FABRIKAUTOMATION

MANUAL

KFU8-FSSP-1.D

FREQUENCY-
VOLTAGE/CURRENT-CONVERTER

CE

₣ PEPPERL+FUCHS

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1   Device description

The frequency-voltage/current converter KFU8-FSSP-1.D is a device for indication and monitoring of periodical signals which occur in almost all areas of process automation, i. e. from frequencies in general and speeds in specific.

The input signal sequence is evaluated and converted into a frequency by a μ-controller in accordance with the cycle method. The μ-controller calculates a voltage or current proportional to the input frequency and produces it with a digital analog converter in respect to the selected measurement range's limit value.

The following analogue signals can be selected:
0 V ... 10 V, 2 V ... 10 V, 0 mA ... 20 mA, 4 mA ... 20 mA.

The pulse output produces the input frequency which is subdivided by the adjustable factor of (1 ... 9999).

Close attention was given the special case of speed measurement during the development of the device. The indicators and inputs can therefore, occur in Hz or in min^{-1}.

Furthermore in applications with slow processes, where the rotary encoders deliver multiple pulses per rotation, it is possible, by indicating the number of pulses per rotation, to automatically operate with the actual speed of the drive.

The frequency-voltage/current converter can be supplied with 115 VAC, 230 VAC or 24 VDC and when powered with AC voltage the converter provides 24 VDC to supply the sensor.

The signal input is galvanically isolated by means of an opto coupler and it accepts all common 2-wire, 3-wire and 4-wire proximity switches as well as the incremental rotary encoders as signal sources. Two further terminals are provided for the connection of proximity switches or incremental rotary encoders according to DIN 19234 (NAMUR).

The input signal - frequency in Hz resp. speed in min^{-1} - or the output voltage in V resp. the current in mA is indicated by a 4 position 7-segment-LED-display on the front side of the device. The parameterization is performed via the 4 buttons below the display.

Frequency-voltage/current converter KFU8-FSSP-1.D
Device description

2 Function description

2.1 Operating mode

Signal frequency

The frequency-voltage/current converter processes input signals of
0.001 Hz ... 9999 Hz or speed of 0.02 min⁻¹ ... 9999 min⁻¹. Signals with an uneven
sensing ratio of 1:1 must have a minimum signal duration of 40 µs.

Falling below the measurement range, signal ⟦– – ⬚ ⬚⟧

This signal appears when no input signal is recognized.

Exceeding the measurement range, signal ⟦9 9 – –⟧

The chosen display and the measurement range were exceeded.

Very low signal frequencies, the display value is invalid, signal ⟦X X X –⟧

The measuring mechanism has determined while measuring very low switching fre-
quencies, that the last calculated frequency was not attained, i. e. the time between
the last two signal slopes has already expired. The device now waits for the next pos-
itive signal slope in order to be able to calculate the next measurement. 'xxx' is used
as a place holder for the first 3 digits of the last measurement.

Self test, signal ⟦P A – P⟧

The device conducts a self-test after initiation of the supply voltage. The above
mentioned signal appears during the determination of an error, i. e. in the
establishment of the test sum of the EEPROM data. In this case the factory-set
parameters are loaded, the EEPROM-data that have been modified in the meantime
are ignored.

If the error is due to an accidentally occurred interference pulse when loading the
EEPROM-data, the fault signal can be eliminated by turning the supply voltage off an
on again, however without previous storage of the parameters.

If the fault signal still appears after having switched on again, the device has to be
recalibrated and the application specific parameters have to be re-entered and stored
afterwards.

2.2   Adjustment mode

(see also the function description overview)

Transition operating mode → adjustment mode

The simultaneous depression of the "Mode" and the "+" buttons initiates the adjust-
ment mode. The display shows the parameters in the form of text.

The parameters can be changed in the parameter display (flashing characters). They
are then temporarily effective until interruption of the operating voltage.

Transition adjustment mode → operating mode

The parameters are permanently stored in an EEPROM and the adjustment mode is
exited by simultaneously depressing the "Enter" and the "+" buttons.

Button functions for the parameter display

"+"   switch to the next parameter.

"-"   switch to the previous parameter.

"Mode"   switch modes of parameter display.

"Enter" a. "+"   ends parameter editor and stores all parameters in the
                   EEPROM.

Button functions for the parameter display (one digit flashing)

"+"   increase the value of the flashing digit.

"-"   decrease the value of the flashing digit.

"Mode"   move digit to the left.

"Enter"   transfer from the parameter value display to the parameter dis-
                   play.

Function selection ⎡FUNC⎤

Two measurement functions are available:

1. **Frequency measurement** in Hz (parameter value = 0)
   The established cycle duration of the input signal is converted into a frequency in
   Hz through the formation of a reciprocal value.
   Range: 0.001 Hz ... 9999 Hz

2. **Speed measurement** in min^{-1} (parameter value = 1)
   The signal frequency calculated from the cycle duration is multiplied by 60 and is
   displayed in min^{-1}.
   Range: 0.02 min^{-1} ... 9999 min^{-1}

Factory set: Speed measurement in min^{-1}

Display and measurement range ⌐dECⰞ

4 display and measurement ranges are available for the frequency measurement and 3 for the speed measurement:

Parameter value	Frequency range in Hz	Speed measurement^{-1}
0000	0 ... 9999	
000.1	0 ... 999.9	
00.02	0 ... 99.99	
0.003	0 ... 9.999	----

Factory set: 0 ... 9999

Signal ⌐Grⁿ P⌐: This display occurs, when the attempt is made to modify the measurement range, so that the formerly entered or "teached in" end value of the measurement range would exceed the display or measuring range, or when the digits after the decimal point would be cut off.

Pulse divider PULS

Applications with slow processes are often equipped with rotary encoders, which deliver multiple signals per rotation. In speed measurement, the device takes over the conversion of the real speed through the entry of the number of the signals per rotation, which means that the display reflects the actual speed of the drive.

The pulse divider is only effective during speed measurement.
Range: 1 ... 1200
Factory set 1 pulse/rotation

Measurement range full scale reading F-HⰞ

In frequency measurement, the set value is measured in Hz or in speed measurement it is measured in min^{-1} (depending on **Function selection**), it determines the frequency or speed at the analog output of the maximum voltage of 10 V or the maximum current of 20 mA.

Range: see display and measurement range.
Factory set: 9999

The frequency or speed of the current input signal can be "teached in" by pushing 'Mode' and then 'Enter'.

Analog output OUEP

Selection of the analog output signal. Either the voltage output (terminals 5 and 6) or the current output (terminals 4 and 5) can be used at a time.

Parameter value	Analog output
0	0 V ... 10 V
1	2 V ... 10 V
2	0 mA ... 20 mA
3	4 mA ... 20 mA

Factory set: 0 V ... 10 V

Display function FdSP

The display shows the determined frequency or speed in Hz and min^{-1} (depending on **Function selection**) or the voltage at the analog output in Volts respectively the output current in mA (depending on the selection in menubar **Analog output**).

Display function	Function selection	Analog output	Display
0	0	—	Frequency in Hz
	1	—	Speed in min^{-1}
1	—	0	Voltage in V
	—	1	Voltage in V
	—	2	Current in mA
	—	3	Current in mA

Factory set: Frequency or speed

Display rate tdSP

The time prior to the acceptance of the current measurement into the display can be selected in order to guarantee a proper reading of the display.

The display rate neither influences the calculation time for establishing the measurement value nor the output voltage.
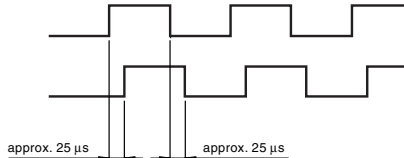
Range: 0.01 s ... 2.5 s
Factory set: 0.33 s

Division factor for the pulse output d FD

If the division factor is set to 1, then the pulse output goes 25 µs toward the positive slope of the input signal to high level and 25 µs toward the negative slope to low level.


approx. 25 µs   approx. 25 µs

With division factors greater than 1, the pulse output goes to high approx. 50 µs after the first positive input signal slope.

For even division factors the output level goes approx. 50 µs after the 'division factor'/2-period to low level for the following periods.

Example:
division factor = 4

output level high:
4/2 = 2 periods

4 periods

2 periods

approx. 50 µs   approx. 50 µs
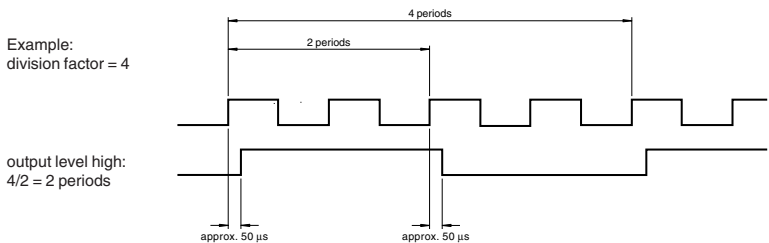
For uneven division factors the output level goes approx. 50 µs after the 'division factor-1)/2-period to low level for the following periods.

Example:
division factor = 5

output level high:
(5-1)/2 = 2 periods

5 periods

2 periods

approx. 50 µs   approx. 50 µs
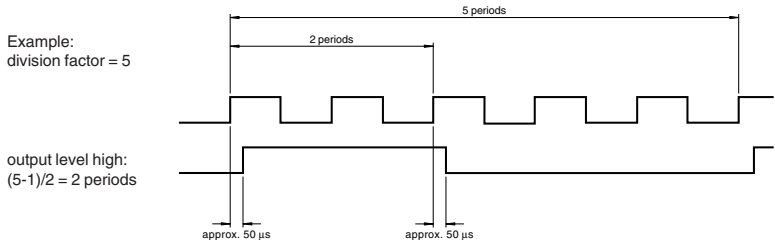
Range: 1 ... 9999
Factory set: 1

Software version number SOFt

The version number of the software can only be read.

3 Technical data

Power supply	196 V ... 264 V, 47 Hz ... 63 Hz, < 5-VA (Term. 16, 18) 98 V ... 132 V, 47 Hz ... 63 Hz, < 5 VA (Term. 17, 18) 20.4 V ... 27.6 V, < 5 W (Term. 11, 12 or across the Power Rail)
Sensor power supply	21.6 VDC ... 26.4 V, I $\leq$ 30 mA, short circuit protected (Term. 1, 7, 13)
Signal inputs	
Function	Cycle duration measurement
Input frequency	$\leq$ 10000 Hz, signal pause/-duration: $\geq$ 40 µs
Function range	0.001 Hz ... 9999 Hz or 0.02 min^{-1} ... 9999 min^{-1}
NAMUR input	Switching points: $\geq$ 1.2 mA; $\leq$ 2.1 mA (Term. 8, 9) No load current: 8.2 V; Short circuit current: 6.5 mA Impedance: 1.2 kΩ
PNP-, NPN input	Galvanically isolated through an opto coupler (Term. 14, 15) High-level: 16 V ... 30 V, Low-level: 0 V ... 6 V Input current high-level: $\leq$ 10 mA, $R_i \approx$ 3 kΩ
Analog outputs	Galvanically isolated voltage and current output
Voltage output	0 V ... 10 V or 2 V ... 10 V, resolution 10 mV $R_i \approx$ 330 Ω (I_{max} = 30 mA), (Term. 5, 6)
Current output	0 mA ... 20 mA or 4 mA ... 20 mA, resolution 20 µA $R_i \leq$ 600 Ω (Term. 4, 5)
Temperature drift	$\leq$ 0.005 %/K from final value
Measurement accuracy	$\leq$ 0.2 % from final value
Pulse output	$\geq$ (U_B - 3 V), 20 mA, short circuit protected (Term. 2)
Frequency, speed, voltage or.current display	4 position 7-segment display, red, character size: 7 mm
Control panel	4 buttons: "Mode", "-", "+", "Enter" for parameterization
Housing	Modular terminal housing (Macrolon), system KF
Mounting	Snap-on to a 35 mm DIN rail per DIN EN50022 or to screw with extendable latches in a 90 mm grid
Connection terminals	Removable, encoded device terminals Cross sectional area: $\leq$ 2 x 2.5 mm^2
Operating temperature	-25 °C ... +60 °C
Storage temperature	-40 °C ... +85 °C
Protection class	IP 20
EMC	per EN 50081-2, EN 50082-2

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4   Terminal assignment

Term. 1:	Sensor-power supply GND	Term. 10:	Not connected
Term. 2:	Pulse output	Term. 11:	Power supply 24 VDC, L +
Term. 3:	Not connected	Term. 12:	Power supply
Term. 4:	Analog output I -	Term. 13:	Sensor-power supply GND
Term. 5:	Analog output I +, U +	Term. 14:	PNP-, NPN-input - (Cathode)
Term. 6:	Analog output U -	Term. 15:	PNP-, NPN-input + (Anode)
Term. 7:	Sensor-power supply + 24 V	Term. 16:	Power supply L1, 230 VAC
Term. 8:	NAMUR input L -	Term. 17:	Power supply L1, 115 VAC
Term. 9:	NAMUR input L	Term. 18:	Power supply N

5   Dimensions, operating and display devices
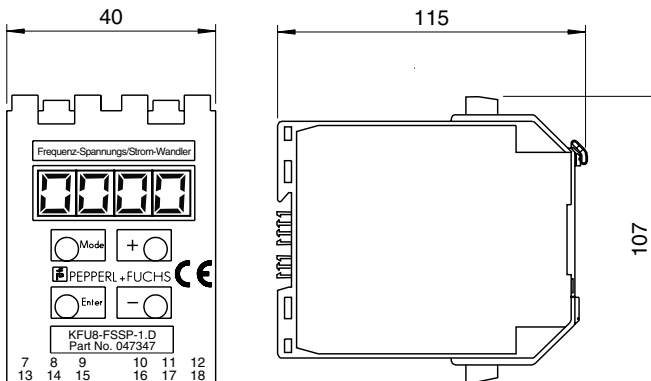
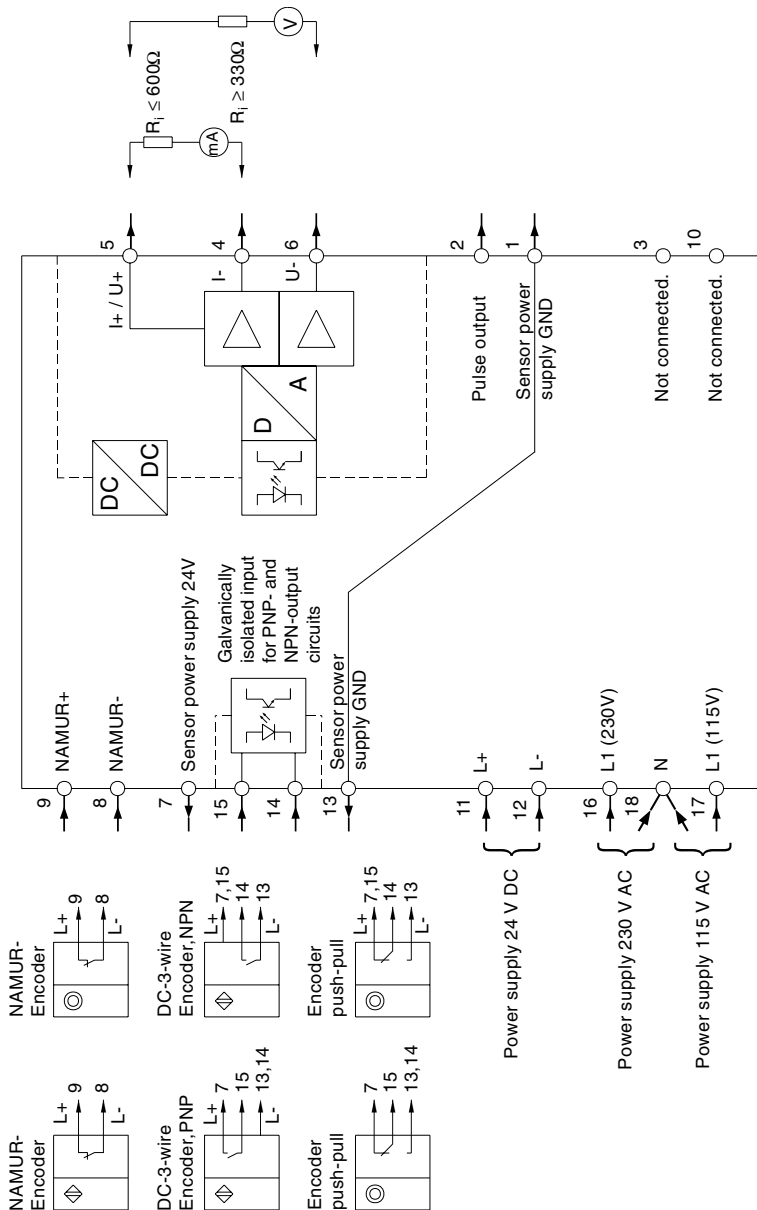|	
"Mode" and "+":	Start parameterization editor
"+":	Advance to next parameter selection or increase the flashing digit by one
"-":	Return to previous parameter selection or decrease the flashing digit by one
"Mode":	Display parameter value (right character flashes) or shift the flashing character to the left
"Enter":	Exit parameter value display, the device now works temporarily with the altered parameter.
"Enter" and "+":	Exit parameter editor, the parameters are now permanently stored in the EEPROM.

6   Connection plan

7 Function description overview
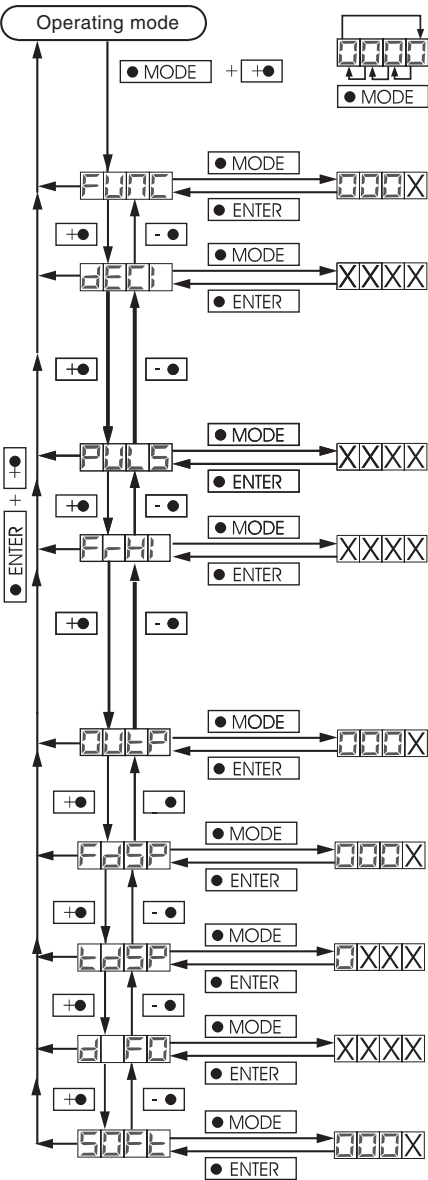
Function selection:
X=0: Frequency meas. 0.001 Hz ...9999 Hz
X=1: Speed meas. 0.02 min^{-1} ... 9999 min^{-1}
Factory set: X = 1

Display and measuring range:
$0 \leq X \leq 3$ at frequency meas.   Factory set:
$0 \leq X \leq 2$ at speed meas.   X = 0000

X	Frequency [Hz]	Speed [min^{-1}]
0000	0 ... 9999	
000.1	0 ... 999.9	
00.02	0 ... 99.99	
0.003	0 ... 9.999	----

Pulse divider:
Number of signals per rotation
(is ignored during frequency measurement)
$1 \leq XXXX \leq 1200$, factory set: XXXX = 1

Measurement range final value:
Frequency or speed, by which 10 V or 20 mA are
applied to the analog output.
$0 \leq XXXX \leq 9999$, factory set: XXXX = 9999

Teach in of the current frequency or speed value
as a measurement range final value by pressing
the "MODE" button and then the "ENTER" button.

X	Analog output
0	0 V ... 10 V
1	2 V ... 10 V
2	0 mA ... 20 mA
3	4 mA ... 20 mA

Factory set: X = 0

Display:
X=0: Frequency or speed
X=1: Voltage display or current display
Factory set: X = 0

Display rate:
$0.01\ s\ \leq X.XX \leq 2.50\ s$
Factory set: X.XX = 0.33 s

Division factor for the pulse output
$1 \leq XXXX \leq 9999$
Factory set: XXXX = 1

Software-version number
Can only be read.

One Company, Two Divisions.

Factory Automation Division

Product Range

- Digital and analogue sensors
- in different technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
- Incremental and absolute rotary encoders
- Counters and control equipment
- Identification Systems
- AS-Interface

Areas of Application

- Machine engineering
- Conveyor or transport
- Packaging and bottling
- Automotive industry

Process Automation Division

Product Range

- Signal conditioners
- Intrinsically safe interface modules
- Remote Process Interface (RPI)
- Intrinsically safe field bus solutions
- Level control sensors
- Process measuring and control systems engineering at the interface level
- Intrinsic safety training

Areas of Application

- Chemical industry
- Industrial and community sewage
- Oil, gas and petrochemical industry
- PLC and process control systems
- Engineering companies for process systems

Service Area

Worldwide sales, customer service and consultation via competent and reliable Pepperl+Fuchs associates ensure that you can contact us wherever or whenever you need us. We have subsidiaries worldwide for your convenience.

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