- Control circuit EEx ia IIC
- Lead breakage (LB) monitoring and short-circuit (SC) monitoring
- 1 signal output with 1 changeover contact
- 1 serially switched output
- 1 error message output
- LC display
- Start-up override
- Preferred direction of the output relay, switching delay, hysteresis and direction of action adjustable

24 V DC:

KFD2-DW-Ex1.D

Successor KFD2-DWB-Ex1.D

Function

The rotation speed monitor compares an input frequency f_E (max. 5 kHz) with a predetermined reference frequency f_S (switch point). The input frequency f_E is adjustable within the range of 0.001 Hz ... 999 Hz (thumbwheel switch S1 ... S4). At higher frequencies, the input frequency f_E must be downscaled by the pre-scaler so that a frequency of max. 1 kHz is available.

LC-display

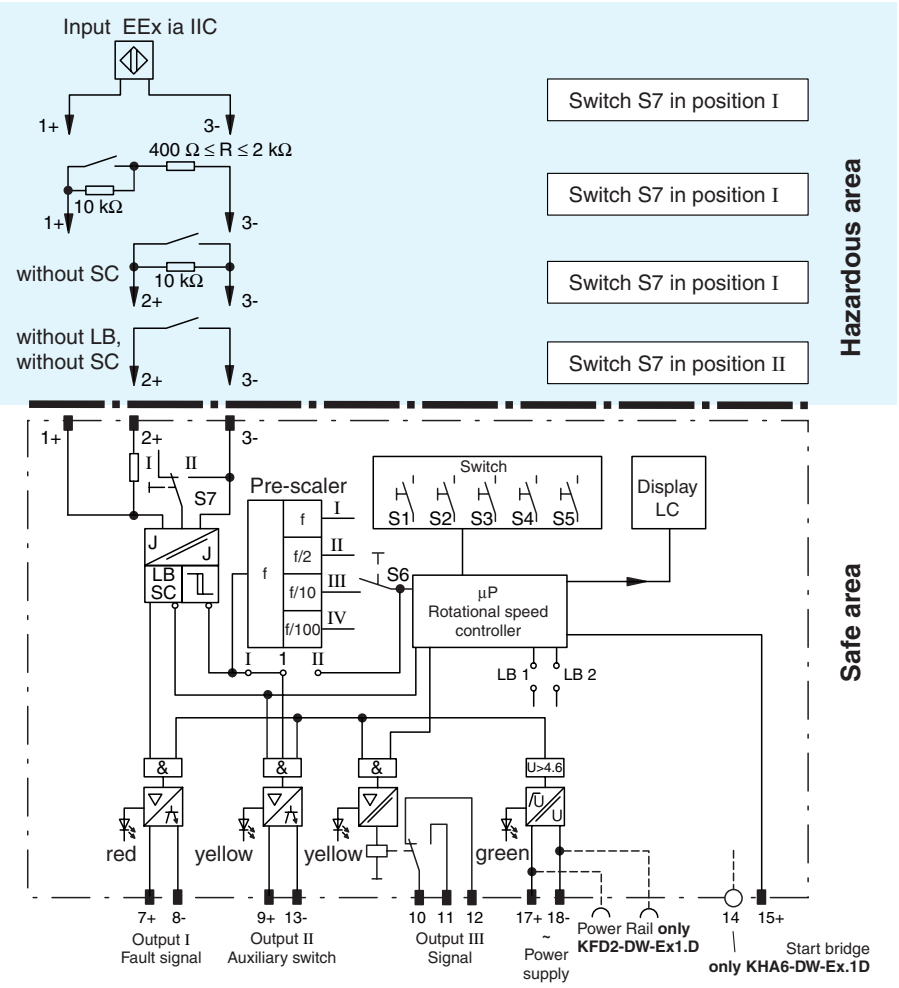
The LC-display shows the input frequency f_E in respect to the adjusted switch point f_S in %; max. display faults ± 2 digit; range: 0.00 % ... 199.9 %.

Start bridge

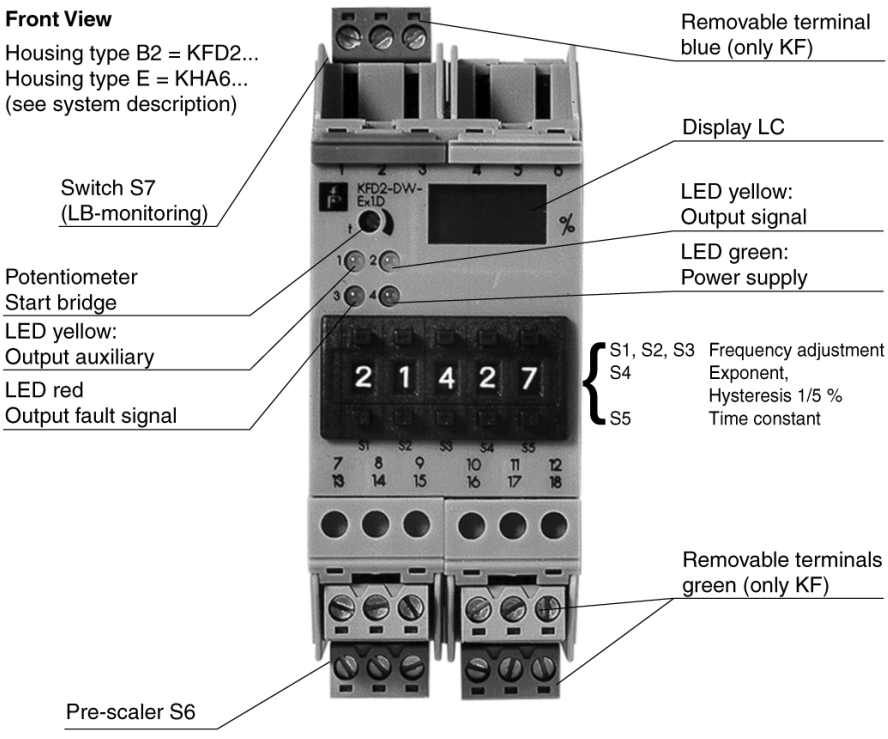
The start-up override is initiated by assigning a "1-signal" to terminal 15 (on a KFD2-DW-Ex1.D) or by using a jumper on terminals 14 and 15 (on a KHA6-DW-Ex1.D).

This function causes the relay output to take up a specific switch status for an adjustable time period. The time period is determined with the S4 thumbwheel switch position and the t potentiometer's position on the front panel. The start bridge is only active as long as terminal 15 is linked. If terminal 15 is already linked before the switching of the supply voltage, then the function is activated by switching.

Connection



Composition



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Supply	
Connection	Power Rail or terminals 17+, 18-
Rated voltage	20 ... 35 V DC
Ripple	≤ 10 %
Rated current	≤ 93 mA
Input	
Connection	intrinsically safe: terminals 1+, 2+, 3- non-intrinsically safe: terminal 15
Rated values	acc. to EN 60947-5-6 (NAMUR), see system description for electrical data
Open-circuit voltage/short-circuit current	approx. 8 V DC / approx. 8 mA
Switching point/Switching hysteresis	1.2 ... 2.1 mA / approx. 0.2 mA
Pulse/Pause ratio	≥ 0.1 ms / ≥ 0.1 ms
Pulse delay	2.5 ... 15 ms
Signal level	1-signal: 15 ... 35 V DC (1 mA at 24 V DC) 0-signal: 0 ... 5 V DC or open input
Function	start-up override
Lead monitoring	breakage I = 0.05 ... 0.15 mA , short-circuit 6.2 ... 7.4 mA
Output	
Connection	output I: terminals 7+, 8- ; output II: terminals 9+, 13- ; output III: terminals 10, 11, 12
Output I	fault signal ; electronic output, passive
Output I and II	
Signal level	1-signal: (L+) -2.5 V (100 mA, short-circuit proof) 0-signal: blocked output (off-state current ≤ 10 µA)
Output II	serial switching ; electronic output, passive
Output III	signal ; relay
Contact loading	250 V AC / 2 A /cos $\phi \geq 0.7$; 40 V DC / 2 A resistive load
Mechanical life	5 x 10^7 switching cycles
Energized/de-energized delay	approx. 20 ms / approx. 20 ms
Transfer characteristics	
Switching frequency	
Signal	≤ 10 Hz
Serial switching	≤ 5 kHz
Switching point error	0.2 % of nominal frequency
Electrical isolation	
Input/output	safe electrical isolation acc. to EN 50020
Input/power supply	safe electrical isolation acc. to EN 50020
Output/power supply	according to DIN EN 50178, rated insulation voltage 253 V_{eff} AC
Output/output	according to DIN EN 50178, rated insulation voltage 253 V_{eff} AC
Directive conformity	
Electromagnetic compatibility	
Directive 89/336/EC	on request
Standard conformity	
Insulation coordination	acc. to DIN EN 50178
Electrical isolation	acc. to DIN EN 50178
Climatic conditions	acc. to DIN IEC 721
Input	acc. to EN 60947-5-6 (NAMUR), see system description for electrical data
Ambient conditions	
Ambient temperature	-25 ... 65 °C (248 ... 338 K)
Mechanical specifications	
Protection degree	IP20
Mass	approx. 270 g
Data for application in conjunction with hazardous areas	
EC-Type Examination Certificate	PTB No. Ex-89.C.2145 ; for additional certificates refer to the approval list
Group, category, type of protection	[EEx ia] IIC resp. [EEx ia] IIB
Voltage U_o	12.7 V
Current I_o	17.3 mA
Power P_o	55 mW
Supply	
Safety maximum voltage U_m	40 V DC
Type of protection [EEx ia]	
Explosion group	IIB IIC
External capacitance	1.1 µF 0.45 µF
External inductance	5 mH 2 mH
Type of protection [EEx ib]	

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Explosion group	IIB	IIC	
External capacitance	5 µF	1.2 µF	
External inductance	410 mH	114 mH	
Outputs			
Safety maximum voltage U_m	40 V DC		
Electrical isolation			
Input/output	safe electrical isolation acc. to EN 50020		
Input/power supply	safe electrical isolation acc. to EN 50020		
Directive conformity			
Directive 94/9 EC	on request		
Safety parameter			
CSA control drawing	LR 36087-19		
Connection	terminals 1, 3; 2, 3; 4, 6; 5, 6		
Input I			
Safety parameter	12.6 V / 650 Ohm		
Voltage V_{OC}	12.6 V		
Current I_{SC}	19.8 mA		
Explosion group	A&B	C&E	D, F&G
Max. external capacitance C_a	1.273 µF	3.82 µF	10.18 µF
Max. external inductance L_a	84.88 mH	298.7 mH	744.4 mH
General information			
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see www.pepperl-fuchs.com.		

Notes

Adjustment instructions: Pre-scaler (S6)

The input frequency f_E can be reduced by means of the pre-scaler S6, as the microprocessor of the rotational speed controller can process a frequency of max. 1 kHz.

Switch S6 in pos. I:	1:1	(1 kHz)	?	Separator ratio TV = 1
Switch S6 in pos. II:	2:1	(2 kHz)	?	Separator ratio TV = 0,5
Switch S6 in pos. III:	10:1	(5 kHz)	?	Separator ratio TV = 0,1
Switch S6 in pos. IV:	100:1	(5 kHz)	?	Separator ratio TV = 0,01

By means of the solder bridge 1 can be determined, if the serially switched output is operated dependent or independant of the adjustment of the pre-scaler.

Solder bridge 1 in pos. I:	serially switched output switches pre-scaler independent
Solder bridge 1 in pos. II:	serially switched output switches pre-scaler dependent
Adjustment of the solder bridge 1:	see drawing on next page)
Delivery:	solder bridge 1 in position I

Adjustment of the reference frequency f_S (switch point)

f_S = (S1 x 100 + S2 x 10 + S3 x 1) x S4 x TV

By means of the thumbwheel switch S1 up to S4 the switch point f_S is adjusted. However, the separator ratio TV should be considered.

Example:

Rotation speed data must be converted into the respective frequencies. The number of the pulses (z) per rotation must be known.

The result is:

$$f = \frac{n \times z}{60}$$ n = revolutions per minute in 1/min

A motor runs with 1065 turns/min. and delivers 2 pulses/rotation.

2 pulses/rotation

$$f_s = \frac{1065 \times 2}{60} = 35{,}5 \text{ Hz}$$

Adjustment:
S1 : 3
S2 : 5
S3 : 5
S4 : 1/5
S6 : I

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Switch S4

Switch S4 switch position	Reference frequency (S1 + S2 + S3)	Hysteresis
0	x 10^{-0} Hz	1
1	x 10^{-1} Hz	1 %
2	x 10^{-2} Hz	1 %
3	x 10^{-3} Hz	1 %
4	x 10^{-0} Hz	5 %
5	x 10^{-1} Hz	5 %
6	x 10^{-2} Hz	5 %
7	x 10^{-3} Hz	5 %

Adjustment of the time delay of the relay output

With the thumbwheel switch S5 the circuit delay of the relay output can be adjusted. The value of the time constant τ is by approximation.

$$\tau = \frac{2^{N+1}}{f_s}$$ f_s = reference frequency

The value N can be adjusted at the thumbwheel switch S5 from 0 ... 9.

Table: start-up override

Switch S4 in Pos.	Time domain Potentiometer τ	Output relay	
		Solder bridge 2 open	Solder bridge 2 closed.
0 or 4	2 s ... 50 s	energized	de-energized
1 or 5	20 s ... 500 s	energized	de-energized
2 or 6	200 s ... 5000 s	energized	de-energized
3 or 7	2000 s ... 50000 s	energized	de-energized

Mode of operation of the relay output

The mode of operation can be determined by means of the solder bridge LB2 (Adjustment of the solder bridge LB2: see drawing below).

Solder bridge LB2 open: $f_E \geq f_S$: Relay energized

Solder bridge LB2 closed: $f_E \geq f_S$: Relay de-energized

Delivery: solder bridge LB2 open

Preferred direction of the relay output

When connecting the supply voltage a preferred direction of the relay output can be set, until the input frequency f_E is measured for the first time.

Adjustment of the solder bridge 1, the solder bridges LB1, LB2

By means of the solder bridge LB1 the following is set after the activation over a duration of approx. 380 ms.

LB1 open (Delivery) $f_E \leq f_S$

LB1 closed $f_E \geq f_S$

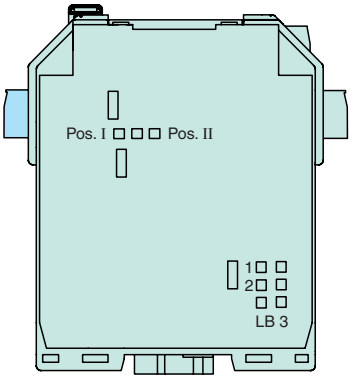
Depending on LB2 the output relay takes the corresponding state for these approx. 380 ms.

If the start-up override ("Logic-1" at terminal 15) is started with power-up, the LB 1 looses significance.

Delivery: solder bridge LB1 open

Solder bridge LB2 open

After removal of the cover and of the left-hand side part the jumpers are visible on the printed circuit board.



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