Post Box 71 02 28
D-30542 Hannover
Kronsberger Straße 25
D-30559 Hannover

Fon +49(0)511 35 71 00 0
Fax +49(0)511 35 71 00 19
www.schaeper.com
info@schaeper.com

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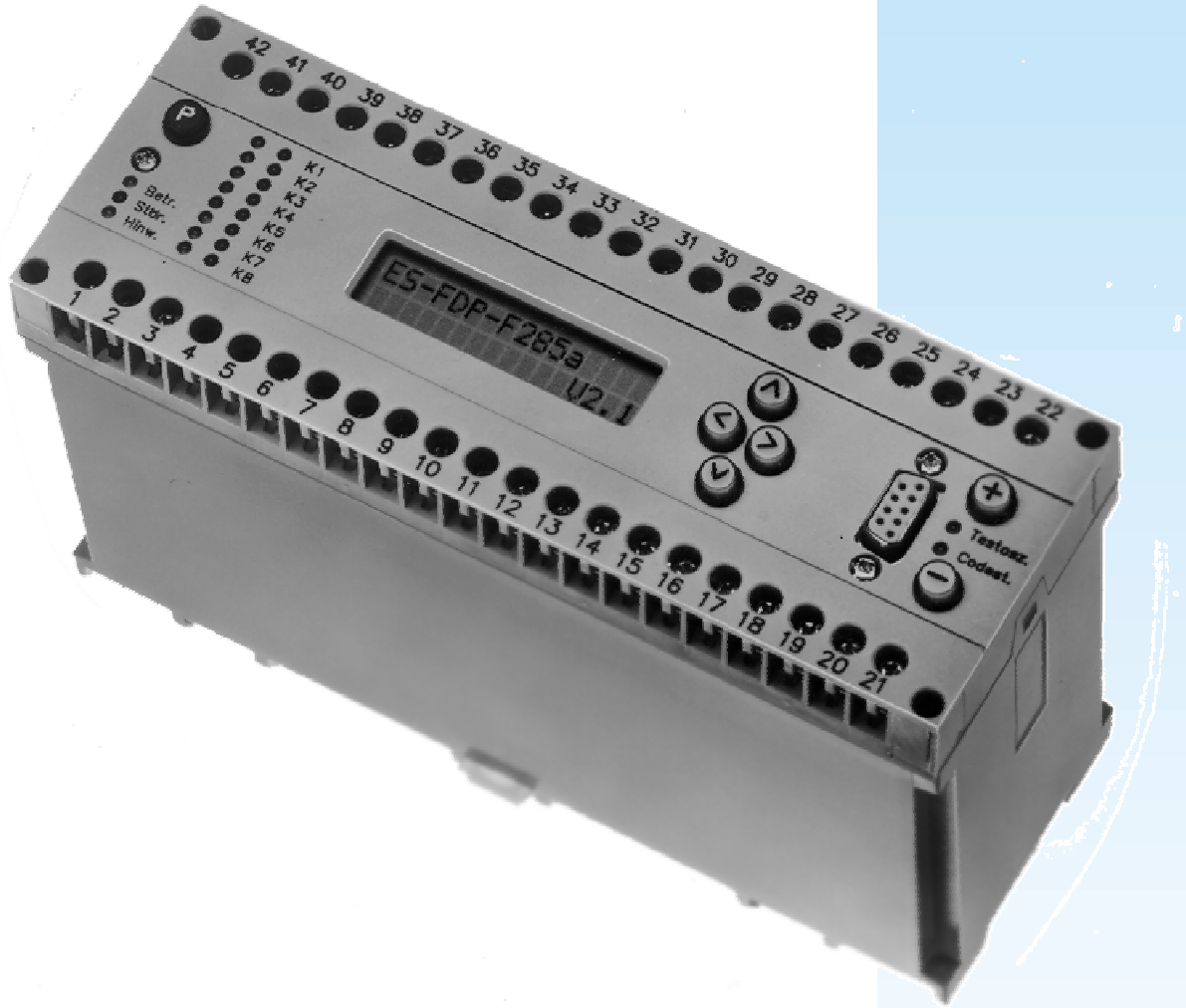
ES-FDP-F122x ... ES-FDP-F285x

Digital Frequency monitors

Operating Instructions



Current versions of the device series:

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

- **Signal pre-processor, ES-SV11.2,** 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 …

- **Digital crane frequency control system, ES-FDP-KR...,** Standard and two-step operation

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 for the digital frequency monitors ES-FDP-F... are for the device as it stands in 2004 with the software-version **V3.0.** These devices were replaced in 2008 by the device series **ES-FDP-FS...**, functionally compatible and with an extended range of functions.

Subject to alterations.

General characteristics

- ☺ frequency or speed measurements
- ☺ especially easy to program using large L.C.-Display with back-lighting
- ☺ protection from unauthorised programming using a code plug
- ☺ double -LED-display (red/green) for relay status
- ☺ up to 8 relay outputs (optional triac or transistor outputs)
- ☺ programmable time delay for the switching outputs
- ☺ analogue output, current or voltage, (Option)
- ☺ open circuit monitoring
- ☺ up to 5 enable outputs (with programmable time delay) which can be allocated to the switching channels as required
- ☺ internal test oscillator for function test
- ☺ measurement inputs are electrically isolated from the other in and outputs
- ☺ high noise immunity (watchdog, special data coding for automatic error recognition)
- ☺ easy to service due to **removable screw-on terminal strip, thus enabling the devices to be changed quickly without the danger of wiring errors**
- ☺ EEPROM for programmable values **(no** batteries required)

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1 Mode of Operation

1.1 Measurement Principle

The input signals to the two measurement inputs are processed using filters and the times of the edges of the impulses (or the zero crossings for AC-input signals) are stored. The frequencies **f1** and **f2** of the input signals are determined by period-duration measurements (resolution: 0,7µs). Every 10 ms the device checks whether the input impulses have been received and evaluates them (frequency and speed calculations, switching commands to the relays).

1.1.1 Calculation of the Frequencies

For frequencies > 100 Hz the measurement time of 10 ms means that an average of several input frequencies is used. At frequencies < 100 Hz the frequency is calculated new for each incoming impulse. The frequency values calculated in this way are evaluated in order to, e.g., monitor for overspeeds, open circuits or for a speed dependant enable control. Normally the frequency range is 0,1 ... 2000 Hz. An extended frequency range of 0,001 ... 2 000 Hz is also possible.

1.1.2 Evaluation of the Measured Values

2 to 8 switching channels are available for monitoring the input frequencies (cf. table 1). The lowest and highest permissible value for the variable being monitored can be programmed to any desired value, and the switching function of the output channel can be made to fit the special monitoring problem in various ways (cf. chapter SWITCHING FUNCTIONS, page 19). When values deviate from the reference value, the switching off can be carried out immediately or after a programmed delay time. The activation of all switching channels can be made dependent on enabling signals.

1.1.3 Speed Measurements

In order to make the programming as easy and as clear as possible, there is the possibility of changing the device from frequency to speed measurement. When using speed measurements, all inputs (programming) and outputs (display) are made in rpm. The conversion to frequency, necessary for the internal evaluation, is carried out by the device for the programmed number of pairs of poles.

1.2 Versions of the Device

	ES-FDP-F122x	ES-FDP-F185x	ES-FDP-F222x	ES-FDP-F285x
Measurement inputs	1	1	2	2
Enable inputs	2	5	2	5
Switching channels	2 (**K1** and **K2**)	8 (**K1** - **K8**)	2 (**K1** and **K2**)	8 (**K1** - **K8**)
- for frequency **f1** (speed **n1**)	**K1** and **K2**	**K1** - **K8**	**K1**	**K1 – K4**
- for frequency **f2** (speed **n2**)	—	—	**K2**	**K5** - **K8**

Table 1: Standard versions of the devices ES-FDP-F122x ... F285x

1.2.1 Measurement Inputs

As can be seen from Table 1 the devices **F1...** are fitted with one measurement input. They monitor, therefore, one input signal. The devices **F2...** comprise two measurement inputs, and monitor both input signals separately, each using the switching channels allocated. The monitoring functions of the measurement inputs 1 and 2 are independent and do not have any influence on each other.

Both measurement inputs and the sensor supplies are galvanically connected but electrically isolated from all other in- and outputs.

The measurement inputs are available with the following constructions:

- for 3-wire proximity switches (PNP or NPN switching, s. type plate)
- for 2-wire proximity switches
- for potential-free contact
- for direct voltage impulses U ≥ 10 V, impulse width ≥ 0,25 ms (max. 50 V)
- for alternating voltage U_{eff} ≥ 1,5 V + 0,1 V/Hz (low-pass behaviour for interference suppression, max. 400 V)

Other input voltages as special designs.

With the standard construction input frequencies between 0,1 ... 2000 Hz can be processed. Models are available for 0,001 ... 2 000 Hz.

The connection diagram for the measurement inputs can be found in the section: „Allocation of Terminals“ on page 24.

1.2.2 Sensor Supply

The standard version of the device is equipped with a voltage supply for two 3 wire proximity switches (20...24 V DC, max. 35 mA total current). If the device has been fitted with measurement inputs for 2 wire proximity switches then the sensor supply has also been designed especially for this type of sensors.

1.2.3 Enable Inputs

There are max. 5 enable inputs available for the arming of the monitoring functions, which can be allocated to the relays as required. Each enable can be allocated an individual time delay. The device is available with different enable input voltages(12V, 24V, 110V, 230V AC/DC).

The enable inputs 1,2 and 5 are galvanically connected, and the enable inputs 3 and 4 are galvanically connected. The enable inputs are electrically isolated from all other in- and outputs.

When operating with direct voltage the common ground must be connected to terminal 13 and to terminal 40 (ground enable). The enable inputs 1...5 can be operated with positive or with negative DC voltage.

When operating with alternating voltage the neutral conductor must be connected to terminal 13 and to terminal 40.

1.2.4 Switching Channels

The switching channels usually operate relays. Other designs for the output stage (triac, transistor) are available on request. Table 1 (page 6) shows the usual allocation of the switching channels to the measurement inputs. Different allocations are, likewise, available.

1.2.5 Notes

One of the variables **f1, f2, n1** or **n2** can be output for display or control purposes using the analogue output (option).

The various groups of in- and outputs (measurement, enabling-inputs, analogue outputs) are electrically isolated from each other.

In order to reduce the temperature in the device it is recommended that the device is installed with a distance of 2 - 3 mm to all other fittings.

Note: The device must only be programmed when the main plant is switched off, because during the programming the outputs can switch in an undefined manner.

2 Displays and Operation

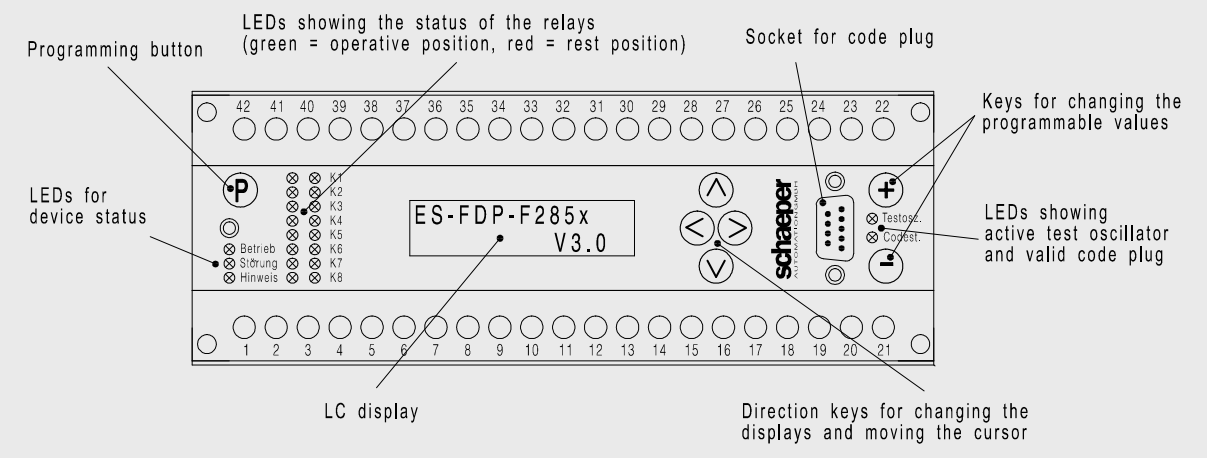


Fig. 1: Operating elements of the device

2.1 LED Indicators

Betrieb
(operation)
(green)

Mains voltage is supplied and the automatic check has been finished.

Störung
(error)
(red)

The program 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 an 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 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 only 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 **f1** or **f2, fT** appears in the display)

Codest.
(code plug.)
(yellow)

Valid code plug has been plugged in
Programming possible (**PRGM**)

2.2 LC-Display

2.2.1 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.

2.2.2 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-F285x
          V3.0  →
```

2.2.3 Selecting the Displays

The sequence of the displays is shown in table 2 (page 10). 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 2). The key Ⓓ calls up the auxiliary display belonging to the current main display (if present). The keys Ⓒ and Ⓐ or Ⓥ bring back the respective main display.

2.2.4 Display-Contrast

The display contrast is adjusted using the display **Displ-Kontr**:

```
ES-FDP-F285x
          V3.0  →
```

```
Displ-Kontr:+25
```

This can be programmed for values between **-99** to **+99** (for programming cf. chapter: Programming, page 11). Changes in the value take immediate effect, allowing the LC-display to be easily adjusted to be perfect for any angle of vision.

2.2.5 Display of the Measured Values

The current measured values are displayed in the second of the main displays:

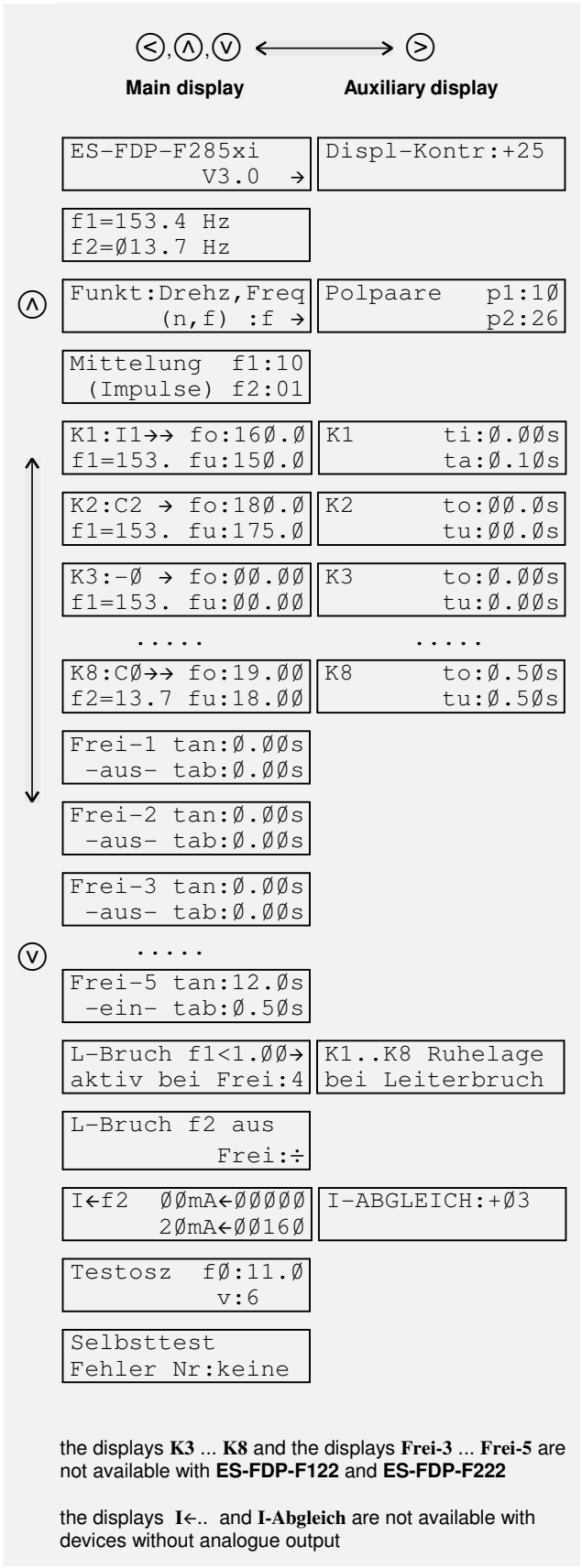
```
f1=***** Hz
f2=***** Hz
```

`*****`: current value

The measured values for the frequencys **f1** and **f2** or speed **n1** and **n2** are displayed here. If **L-Br** is displayed instead of a frequency this means that the open circuit monitoring has responded. If the open circuit monitoring is not active the display will show "0" if the frequency falls below the minimum frequency (0,1 Hz in the standard version).

The current measured values are, likewise, shown in the displays for the switching channels **K1 ... K8.** The variable that is being monitored by the selected switching channel is showed in the display. Furthermore, the situation at the enabling inputs is shown. In the displays **Frei1 ... Frei5** a "**-ein-**" *(on)* or "**-aus-**" *(off)* is shown, providing information about whether there is voltage applied to the enabling inputs.

ES-FDP-..	Device specification
V..	Software version
f1=.., f2=..	Frequency at measurement input 1 or 2 (Hz)
n1=.., n2=..	Speed at measurement input 1 or 2 (rpm)
Mittelung	Averaging of the measurement over a programmable number of input impulses
fo:.., no:..	Upper switching value for frequency, speed
fu:.., nu:..	Lower switching value for frequency, speed
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
Testosz	Test oscillator
fØ:..	Initial-frequency for the test oscillator
v:..	Speed with which the test oscillator values change
fT=..	Simulated value from internal test oscillator
K..	Switching channel
Frei-..	Enabling input
tan:..	Response delay for enabling (s)
tab:..	Drop-off time delay for enabling (s)
-ein-	*("on")* Signal to enabling input
-aus-	*("off")* No signal to enabling input
L-Bruch	Display for programming open circuit monitoring
..aktiv	Open circuit monitoring is programmed
..aus	No open circuit monitoring programmed
L-Br	Appears in the display instead of the measured frequency when the open circuit monitoring has responded
Frei:..	Allocated enabling input
Displ-Kontr:..	Display contrast
Funkt:	To select speed or frequency measurement
p1:.., p2:..	Number of pairs of poles for measurement input 1 and 2 (for speed measurements)
I←.., U←..	Optional analogue output: Allocation of the analogue output to f1 (n1) or f2 (n2)
..mA←.. **..V←..**	Optional analogue output: allocation of a analogue value to a frequency (or speed)
I-Abgleich:.., **U-Abgleich:..**	Optional analogue output: Calibration of maximal value
→	Indication of a further display, right
→→	A time delay has been programmed for this output
PRGM	Programming mode



the displays **K3** ... **K8** and the displays **Frei-3** ... **Frei-5** are not available with **ES-FDP-F122** and **ES-FDP-F222**

the displays **I←..** and **I-Abgleich** are not available with devices without analogue output

Table 2: Sequence of the displays and the meaning of the display texts

2.3 Programming (PRGM)

2.3.1 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 connector being plugged in, the following will be displayed:

```
PROGRAMMIERUNG
GESPERRT
```

(programming not possible)

2.3.2 Programming Sequence

The meaning of the programmable parameters for each display selected is described starting on page 12 (chapter: Programming the Functions). 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 2 keys must be pressed at the same time. Even when the programming key Ⓟ is accidentally pressed, the programming mode can be left simply by following step 6.

	the key to be used
1. Select required display	Ⓐ, Ⓥ, Ⓒ, Ⓓ

2. Switch on programming mode
`K4:A1 → fo:2Ø.ØØ`
`PRGM  fu:18.ØØ`
(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`
Number of an enable input	`÷` `Ø` `1` `2` `3` `4` `5` or `÷` `Ø` `1` `2` (`÷` and `Ø` are not programmable for all functions)
Digits for switching values, delay times, etc.	`Ø` `1` `2` `3` `4` `5` `6` `7` `8` `9` `.`
Display-contrast	`-99` ... `+99`
Type of function (speed or frequency measurement)	`n` `f`

Table 4: Permissible values for programming

Only values which have been defined can be programmed (cf. table 4). The number of an enable input allocated to a particular switching channel can only be set at a number between 1 and 2 or 5. For switching values and time delays the decimal point can also be moved. The decimal point cannot be moved to the first position for time delays.

Example: For programming the switching value "50", the following have identical meanings:

5Ø.ØØ	Ø5Ø.Ø	ØØ5Ø.	ØØØ5Ø

But: .5Ø.Ø is taken as 0,5 due to the first decimal point!

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.

3 Programming the Functions

3.1 Frequency- or Speed Measurements, Pole Pairs

The change between frequency (**f**) and speed (**n**) measurement is done in the third main display.

Funkt:Drehz,Freq (n,f) :f →	Polpaare p1:1Ø p2:26

(Function: speed, frequency) *(Pole pairs)*

If the device is programmed for the measurement of speed, the number of pairs of poles (when using AC tachos) or the number of impulses per revolution (with incremental sensors) can be programmed for both speed sensors. Thus enabling switching values to be programmed directly as speeds. If the device has been programmed for frequency measurements **f** then the number of pole pairs has no influence. All measurement and switching values are shown in Hz or rpm.

Warning: when changing the programming from frequency to speed measurements, or vice-versa, the switching values (**f**, **n**) are not automatically corrected, and the switching channels will have to be re-programmed.

3.2 Averaging function

With some applications it cannot be ensured that the input impulses which are being received are even. If a driving apparatus is monitored with, e.g., incremental sensors with a too high resolution, it is possible that play or vibrations can lead to an erratic signal. The frequency fluctuates around a mean value; the short frequency increases can cause an unwanted activation of the monitoring relay. Irregular input impulses could also be caused when sampling a toothed ring with proximity switches if the teeth are not evenly distributed. Using the averaging function, the device can be made less sensitive to such situations. The means are not taken over a fixed time period but over a programmable number of input impulses.

Mittelung f1:Ø1 (Impulse) f2:12

(Mittelung = averaging)

The number of input impulses over which an average is to be taken is set for input 1 and input 2 separately. The max. averaging number is 31. If the device has only one measurement input (**F122a** or **F185a**) the respective display looks as follows:

Mittelung f1:Ø5 (Impulse)

(Mittelung = averaging)

The determination of the average values for a fixed number of input impulses has the advantage of doing so over a fixed period of time that even the irregularities which occur with very infrequently

occurring impulses are filtered out. At the same time, a short reaction time is achieved with a high frequency, because the fast impulse sequence means that the measurement time is respectively shortened (especially important for monitoring overspeed).

A special feature of the devices **ES-FDP-F...** is that they do not simply wait for a fixed number of impulses (**m1** or **m2**) and then give an evaluation, but **every** incoming input impulse is evaluated. This is made possible by the fact that the times of the last input impulses are stored internally (max. 31). Each new input impulse is calculated with the previous ones (according to the programmed average determination time) and the average value for the frequency is used for the evaluation and to drive the switching channels.

Warning: programming the averaging function influences the open circuit monitoring

3.3 Switching Channels

The monitoring of the frequencies (speeds) is carried out by the switching channels (**K1** to **K2** or, respectively, to **K8**). The usual allocation of the switching channels to the measurement inputs is shown in Table 1 (page 6).

The switching behaviour of every switching channels can be programmed independently. This is done by programming a switching function, the allocation of an enabling input, by the switching values and, if necessary, by programming a delay time (table 5).

Main display and auxiliary display for the switching channel (programmable parameters are underlined)
 	
`K1:A4→→ fo:12.ØØ`
`PRGM fu:1Ø.ØØ`
 	
`K1 to:Ø.Ø5s`
`tu:ØØ.Øs`
	`K1:` First frequency channel selected
	`PRGM` Programming mode switched on
	`→→` shows that there is a programmed time in auxiliary display
	
	Main display:
	
	`A` selected switching function
	`4` Enable input 4 has been allocated
	`12.ØØ` upper switching value fo (or no)
	`1Ø.ØØ` lower switching value fu (or nu)
	
	Auxiliary display:
	`Ø.Ø5` Delay time to programmed at Ø,Ø5s
	`ØØ.Ø` no delay time tu programmed

Table 5: Programmable parameters for the switching channel

3.3.1 Switching Function

The switching 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 program **hysteresis switching functions A ... H** (table 7, page. 19) and **window switching functions I ... Q** (table 8, page 20).

Hysteresis switching functions A ... H: Because two switching values **So** and **Su** (**S** stands for **f** or **n**) can be programmed there is a switching hysteresis produced (**So** - **Su**). This enables the relay to be kept in a stable condition.

Window switching function I ... Q: The upper switching value **So** and the lower switching value **Su** means that a window area is determined. The relay switches if the measured value moves out of this programmed window. The switching values for the window function have no switching hysteresis.

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

3.3.2 Enabling

The digit after the switching function represents the number of the **enabling input** which is allocated to the switching 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.

3.3.3 Switching Values

The upper switching value **fo** (for the frequencies) or **no** (for the speeds) is shown on the right hand side of the upper line. The lower switching value **fu** or, respectively, **nu** is shown directly beneath it. The two values **fo,fu**, or **no,nu** determine the **switching hysteresis** (switching function **A**...**H**) or the **switching window** (switching function **I**...**Q**).

The switching values for the frequencies can be set to any value in the range between 0,1 ... 2000 Hz.

The switching values which are possible for the speed depends on the programmed number of pairs of poles **p1** or **p2** (frequency range 0,1 ... 2000 Hz be adhered to). For **p1 = 2,** values can be set between 3 ... 60000 rpm; for **p1 = 20**, therefore, switching values can be programmed between 0,3 ... 6000 rpm. In general, the following is valid:

$$n1 = \frac{f1}{p1} \cdot 60 \qquad n2 = \frac{f2}{p2} \cdot 60 \qquad [rpm]$$

3.3.4 Time Delay for the Switching Channels

A double arrow →→ in the main display for a switching channel indicates that the respective output has a time delay (when time delay has not been programmed a single arrow → indicates the presence of an auxiliary display, cf. chapter LC-Display, page 9). The display for the delay times can be called up using the key Ⓢ.

K1:I1→→ fo:12.ØØ f1=**** fu:1Ø.ØØ	K1 ti:Ø.ØØs ta:Ø.1Øs
K2:CØ → fo:16Ø.Ø f2=**** fu:158.Ø	K2 to:ØØ.Øs tu:ØØ.Øs

****: current value

The delay times can be programmed for times between 0 ... 65 s.

With switching functions **A**...**H** (Hysteresis) the delay time **to** is effective when the upper switching values **fo** or **no** are exceeded, if the value goes under the lower switching values **fu** or **nu** the time **tu** is valid.

With the switching functions **I**...**Q** (window) the delay time **ti** is valid if the value **f** or **n** enters into the window area. The time **ta** is valid when the measured value goes out of the window area. It is completely irrelevant whether the measured value is increasing or decreasing when it enters or leaves the window area (cf. fig. 2).

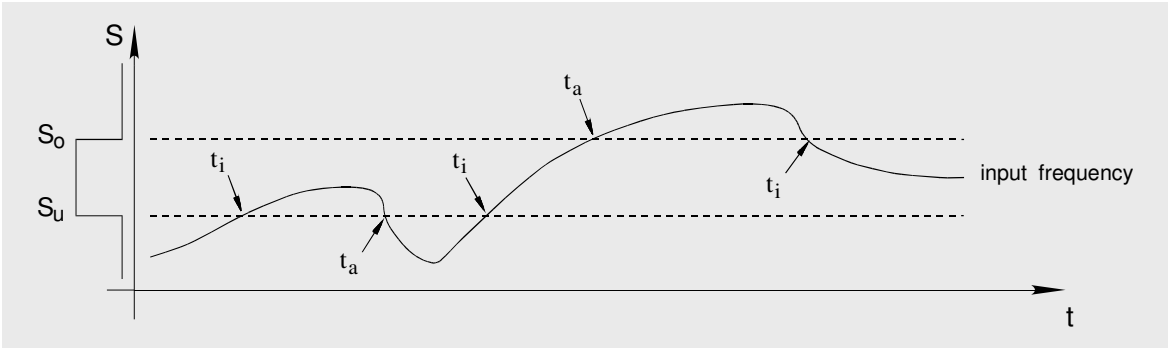


Fig. 2: Example of the validity of the time delays **ti** and **ta** for a window switching function

3.4 Enable Inputs

An activation time delay **tan** *(on)* and a drop-off time delay **tab** *(off)* (in seconds) can be programmed for every enable input. The corresponding displays are **Frei-1** to **Frei-5:**

```
Frei-1 tan:1.5Øs
 -ein- tab:2.ØØs
```

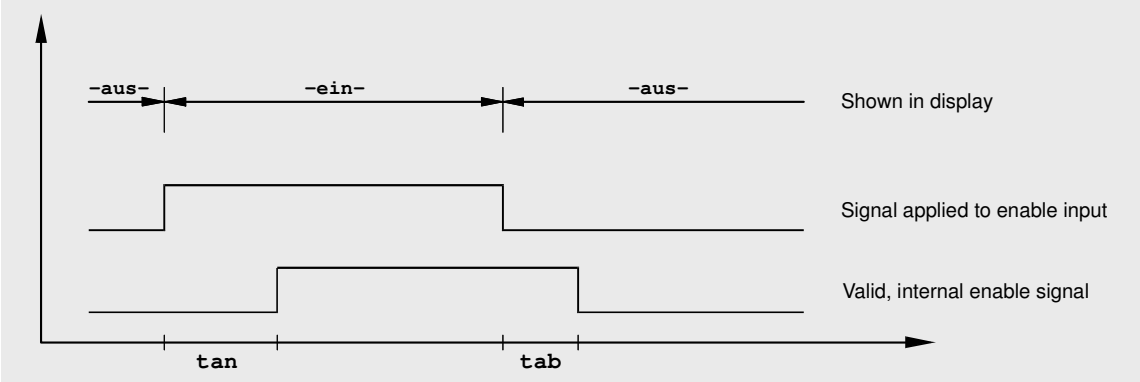


Fig. 3: Delay times for the enable signal

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

The enable inputs **Frei-3** to **Frei-5** are only available with types **ES-FDP-F185** and **ES-FDP-F285**.

3.5 Open circuit Monitoring

This function enables all switching outputs **K1** to **K2** or to **K8** to be switched to the rest position if the frequency falls below a minimum.

```
L-Bruch f1<1.ØØ→   K1..K8 Ruhelage
aktiv bei Frei:4   bei Leiterbruch
```

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

The open circuit monitoring can be set independently for both input frequencies **f1** and **f2** (or speeds **n1** and **n2**).

If an open is detected then the switching outputs are switched to the rest position irrespective of the switching function which has been programmed for normal operation. **Warning:** the frequency (speed) must be programmed at a value below the lowest value which can occur during normal operation.

To bypass the starting procedure this function can be activated using an enable input (also time delayed). Only when the enable signal is applied, the open circuit monitoring is activated. The digit after **Frei:** can be programmed and indicates the enable input allocated. The digit **Ø** means that the open circuit monitoring is always activated.

If instead of a digit a ÷ is programmed then the open circuit monitor is always off and after the programming has been completed the word **aus** *(off)* will appear at the top right of the display. To re-activate simply re-programme with a digit.

```
L-Bruch f2 aus
          Frei:÷
```

If the open circuit monitoring has been operated this is indicated in the display for the input frequency with "**L-Br**" (example: display for a switching channel):

```
K2:CØ → fo:16Ø.Ø   K2       to:ØØ.Øs
f2=L-Br fu:158.Ø             tu:ØØ.Øs
```

3.5.1 Open Circuit Monitoring with Programmed Averaging Function

The open circuit monitoring for the series ES-FDP is carried out by monitoring the input frequency. If the frequency goes under the minimum frequency programmed in the open circuit display, all relays

switch to the rest position. With the current software version (**V3.0**) the open circuit monitoring internally evaluates the same measured variables as the switching channels. When the averaging function **m1** or **m2** is programmed this measured variable is an average of a number of input signals. If there are no input impulses, then this average goes down. However, this decrease is reduced by a factor, determined by the programmed averaging number, and is therefore slower than the incoming frequency, meaning that the open circuit monitoring reacts with this delay.

Example: The open circuit monitoring is programmed for 1,0 Hz. Without the averaging process an open circuit is recognized after *T = 1/f = 1 sec*. If the averaging function is set at, e.g., m=5, then this time is increased to 5 sec.

3.6 Analogue Output (Option)

The **ES-FDP-F...** can be fitted with an additional analogue output for current (**I**) or voltage (**U**). The smallest and largest value of a frequency (speed) or frequency (speed) ratio to be output can be defined by any current or voltage within the ranges: 0 mA ... 20 mA and 0 V ... 10 V.

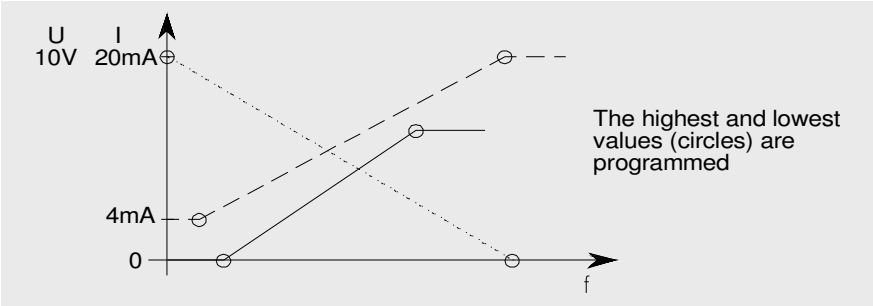


Fig. 4: Example showing the possibility of programming the analogue output to any desired value

The programming is carried out in the following display:

I←f2 ØØmA←ØØØØØ 2ØmA←ØØ16Ø	I-ABGLEICH:+Ø3

or for voltage output:

U←f1 ØØV←18.ØØ 1ØV←15.6Ø	U-ABGLEICH:+12

The allocation of an analogue output to one of the input frequencies (or speeds) can be programmed, as required, by selecting **I←f1** (**n1**) or **I←f2** (**n2**). Furthermore, the current or voltage values and the respective switching values (frequency, speed, quotient) are programmed in the main display. The maximum value is adjusted in the auxiliary display (key Ⓢ), thus enabling, e.g. the tolerances of a display instrument or, for voltage outputs, line resistance to be taken into account. The value is programmed by adjusting a set value on a connected display instrument. An input frequency is not necessary for doing this because in the programming mode the programmed maximum value is automatically output when the „**ABGLEICH**“ *(adjust)* display is shown.

After the adjustment has been carried out the maximum error for the standard design is 2% (based on $\mathbf{I_{max.}}$ = 20 mA or $\mathbf{U_{max.}}$ = 10V).

The analogue output is electrically isolated from all other in- and outputs.

3.7 Test Oscillator

The display for the **test- oscillator** is laid out as follows:

Testosz fØ:11.Ø v:3	fØ: initial value for frequency (nØ for speed measurements) v: speed of the changes in value

The initial frequency **f0** (or speed **n0**) can be programmed for the test oscillator and are effective instead of the measured values when it is activated. The test oscillator is activated and switched off by pressing the keys ⊕ and ⊖ at the same time. When the test oscillator is activated (only possible when the code plug is connected) the simulated values (frequency, speed) are changed by pressing the keys ⊕ (value increases) or ⊖ (value decreases). The speed of the change during simulation is determined by the programmable value **v**.

Activation is only possible if one of the switching channels **K1** to **K8** is shown in the display. If the channel shown uses the frequencies (or speeds) then the respective input frequency (or speed) is simulated when the test oscillator is switched on. The display changes from **f1** or **f2** to **fT** (from **n1** or **n2** to **nT**). The test oscillator does not only effect the switching channel shown but all switching channels at the same time which have been allocated to evaluate the simulated input frequency (or speed).

Activation is blocked as long as one of the two input frequencies is above the smallest measurable frequency (0,1 Hz for the standard design). The device switches the test oscillator off when there is a voltage to the measurement inputs or the code plug is disconnected. If there is no voltage to the measurement inputs, the test oscillator can be activated immediately after the mains supply has been switched on.

For reasons of safety the test oscillator should only be activated when the main plant is switched off!

4 Device Errors

4.1 Self-test

All the time it is operating, the device continually carries out a 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. 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.

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

(self-test)

***: 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:***
```

(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 and then the keys ⊕ and ⊖ (simultaneously). The message **Neuprogrammierung** *(re-programming)* will appear in the display and the device will correct all error data to permissible values.

Warning: All programmed data must then be checked.

4.2 Meaning of the Error Messages

Error number	Significance
001...015	Error in programme flow
016...063	Data error in internal processor register
064...095	Data error in program 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	Coding in EEPROM contains values not permitted
240...242	Data error in RAM

Table 6: Error numbers of the self-test

Extreme external disturbances can give rise to errors in the program flow or in the stored data. The device recognizes this by means of the self-test and undertakes the respective corrections. The errors found and the corrective measures are shown by error numbers (cf. table 6, page 18). 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.

4.3 External Error Message

A disturbance which results in the red error LED lighting up 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.

4.4 Wiring of the Enable Inputs

In some cases the cause of a disturbance can be an extreme over-voltage from the enable inputs. **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.

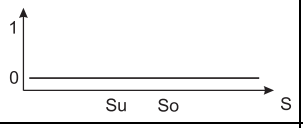
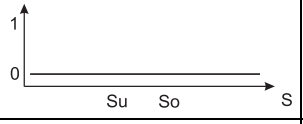
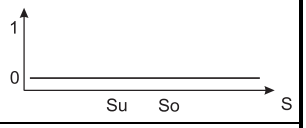
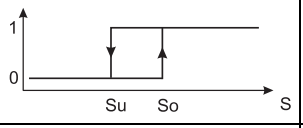
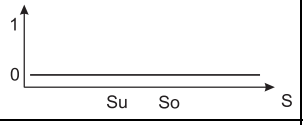
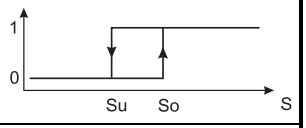
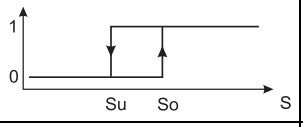
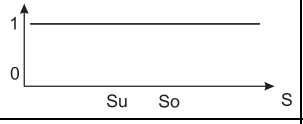
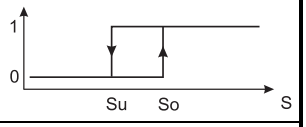
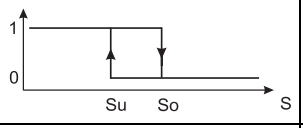
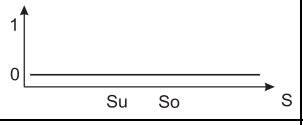
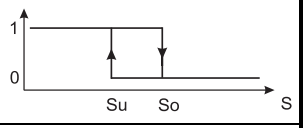
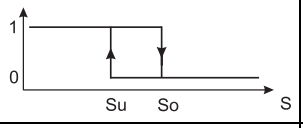
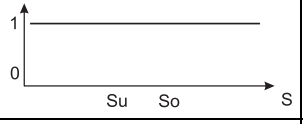
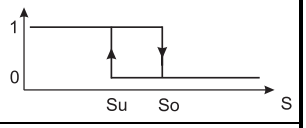
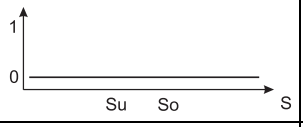
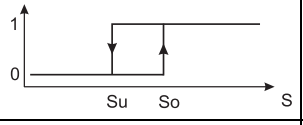
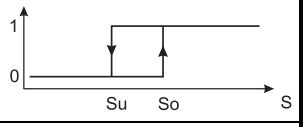
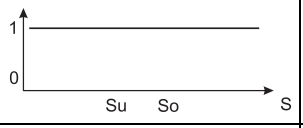
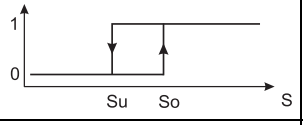
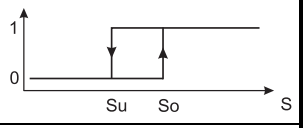
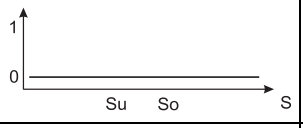
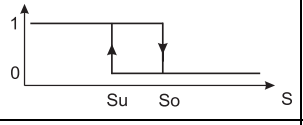
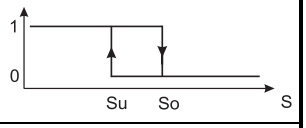
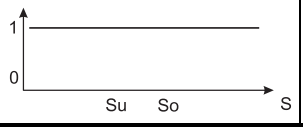
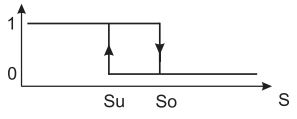
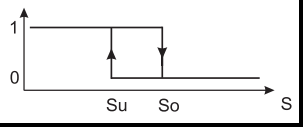
4.5 Blown Fuse

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

A fuse of the type **TR5 160mA/250V, slow-blow** should be soldered in.

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

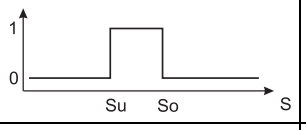
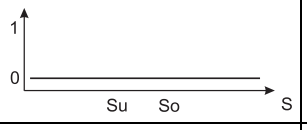
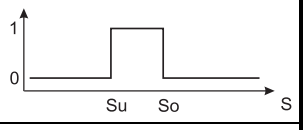
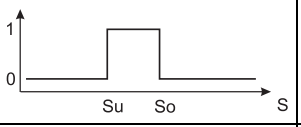
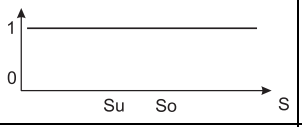
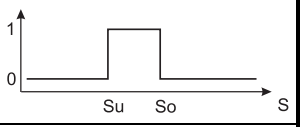
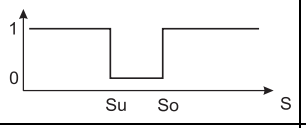
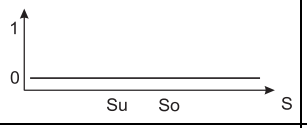
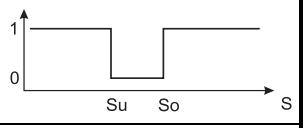
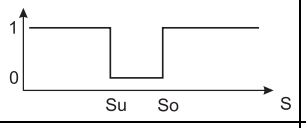
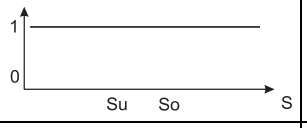
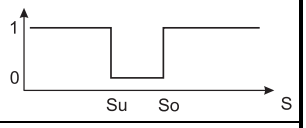
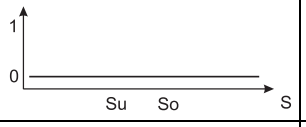
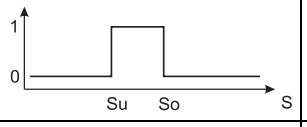
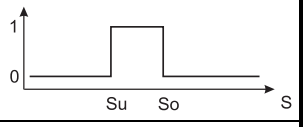
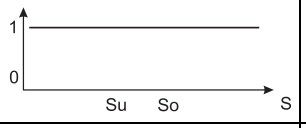
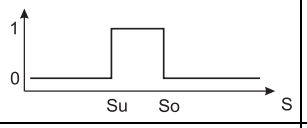
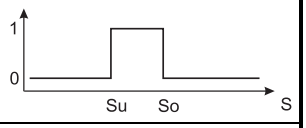
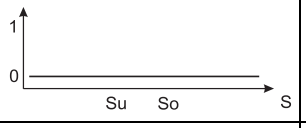
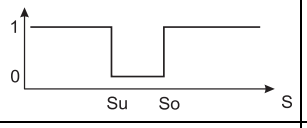
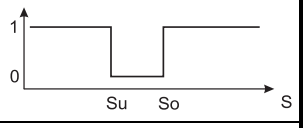
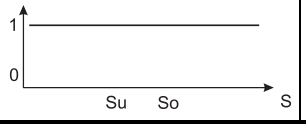
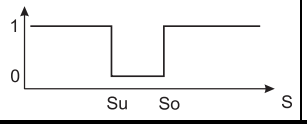
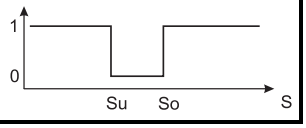
5 Switching Functions for the Relays

	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: Make contact
0: Rest contact

So: programmed upper switching value (fo or no)
Su: programmed lower switching value (fu or nu)

Table 7: Programmable hysteresis-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: Make contact
0: Rest contact

So: programmed upper switching value (fo or no)
Su: programmed lower switching value (fu or nu)

Table 8: Programmable window -functions for the relays and their dependency on the enable signal

6 General Technical Data

Measurement inputs: for 3-wire proximity switches (PNP or NPN)
or 2-wire proximity switches
or potential free contact
or direct voltage impulses U ≥ 10 V (max. 50 V) ,
pulse width ≥ 0,25 ms; (input resistance approx. 22 kΩ)
or alternating voltage U_{eff} ≥ 1,5 V + 0,1 V/Hz
(low-pass behaviour for interference suppression,
max. 400 V,
input resistance approx. 330 kΩ)

Measuring range: for frequencies: 0,1 ... 2000 Hz (Standard)
0,001 ... 2 000 Hz (Option)

Measuring error: < 0,1% at the permissible ambient temperatures

Measuring principle: Period-duration measurement

Sensor supply: 20...24 V=, max. 35 mA total current

Enable inputs: For 12V (10 ... 40V) AC/DC,
or 24V (20 ... 80V) AC/DC,
or 115V (97 ... 150V) AC/DC,
or 230V (195 ... 260V) AC/DC

Switching outputs: relay, 1 change-over contact, 250 V~, 5 A
electric. contact life (250 V~, 5 A / 30 V=, 5 A):
1 x 10^5 switching cycles

Supply voltage: 230V AC, ±10%, 50 ... 60 Hz

Power consumption: approx. 15 VA

Fuses: type TR5 160 mA / 250 V, slow-blow (soldered in)

Ambient temperature: -10 ... +50 °C (operation)
-20 ... +70 °C (storage)

Housing dimensions: L = 200 mm, W = 75 mm, H = 126 mm
with screw and snap-on mounting
(DIN 46 277, 35 mm rail)

Behaviour in fire: according to UL: V-0 or VDE 0304: stage I
(housing and keys)

Connection terminals: removable connector block with self-lifting BI-slotted screws for 2x2,5 mm^2; including terminal cover with protection against accidental contact according to VBG 4 and VDE 0106 part 100

Creep resistance: Insulation group C 250VE/300VG (creeping distance 4 mm); according to DIN 57110 and VDE 0110

Protective system: IP 40

Mass: approx. 1300 g

(We reserve the right to make changes.)

7 Device versions and order numbers

Overview of the available device versions:		
Version:	**Order number**	**Short description**
ES-FDP-F122x	**EF1X-** *ii/fv***	Frequency monitor with 1 measuring input, 2 enable inputs, 2 output relays
ES-FDP-F222x	**EF2X-** *ii/fv***	Frequency monitor with 2 measuring inputs, 2 enable inputs, 2 output relays
ES-FDP-F185x	**EF7X-** *ii/fv***	Frequency monitor with 1 measuring input, 5 enable inputs, 8 output relays
ES-FDP-F285x	**EF8X-** *ii/fv***	Frequency monitor with 2 measuring inputs, 5 enable inputs, 8 output relays
ES-FDP-F122xi	**EF1Y-** *ii/fv***	Frequency monitor ES-FDP-F122x, with analogue output for current 0(4)...20mA
ES-FDP-F222xi	**EF2Y** *ii/fv***	Frequency monitor ES-FDP-F222x, with analogue output for current 0(4)...20mA
ES-FDP-F185xi	**EF7Y-** *ii/fv***	Frequency monitor ES-FDP-F185x, with analogue output for current 0(4)...20mA
ES-FDP-F285xi	**EF8Y-** *ii/fv***	Frequency monitor ES-FDP-F285x, with analogue output for current 0(4)...20mA
ES-FDP-F122xu	**EF1Z-** *ii/fv***	Frequency monitor ES-FDP-F122x, with analogue output for voltage 0...10V
ES-FDP-F222xu	**EF2Z** *ii/fv***	Frequency monitor ES-FDP-F222x, with analogue output for voltage 0...10V
ES-FDP-F185xu	**EF7Z-** *ii/fv***	Frequency monitor ES-FDP-F185x, with analogue output for voltage 0...10V
ES-FDP-F285xu	**EF8Z-** *ii/fv***	Frequency monitor ES-FDP-F285x, with analogue output for voltage 0...10V

Breakdown of the order number *ii/fv*

ii	Measuring input	***f***	Enable inputs	***v***	Supply voltage
I1	for DC pulses 10..50V	9	enabling voltage 230V AC/DC	9	230V, 50-60Hz
I2	for DC pulses 20..50V	7	enabling voltage 110V AC/DC	7	110V, 50-60Hz
2D	for 2-wire sensor	2	enabling voltage 24V AC/DC		
3N	for 3-wire sensor NPN	1	enabling voltage 12V AC/DC		
3P	for 3-wire sensor PNP				
T1	for AC speedometer, 1,5...30V				
T9	for AC speedometer, max. 300V				

Example for the order number of a frequency monitor ES-FDP-F185xu (device with 1 measuring input, 5 enable inputs, 8 output relays and analogue output for voltage 0...10V), measuring input for DC pulses 10...50V, enabling voltage 24V, und supply voltage 230V:

EF7Z-I1/29

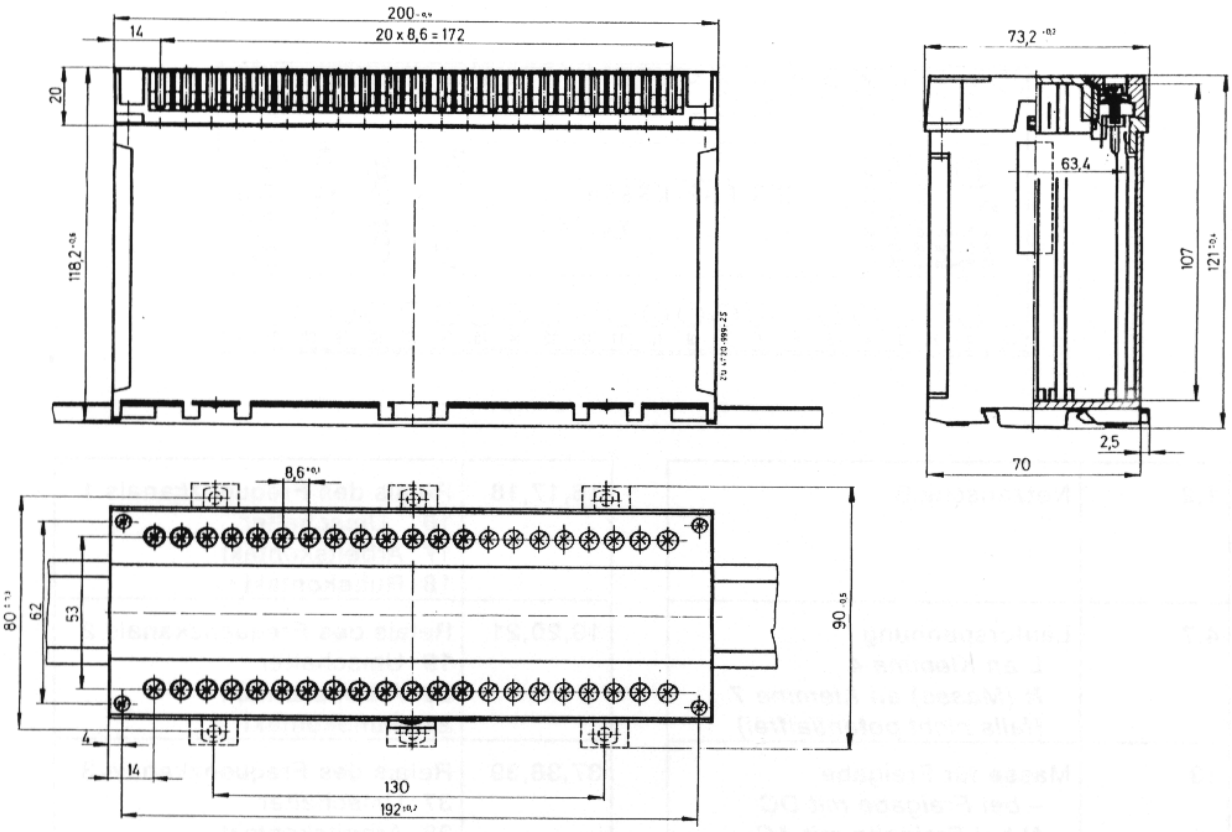
EF7Z = ES-FDP-F185xu

I1 = DC pulses 10..50V

2 = Enabling voltage 24V AC/DC

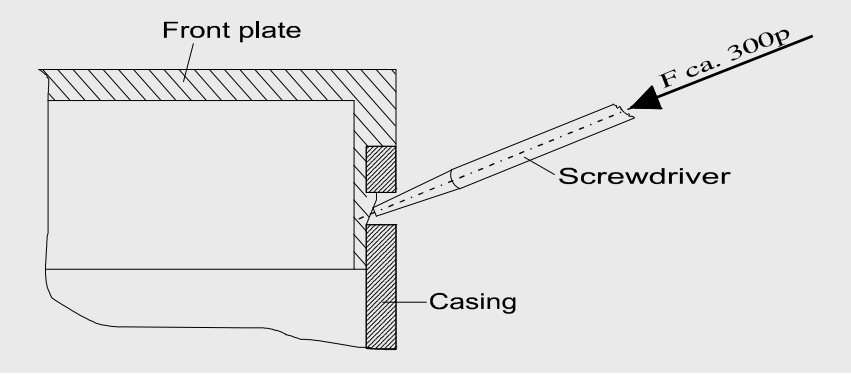
9 = Supply voltage 230VAC

8 Housing Dimensions



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 Allocation of Terminals

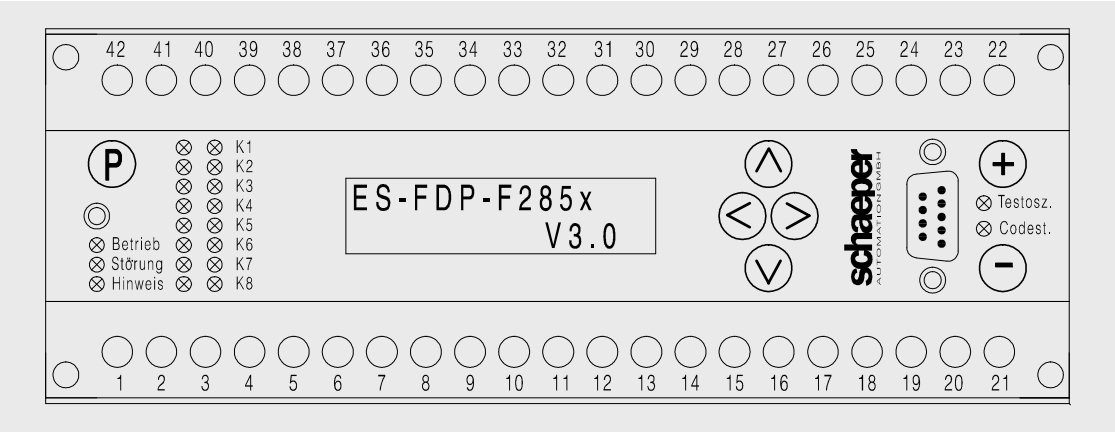


Fig. 5: Front plate and terminal strips

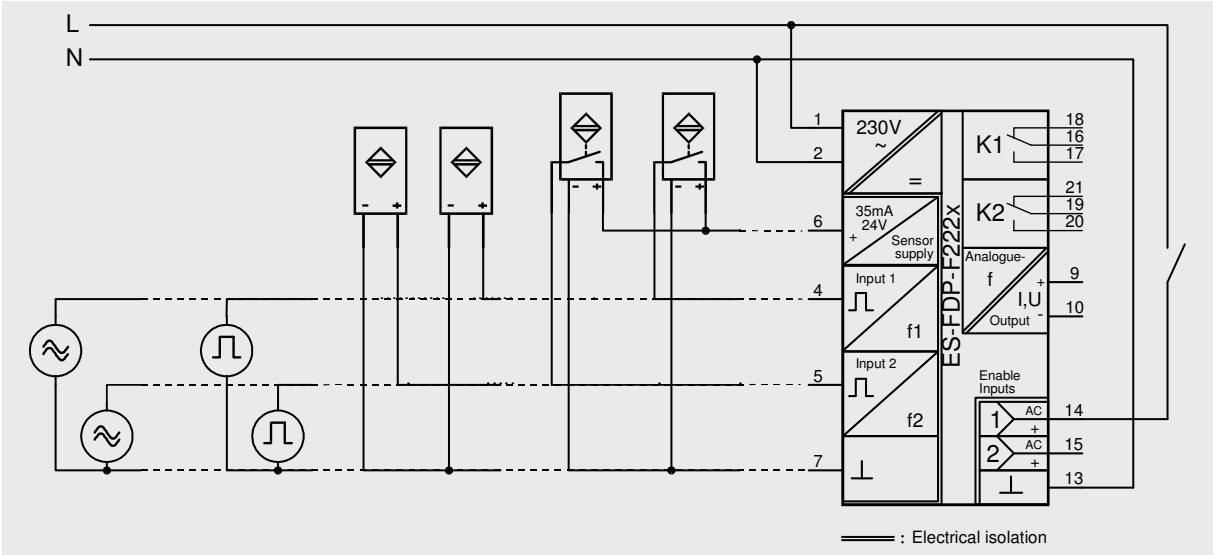


Fig. 6: Connection diagram **ES-FDP-F222x** and example for connections

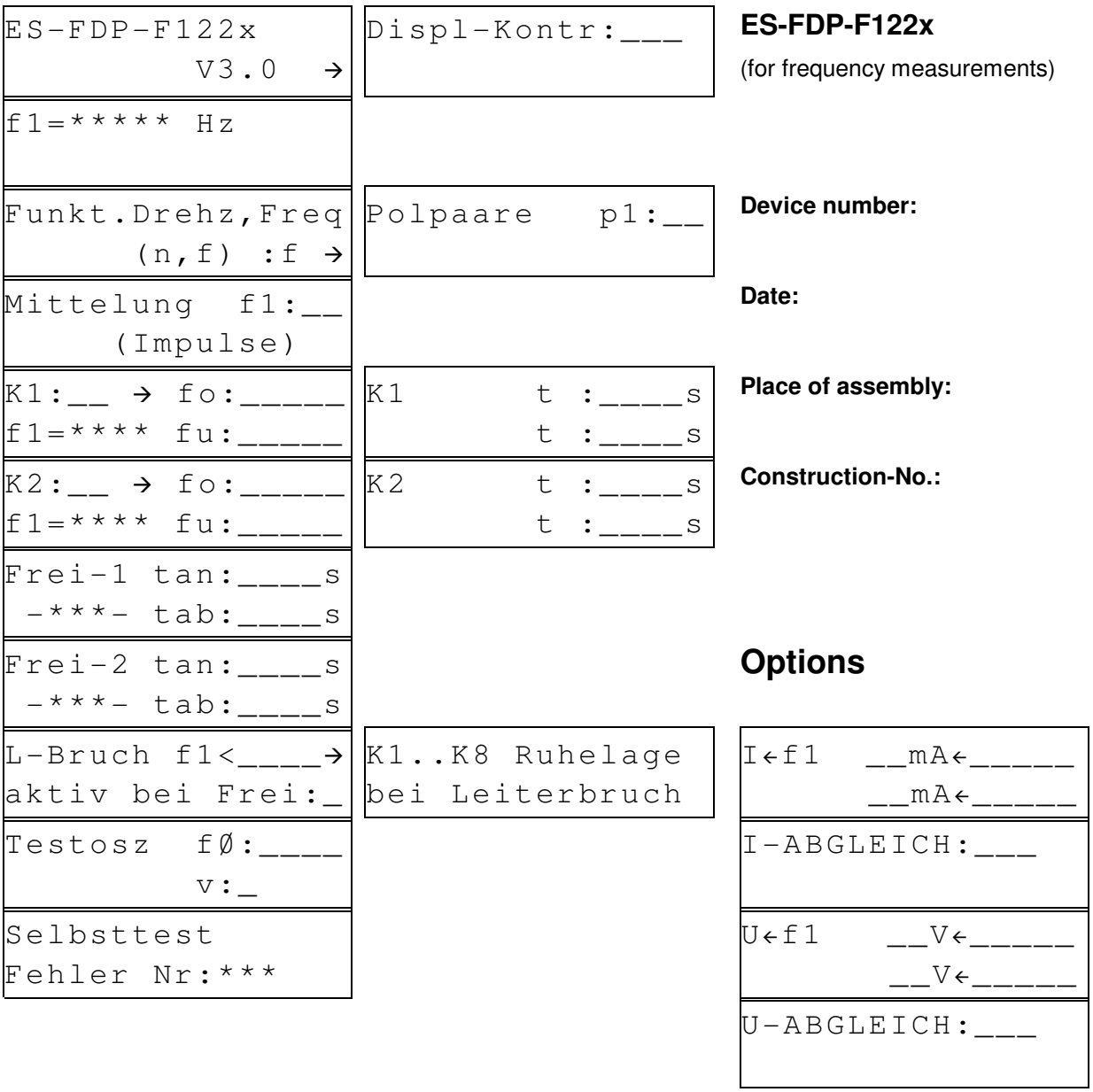
1,2	Power supply	
4	Input 1	
5	Input 2	
6	Sensor supply **"+"** 20..24V, max. 35 mA	
7	Sensor supply **"–",** Ground for input 1 and input 2	
9	Analogue output **"+"** (Option)	
10	Analogue output **"–"** (Option)	
13	Ground for enable inputs 1, 2, 5 ***–*** *for enable with DC* ***N*** *for enable with AC*	
14	Enable input 1 ***+*** *for enable with DC* ***L*** *for enable with AC*	
15	Enable-input 2 ***+*** *for enable with DC* ***L*** *enable with AC*	
12	Enable-input 5 ***+*** *for enable with DC* ***L*** *for enable with AC*	*
40	Ground for enable inputs 3, 4 ***–*** *for enable with DC* ***N*** *for enable with AC*	*

42	Enable-input 3 ***+*** for enable with *DC* ***L*** *for enable with AC*	*
41	Enable-input 4 ***+*** *for enable with DC* ***L*** *for enable with AC*	*
16,17,18	Relay for the switching channel 1 16 change-over switch 17 make contact 18 rest contact	
19,20,21	Relay for the switching channel 2 19 change-over switch 20 make contact 21 rest contact	
37,38,39	Relay for the switching channel 3 37 change-over switch 38 make contact 39 rest contact	*
34,35,36	Relay for the switching channel 4 34 change-over switch 35 make contact 36 rest contact	*
31,32,33	Relay for the switching channel 5 31 change-over switch 32 make contact 33 rest contact	*
28,29,30	Relay for the switching channel 6 28 change-over switch 29 make contact 30 rest contact	*
25,26,27	Relay for the switching channel 7 25 change-over switch 26 make contact 27 rest contact	*
22,23,24	Relay for the switching channel 8 22 change-over switch 23 make contact 24 rest contact	*

*: only for **ES-FDP-F185x** and **ES-FDP-F285x**

Do not make connections to terminals not listed.

10 Programming Reference Material



ES-FDP-F122x

(for frequency measurements)

Device number:

Date:

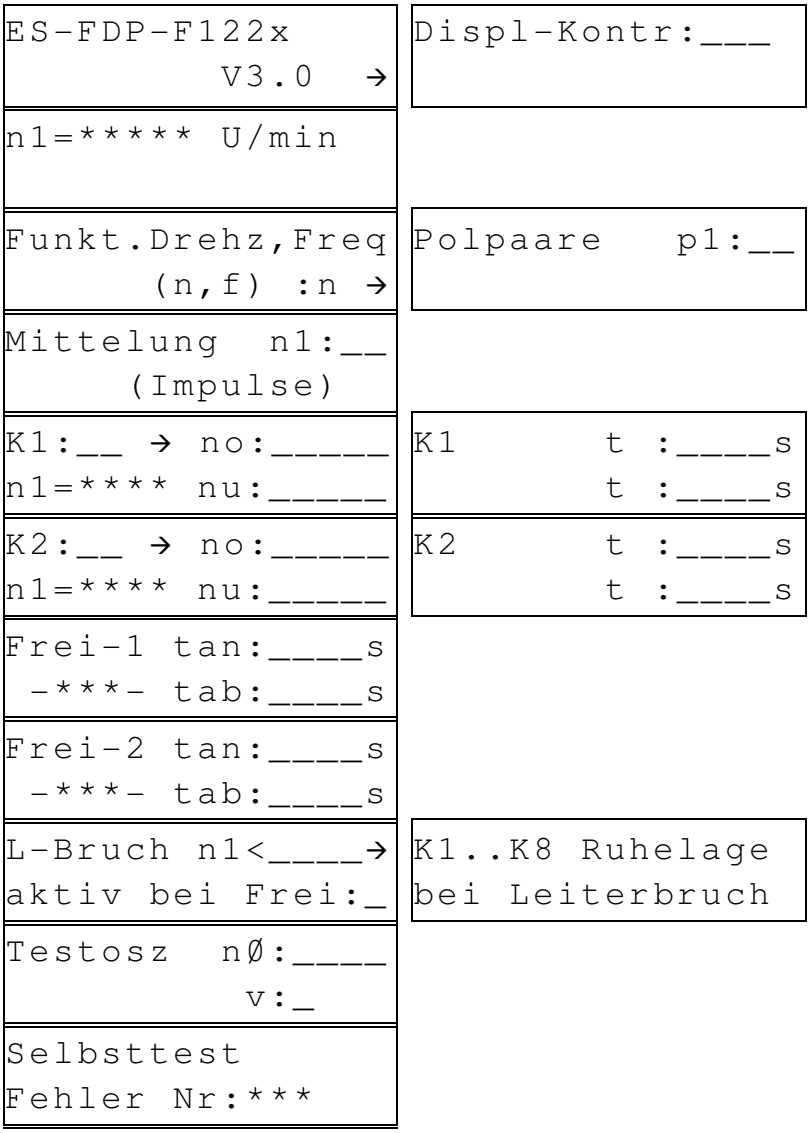
Place of assembly:

Construction-No.:

Options

..: **current values**

Programming reference material



ES-FDP-F122x

(for speed measurements)

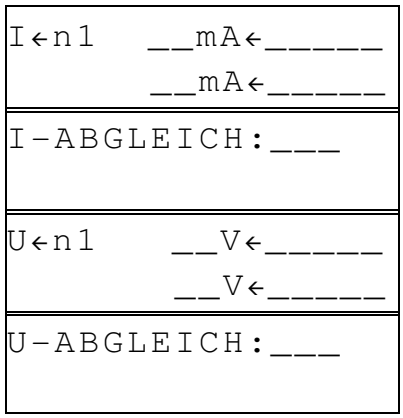
Device number:

Date:

Place of assembly:

Construction-No.:

Options



..: **current values**

Programming reference material

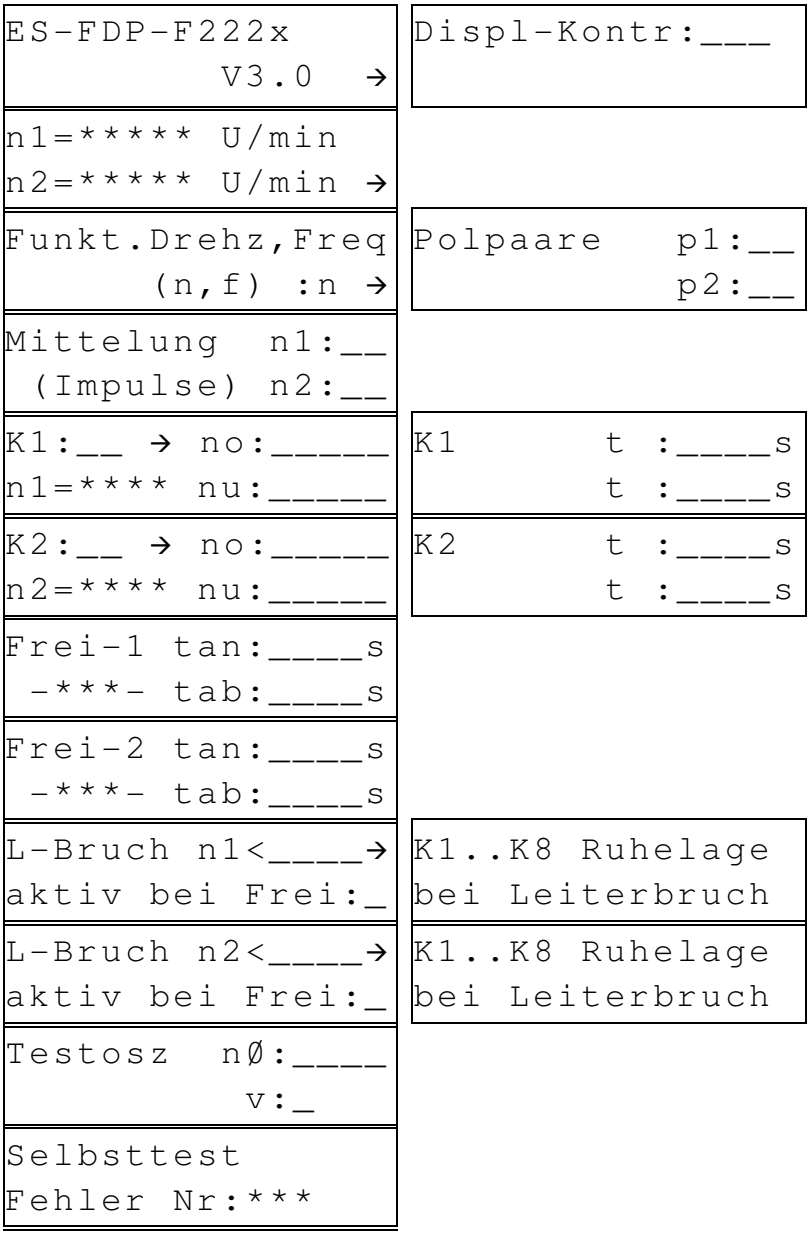
ES-FDP-F222x V3.0 →	Displ-Kontr:___	**ES-FDP-F222x** (for frequency measurements)
f1=***** Hz f2=***** Hz		
Funkt.Drehz,Freq (n,f) :f →	Polpaare p1:__ p2:__	**Device number:**
Mittelung f1:__ (Impulse) f2:__		**Date:**
K1:__ → fo:_____ f1=**** fu:_____	K1 t :____s t :____s	**Place of assembly:**
K2:__ → fo:_____ f2=**** fu:_____	K2 t :____s t :____s	**Construction-No.:**
Frei-1 tan:____s -***- tab:____s		
Frei-2 tan:____s -***- tab:____s		
L-Bruch f1<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch	
L-Bruch f2<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch	
Testosz fØ:____ v:_		
Selbsttest Fehler Nr:***		

Options

I←f_ __mA←_____ __mA←_____
I-ABGLEICH:___
U←f_ __V←_____ __V←_____
U-ABGLEICH:___

..: **current values**

Programming reference material



ES-FDP-F222x

(for speed measurements)

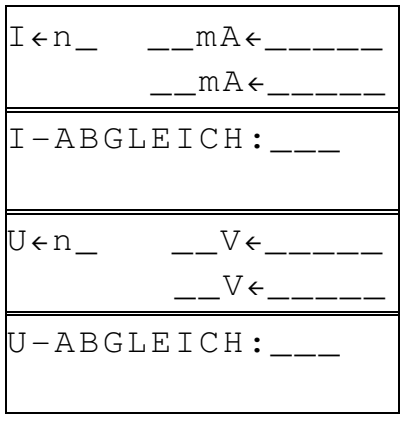
Device number:

Date:

Place of assembly:

Construction-No.:

Options



..: **current values**

ES-FDP-F285x V3.0 →	Displ-Kontr:___
f1=***** Hz f2=***** Hz	
Funkt.Drehz,Freq (n,f) :f →	Polpaare p1:__ p2:__
Mittelung f1:__ (Impulse) f2:__	
K1:__ → fo:_____ f1=**** fu:_____	K1 t :____s t :____s
K2:__ → fo:_____ f1=**** fu:_____	K2 t :____s t :____s
K3:__ → fo:_____ f1=**** fu:_____	K3 t :____s t :____s
K4:__ → fo:_____ f1=**** fu:_____	K4 t :____s t :____s
K5:__ → fo:_____ f2=**** fu:_____	K5 t :____s t :____s
K6:__ → fo:_____ f2=**** fu:_____	K6 t :____s t :____s
K7:__ → fo:_____ f2=**** fu:_____	K7 t :____s t :____s
K8:__ → fo:_____ f2=**** fu:_____	K8 t :____s t :____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 f1<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
L-Bruch f2<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
Testosz fØ:____ v:_	
Selbsttest Fehler Nr:***	

Programming reference material

ES-FDP-F285x

(for frequency measurements)

Device number:

Date:

Place of assembly:

Construction-No.:

Options

I←f_ __mA←_____ __mA←_____
I-ABGLEICH:___
U←f_ __V←_____ __V←_____
U-ABGLEICH:___

..: **current values**

ES-FDP-F285x V3.0 →	Displ-Kontr:___
n1=***** U/min n1=***** U/min	
Funkt.Drehz,Freq (n,f) :n →	Polpaare p1:__ p2:__
Mittelung n1:__ (Impulse) n2:__	
K1:__ → no:_____ n1=**** nu:_____	K1 t :____s t :____s
K2:__ → no:_____ n1=**** nu:_____	K2 t :____s t :____s
K3:__ → no:_____ n1=**** nu:_____	K3 t :____s t :____s
K4:__ → no:_____ n1=**** nu:_____	K4 t :____s t :____s
K5:__ → no:_____ n2=**** nu:_____	K5 t :____s t :____s
K6:__ → no:_____ n2=**** nu:_____	K6 t :____s t :____s
K7:__ → no:_____ n2=**** nu:_____	K7 t :____s t :____s
K8:__ → no:_____ n2=**** nu:_____	K8 t :____s t :____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 n1<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
L-Bruch n2<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
Testosz nØ:____ v:_	
Selbsttest Fehler Nr:***	

Programming reference material

ES-FDP-F285x
(for speed measurements)

Device number:

Date:

Place of assembly:

Construction-No.:

Options

I←n_ __mA←_____ __mA←_____
I-ABGLEICH:___
U←n_ __V←_____ __V←_____
U-ABGLEICH:___

..: **current values**

ES-FDP-F185x V3.0 →	Displ-Kontr:___
f1=***** Hz	
Funkt.Drehz,Freq (n,f) :f →	Polpaare p1:__
Mittelung f1:__ (Impulse)	
K1:__ → fo:_____ f1=**** fu:_____	K1 t :____s t :____s
K2:__ → fo:_____ f1=**** fu:_____	K2 t :____s t :____s
K3:__ → fo:_____ f1=**** fu:_____	K3 t :____s t :____s
K4:__ → fo:_____ f1=**** fu:_____	K4 t :____s t :____s
K5:__ → fo:_____ f1=**** fu:_____	K5 t :____s t :____s
K6:__ → fo:_____ f1=**** fu:_____	K6 t :____s t :____s
K7:__ → fo:_____ f1=**** fu:_____	K7 t :____s t :____s
K8:__ → fo:_____ f1=**** fu:_____	K8 t :____s t :____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 f1<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
Testosz fØ:____ v:_	
Selbsttest Fehler Nr:***	

Programming reference material

ES-FDP-F185x

(for frequency measurements)

Device number:

Date:

Place of assembly:

Construction-No.:

Options

I←f1 __mA←_____ __mA←_____
I-ABGLEICH:___
U←f1 __V←_____ __V←_____
U-ABGLEICH:___

..: **current values**

ES-FDP-F185x V3.0 →	Displ-Kontr:___
n1=***** U/min	
Funkt.Drehz,Freq (n,f) :n →	Polpaare p1:__
Mittelung n1:__ (Impulse)	
K1:__ → no:_____ n1=**** nu:_____	K1 t :____s t :____s
K2:__ → no:_____ n1=**** nu:_____	K2 t :____s t :____s
K3:__ → no:_____ n1=**** nu:_____	K3 t :____s t :____s
K4:__ → no:_____ n1=**** nu:_____	K4 t :____s t :____s
K5:__ → no:_____ n1=**** nu:_____	K5 t :____s t :____s
K6:__ → no:_____ n1=**** nu:_____	K6 t :____s t :____s
K7:__ → no:_____ n1=**** nu:_____	K7 t :____s t :____s
K8:__ → no:_____ n1=**** nu:_____	K8 t :____s t :____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 n1<____→ aktiv bei Frei:_	K1..K8 Ruhelage bei Leiterbruch
Testosz nØ:____ v:_	
Selbsttest Fehler Nr:***	

Programming reference material

ES-FDP-F185x
(for speed measurements)

Device number:

Date:

Place of assembly:

Construction-No.:

Options

I←n1 __mA←_____ __mA←_____
I-ABGLEICH:___
U←n1 __V←_____ __V←_____
U-ABGLEICH:___

..: **current values**

11 Wiring Symbols