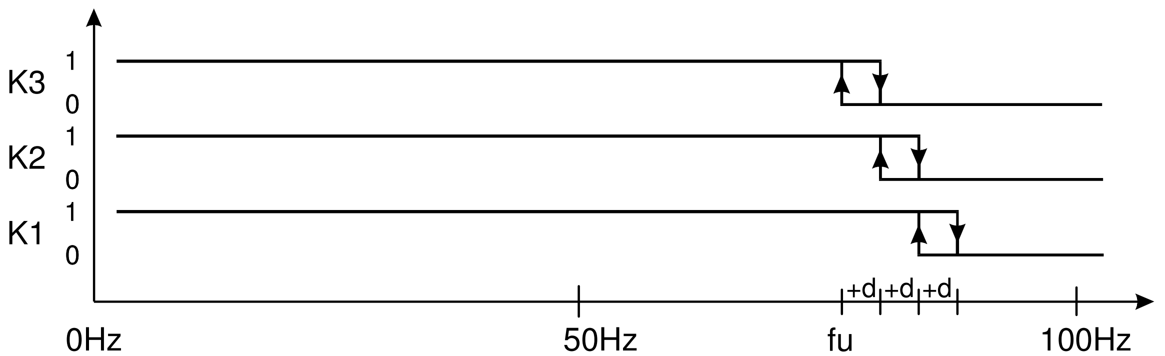
Lifting 1: Enable 1 active



Lowering 1: Enable 2 active



Lowering 2: Enable 3 active



1: Operative position
0: Rest position

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

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

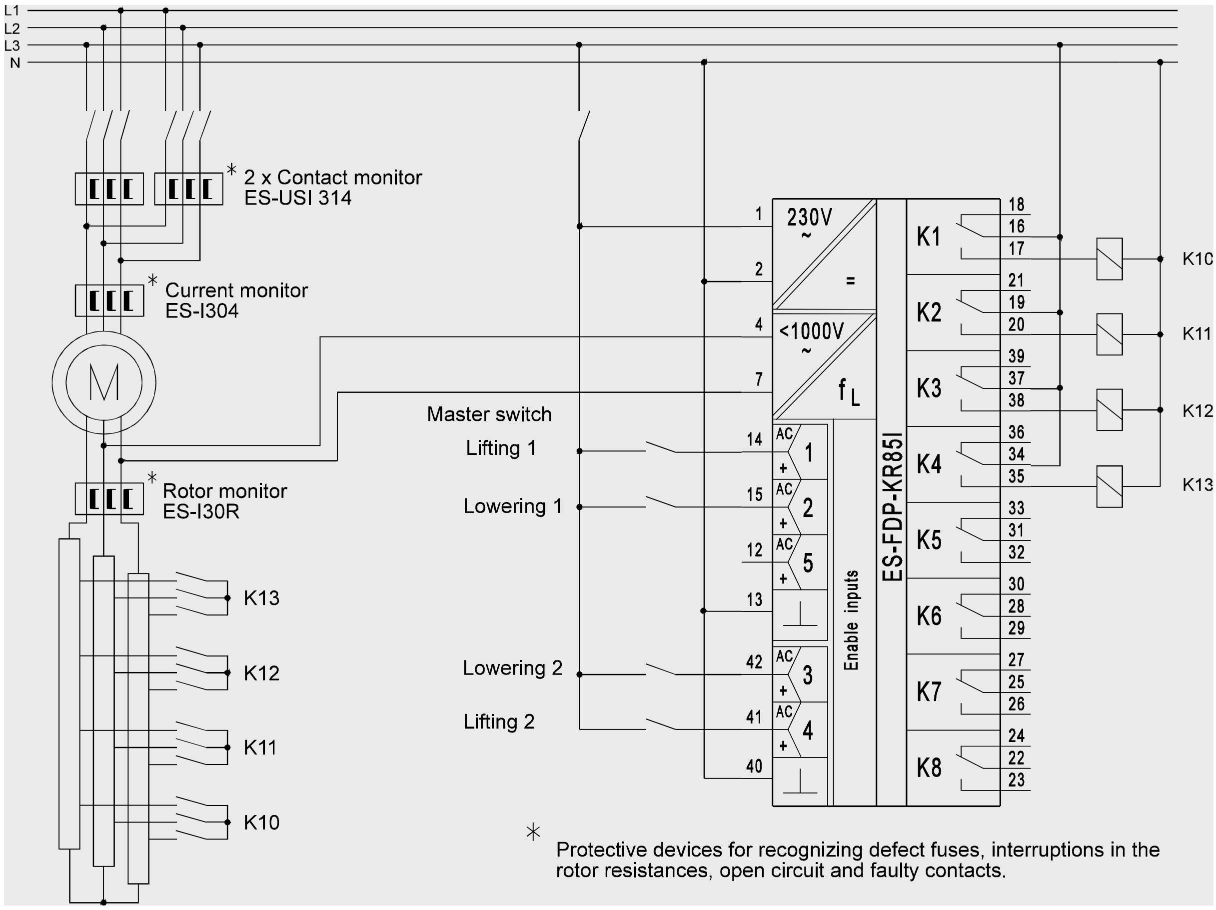
Table 8: Switching functions of the frequency channels K1, K2 and K3 in two-step operation

5 General Technical Data

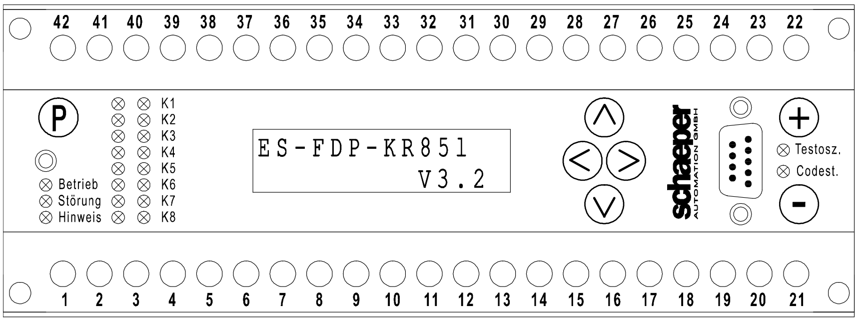
Measurement input (U_{eff}): Terminals (4) and (7)	< 300 V continuous operation permissible < 500 V 1 min. ON / 1 min. OFF < 750 V 1 min. ON / 2 min. OFF < 1000 V 1 min. ON / 3 min. OFF (values are valid for 40°C ambient temperature) sensitivity: 1,5 V for input frequency <5 Hz 0,3 V/Hz for input frequency >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	type TR5, 100 mA / 250 V, slow-blow (soldered)
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)

6 Connection Example



7 Terminal Allocation

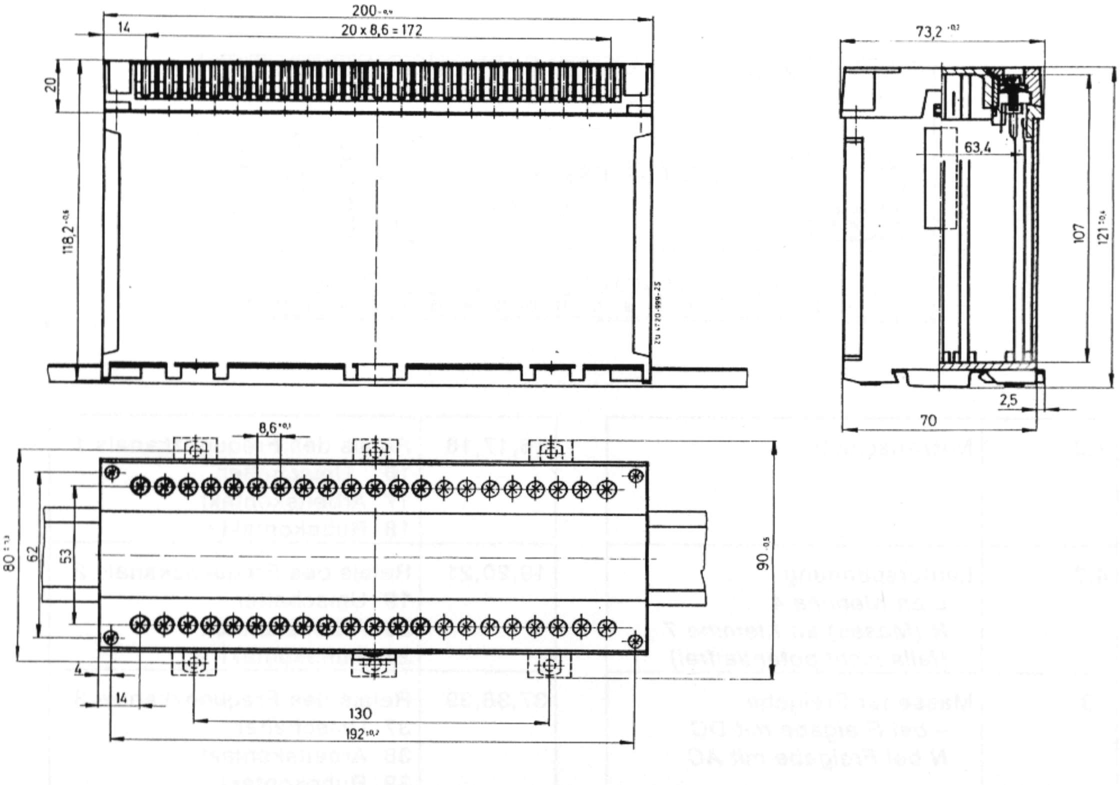


1,2	Power supply
4,7	Rotor voltage ***L** to terminal 4* ***N** (earth) to terminal 7* *(if not potential-free)*
14	Enable-input 1 (two-step operation: lifting 1) ***+** for enable with DC* ***L** for enable with AC*
15	Enable-input 2 (two-step operation: lowering 1) ***+** for enable with DC* ***L** 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

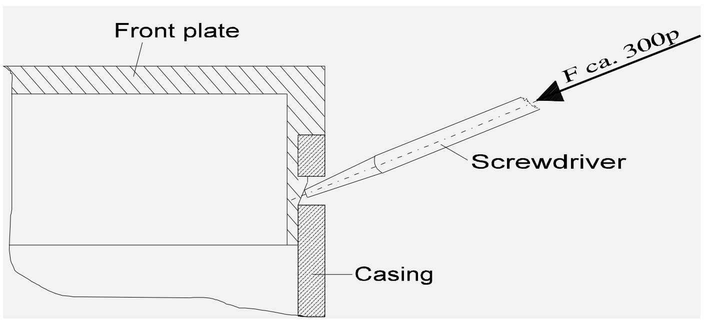
Connections should not be made to terminals not listed.

8 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.



9 Programming Reference Material for Normal Operation

ES-FDP-KR85l → fL=**** V3.0	Displ-Kontr:___
Funktion K1-K3 Norm=N/Takt=T :N	
K1:__ → fo:__._ fL=**** fu:__._	K1 to:____s tu:____s
K2:__ → fo:__._ fL=**** fu:__._	K2 to:____s tu:____s
K3:__ → fo:__._ fL=**** fu:__._	K3 to:____s tu:____s
K4:__ → fo:__._ fL=**** fu:__._	K4 to:____s tu:____s
K5:__ → fo:__._ fL=**** fu:__._	K5 to:____s tu:____s
K6:__ → fo:__._ fL=**** fu:__._	K6 to:____s tu:____s
K7:__ → fo:__._ fL=**** fu:__._	K7 to:____s tu:____s
K8:__ → fo:__._ fL=**** fu:__._	K8 to:____s tu:____s
Frei-1 tan:____s -***- tab:____s	
Frei-2 tan:____s -***- tab:____s	
Frei-3 tan:____s -***- tab:____s	
Frei-4 tan:____s -***- tab:____s	
Frei-5 tan:____s -***- tab:____s	
L-Bruch fL<____→ aktiv for Frei:_	K1..K8 Ruhelage bei Leiterbruch
Testosz f0:__._ fL=**** v:_ KS:_	
Selbsttest Fehler Nr:***	

Device-No.:

Date:

Place of assembly:

Construction-No.:

..: current values

10 Programming Reference Material for Two-Step Operation

ES-FDP-KR851 → fL=**** V3.0	Displ-Kontr:___	Device-No.:
Funktion K1-K3 Norm=N/Takt=T :T		Date:
K1-3:HE1 fo:__._ fL=**** -d:_._		Place of assembly:
K3-1:SE1 fu:__._ fL=**** +d:_._		Construction-No.:
K3-1:SE2 fu:__._ fL=**** +d:_._		
K4:__ → fo:__._ fL=**** fu:__._	K4 to:____s tu:____s	
K5:__ → fo:__._ fL=**** fu:__._	K5 to:____s tu:____s	
K6:__ → fo:__._ fL=**** fu:__._	K6 to:____s tu:____s	
K7:__ → fo:__._ fL=**** fu:__._	K7 to:____s tu:____s	
K8:__ → fo:__._ fL=**** fu:__._	K8 to:____s tu:____s	
Frei-1 tan:____s -***- tab:____s		
Frei-2 tan:____s -***- tab:____s		
Frei-3 tan:____s -***- tab:____s		
Frei-4 tan:____s -***- tab:____s		
Frei-5 tan:____s -***- tab:____s		
L-Bruch fL<____→ aktiv for Frei:_	K1..K8 Ruhelage bei Leiterbruch	
Testosz f0:__._ fL=**** v:_ KS:_		
Selbsttest Fehler Nr:***		*..*: current Values

11 Wiring Symbol