- Control circuit EEx ia IIC
- Lead breakage (LB) monitoring and short-circuit (SC) monitoring
- Analogue output 0/4 mA ... 20 mA
- 1 serially switched output
- 1 error message output

230 V AC:

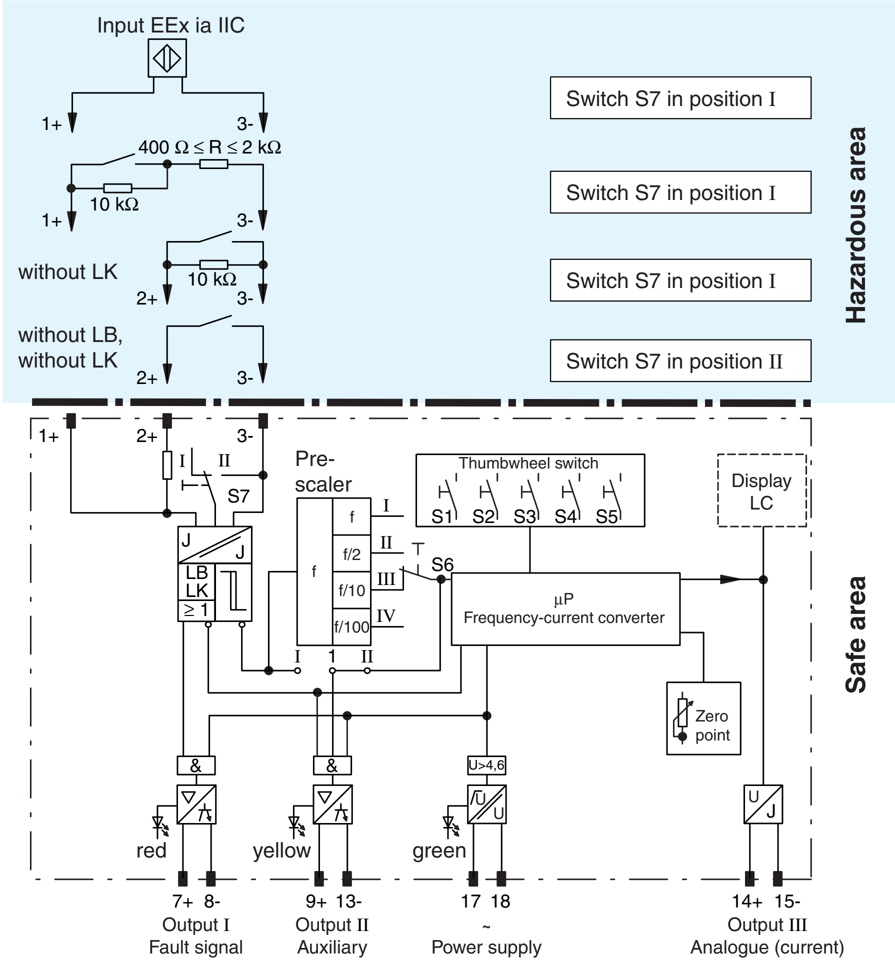
KHA6-FSU-Ex1.D

with LC indicator
Successor KFU8-UFC-Ex1.D

Function

The frequency current converter converts the input frequency into a set current. It is designed for the connection of a sensor per DIN EN 60947-5-6 (NAMUR), a non-rebounding contact or an electrical switch.
The input frequency (max. 5 kHz), in which 20 mA should flow across the output, is adjustable within the range of 0.001 ... 999 Hz. At higher frequencies, the input frequency should be divided across a pre-separator so that a max. frequency of 1 kHz lies at the microprocessor of the FSU. A load of 0 to 650 Ohm is approved at the analogue output. The present current value is indicated by units with LC-displays in 3 1/2 characters. The zero point (0 mA or 4 mA) can be adjusted through the "Zero point" potentiometer on the front panel. The zero point is pre-set at the factory. A readjustment is normally not necessary.
The response time of the analogue output is set using the S5 thumbwheel switch with jumps in the input frequency. The fault signal output, the serial switch output, the power supply and the current output are galvanically isolated per DIN VDE 0160.
The power supply and the current output are galvanically isolated from each other in accordance with DIN VDE 0160.

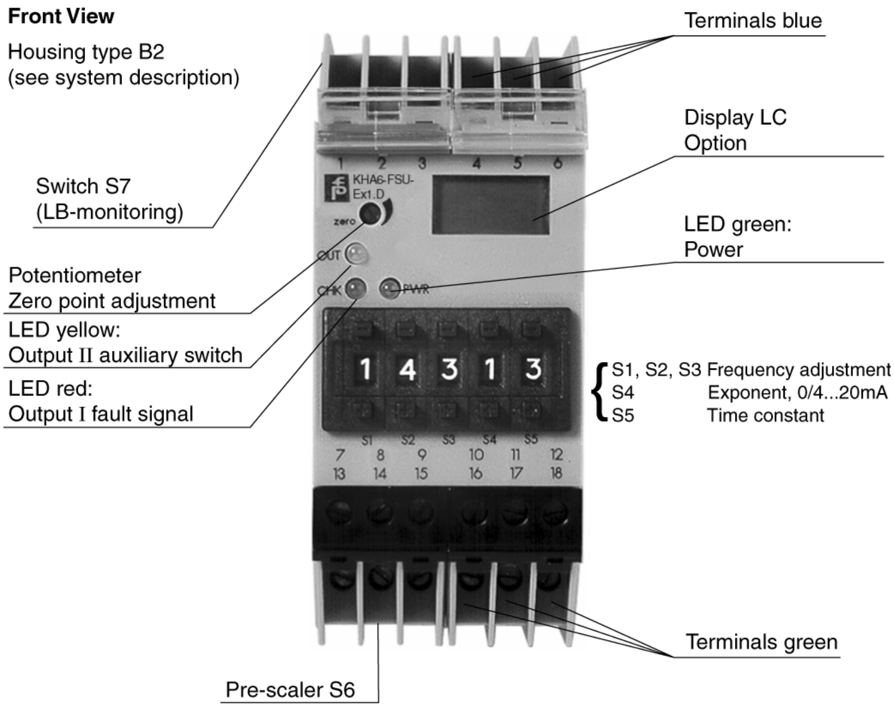
Connection



Composition

Front View

Housing type B2
(see system description)



Pepperl+Fuchs Group • Tel.: Germany +49 621 776-0 • USA +1 330 4253555 • Singapore +65 67799091 • Internet http://www.pepperl-fuchs.com

Supply	
Connection	terminals 17, 18
Rated voltage	85 ... 253 V AC , 45 ... 65 Hz
Power consumption	≤ 4 W
Input	
Connection	terminals 1+, 2+, 3-
Rated values	acc. to ENnbsp;60947-5-6 (NAMUR, DIN 19234), 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
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 14+, 15-
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	Analogue output
Current range	0 ... 20 mA or 4 ... 20 mA , max. 25 mA
Open loop voltage	≤ 27 V DC
Load	≤ 650 Ω
Transfer characteristics	
Resolution	12 Bit (equivalent to 6.1 μA)
Deviation	current-frequncy converter, analogue output: ± 0.6 % of nominal output current ± 60 μA LC display (optional): ± 0.6 % of nominal output current ± 100 μA
Switching frequency	≤ 5 kHz
Electrical isolation	
Input/Output	safe electrical isolation acc. to EN 50020
Input/power supply	safe electrical isolation acc. to EN 50020
Output/power supply	available
Output/Output	available
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 ENnbsp;60947-5-6 (NAMUR, DIN 19234), see system description for electrical data
Ambient conditions	
Ambient temperature	-25 ... 65 °C (248 ... 338 K)
Mechanical specifications	
Protection degree	IP20
Mass	approx. 260 g
Dimensions	40 x 100 x 115 mm (1.6 x 3.9 x 4.5 in)
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_0	12,7 V
Current I_0	17,3 mA
Power P_0	55 mW
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]	
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

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

Lead breakage and short circuit monitoring

The outputs are cut off, when the current in the control circuit is J < 0,1 mA (in respect to lead breakage monitoring) or J > 6 mA (in respect to short circuit monitoring), in this case the fault signal output is switched and indicates a fault through the illumination of LED 2 (red).

Adjustment instructions pre-scaler (S6)

The input frequency f_E can be reduced via a pre-scaler, as the microprocessor of the frequency current converter can process a maximum of 1 kHz (pulse to no-current ratio 1 : 1).

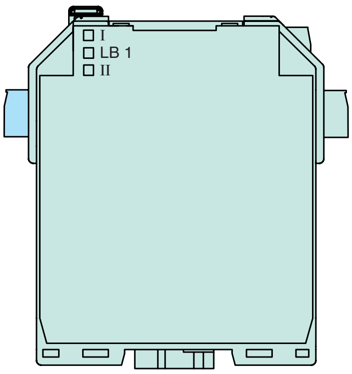
The adjustment is accomplished via a multi position switch.			
Switch in pos. I:	1 : 1 (1 kHz)	Æ	Separator ratio TV = 1
Switch in pos. II:	2 : 1 (2 kHz)	Æ	Separator ratio TV = 0.5
Switch in pos. III:	10 : 1 (5 kHz)	Æ	Separator ratio TV = 0.1
Switch in pos. IV:	100 : 1 (5 kHz)	Æ	Separator ratio TV = 0.01

By means of the solder bridge 1 can be determined, if the serially switched output is operated dependent or independent 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**
Delivery:	Solder bridge 1 in position II

Adjustment of the jumper 1

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



Input frequency adjustment f_E

By means of the thumbwheel switch S1 - S4 the frequency is adjustable, at which the maximum current of 20 mA is to flow. However the position of the pre-scaler should be considered.

Adjustment of the thumbwheel switches

Nominal frequency	example:	nominal frequency	0 Hz ... 3.57 Hz
f_n = (S1 x 100 + S2 x 10 + S3 x 1) x S4 x TV		output current	4 mA ... 20 mA
TV = separator ratio		adjustment	S1 : 3/S2 : 5
			S3 : 7/S4 : 6
		→	(357 x 10^{-2} Hz)
			S6 : I (TV = 1)

Switch S1	(0 - 9) x 100
Switch S2	(0 - 9) x 10
Switch S3	(0 - 9) x 1
Switch S4	according to the table

Switch S4 switch position	Input frequency f_E (S1 + S2 + S3)	0-Point of the output characteristic
0	x 10-0 Hz	0 mA
1	x 10-1 Hz	0 mA
2	x 10-2 Hz	0 mA
3	x 10-3 Hz	0 mA
4	x 10-0 Hz	4 mA
5	x 10-1 Hz	4 mA
6	x 10-2 Hz	4 mA
7	x 10-3 Hz	4 mA

Adjustment of the time response

By means of the thumbwheel switch S5 the time can be set, after which the output current rises in case of an erratic rise of the input frequency.

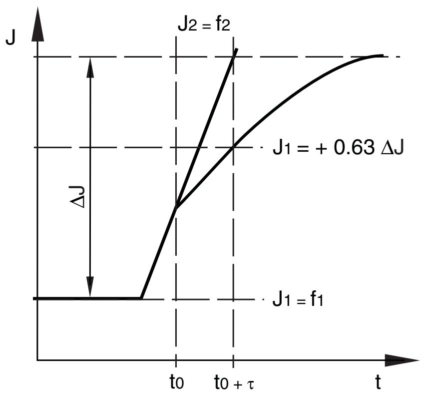
The value of the time constant t is calculated from the following formula:

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

f_s = reference frequency

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

Step response



$J(t) = J_1 + (J_2 - J_1) \times (1 - e^{-\frac{t}{\tau}})$

$J(t) = J_1 + \Delta J \times (1 - e^{-\frac{t}{\tau}})$

$J(t)$: Output current

J_1: Output current at frequency f_1

J_2: Output current at frequency f_2

ΔJ: Output current difference $J_2 - J_1$

τ: time constant