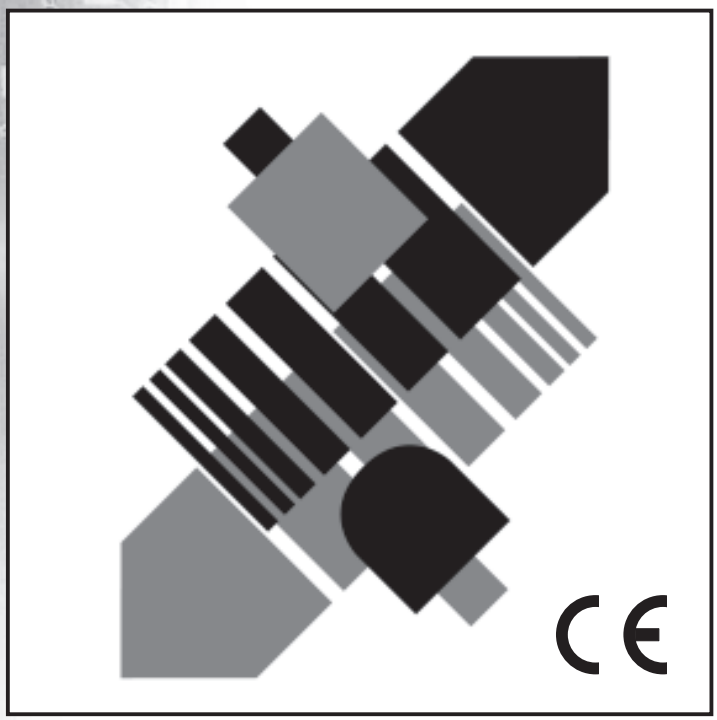
FACTORY AUTOMATION

Manual

Speed Monitor

KHU8-DW-1.D



PEPPERL+FUCHS

Speed Monitor KHU8-DW-1.D

page

1. Technical description

The KHU8-DW-1.D is a device used to **indicate and monitor periodic signals** which occur in almost all areas of automation and process engineering, i.e. frequencies in general and rotational speeds in particular.
The input signals are evaluated using the cycle method, i.e. by measuring the duration of a period, and then converted by a very fast µ-controller to frequency, or rotational speed.

The frequently occuring special case of rotational speed measurement was given particular attention. For this reason, **indications** and **inputs** can be either in **Hz** or in **rpm**.
In addition, the possibility exists, on applications involving lengthy processes, whose sensors provide a **number of pulses per revolution**, to operate automatically with the **actual rotational speed** of the drive, by presetting the number of pulses.

Indication of the measured value is achieved by means of a **4-digit 7-segment-LED-display** on the front of the device, with **up to 3 places following the decimal point**.

The monitoring function is actuated by a **limiting value**, whose upper and lower hysteresis values can **be selected** within the appropriate measuring and indicating range.
The **output signal** is generated by a change-over relay when the hysteresis limits are either **exceeded or fallen below**. Due to its high switching capability, the relay output can be used to **directly drive** an actuator, or as an **input signal to a higher level control**.
In addition, the switching state of the relay is indicated by **a yellow LED** on the front face of the device.
A function block is connected in line with the output relay, which enables **10 different timer functions** to be employed; thus there is no need to connect a separate timer relay in series. In addition to **ON delay and OFF delay, defined ON time and pulse lengthening**, the **direction of operation of the relay**, i.e. to monitor underspeed or overspeed, can also be selected. The built-in **start-up bypass**, triggered by switching on the supply voltage, or by an external signal, **prevents false signals** from occuring during the start-up of the monitored system.

The speed monitor may be supplied with **115 V AC, 230 V AC or 24 V DC.** When an alternating voltage is connected, a **24 V DC source is available for the signal transducer**.

All currently available **two-, three- or four-wire proximity switches** and incremental **rotary encoders** are accepatable as the **sensor**. Moreover two terminals are reserved for the connection of **proximity switches to DIN 19234 (NAMUR)**.

Safety notes:
Insulation co-ordinates for specifying data on galvanic/electrical isolation are in accordance with DIN EN 50 178:
The KHU8-DW-1.D device is intended for use in enclosed electrical operating areas, to which only competent electrical personnel or properly instructed electrotechnical personnel have access or entry.
The device is rated for use in conditions of pollution severity class 2, overvoltage category II in accordance with EN 50 178.
The device comprises 3 galvanically isolated circuits:
- 230 V, 115 V voltage supply circuit, connections: 16, 17, 18
- Signal circuit
  24 V voltage supply, connections: 4, 5
  Sensor/signal, connections: 1, 2, 3, 7, 8, 9, 13, 14, 15
- Relay output circuit, connections: 10, 11, 12

There is no isolation between the signal circuit connections and the exposed/contactable surfaces.

2. Operation

2.1 Operating mode

Signal frequency

The speed monitor processes input signals from 0.001 Hz ... 5000 Hz, over 4 measuring ranges, i.e., cycle durations of 0.0002 s to 1000 s are evaluated. Signals not having a duty rate of 1:1 must have a minimum pulse pause or pulse duration of 20 µs in order to be detected with certainty behind the input filter.

Signal has fallen below the measuring range, message 
This message appears either when no input signal is detected, or if the displayed value would be zero, due to the selection of a measurring range which is too high.
Example: The device receives a signal of 0.1 Hz in the 0 Hz to 5000 Hz measuring and display range. This implies that the display would indicate zero and an observer might presume that the machine had stopped.

Signal is above the measuring range, message 
The set display and measuring range has been exceeded.
Solution: Select a larger measuring range.

Very low signal frequencies, displayed value is not valid, message 
During the measurement of very low signal frequencies, the measuring system has detected that the signal has fallen below the last computed frequency, i.e., the time between the last two signal edges has already elapsed. The unit is now waiting for the next positive signal edge, in order to be able to compute the next measured value. Here, 'XXX' represents the positions of the first three digits of the last measured value.

Self test, message 
When the supply voltage is switched on, the speed monitor carries out a self test. The message appears when it is established that there is an error, for example during the check summation of the EEPROM data; in this state, the output relay behaves as if there has been a power failure. The error message can be cleared by switching the supply voltage off and then on again.
If, on switching on again, the error message U-01 appears, then the factory presets were loaded, i.e., the parameters must be newly entered. In order to restore the normal function of the output relay, the speed monitor must once again be switched off and then on.

2.2 Setting mode

(see also the operating summary on the fold-out page)

Password protection 

The password protection function is not active. The password can be displayed, but not changed.

Function selection 

Two measuring functions are available:
1. Frequency measurement in Hz
The period of duration of the input signal, as determined, is converted to a frequency in Hz by forming the reciprocal value and then displayed. The hysteresis limits of the switch point are also specified in Hz.
2. Rotational speed measurement in rpm (preset at the factory)
The signal frequency, derived from the period of duration, is multiplied by 60 and displayed as rpm. The hysteresis limits are likewise specified in rpm.

Pulse divider 

(Preset at the factory: 1 pulse/revolution)
Applications involving slow processes are frequently equipped with sensors which provide several pulses per revolution. In the rotational speed measuring function, the device undertakes the conversion to the actual value of rpm by inputting the numerical value (of pulses/revolution), i.e. both the indication and the input of the hysteresis limits are directly obtained from the actual rate of rotation of the drive.

Example:
In normal operation, a machine rotates at 450 rpm. An incremental rotary encoder providing 10 pulses per revolution is used as the rate of rotation sensing element.
The input frequency is

$$\frac{\text{450 rpm x 10 pulses per revolution}}{\text{60 s/min}} = \text{75 Hz}$$

A rate of rotation of 450 rpm x 10 pulses/revolution = 4500 rpm would be displayed in the rotational speed measuring function.
By programming the pulse divider to 10 pulses/revolution, the display would indicate the actual drive speed of 450 rpm.

Display and measuring range dECI

(Preset at the factory: 0 ... 999.9)
Four measuring and display ranges are available for frequency measurement and three measuring and display ranges are available for speed measurement, as follows:

Display in parameter editor	Frequency range in Hz	Rotational speed in rpm	Number of decimal places
0000	0 ... 5000	0 ... 9999	0
000.1	0.0 ... 999.9		1
00.02	0.0 ... 99.99		2
0.003	0.0 ... 9.999	—	3

Example (continued from above):
The maximum permissible rotational speed of the drive is 600.5 rpm.
The first two measuring ranges can be selected. However, in order to fully utilise the accuracy of the display, it is recommended that the second measuring range is used.

Message Gr P
This message appears when an attempt has been made to change the range in such a way, that previously input limiting values lie outside the display and measuring range, or the respective places following the decimal point would be cut off.

Example (continued from above):
The maximum permissible value of 600.5 rpm has already been input as the upper hysteresis limit, and an attempt is being made to change the range to 0.01 rpm to 99.99 rpm (the limiting value is outside the display and measuring range), or an attempt is being made to change the range to 0 rpm to 9999 rpm (places following the decimal point would be cut off).

Output relay switch points U Gr O Gr

(Preset at the factory: 1 and 2)
The output relay switch points are defined by the upper and lower hysteresis limit. When the upper hysteresis limit O_Gr is exceeded, switching is triggered and on falling below the lower hysteresis limit U_Gr, switch back occurs. If no hysteresis limit is desired, i.e., the output relay is required to switch both on and off at a defined rpm, the same value has to be input for both parameters.

Example (continued from above):
On exceeding the maximum permissible rotational speed of 600.5 rpm, a signal should be activated in the control room. The alarm message should then extinguish when the speed drops again to 500 rpm. The upper hysteresis limit is to be set at 600.5 rpm, the lower at 500 rpm.

Message GrU? GrO?
The message GrU? appears if an attempt is made to set a value for the upper hysteresis limit which is lower than the lower hysteresis limit and GrO? is displayed on an attempt to programme a value for the lower hysteresis limit which is larger than the upper hysteresis value.

Timer functions, reversal of direction of operation of the output relay

Time base for the timer functions tr-EL
(Preset at factory: 1.0 s)
A time between 0.1 s and 999.9 s can be set for the timer function of the output relay.

Timer functions and reversal of direction of operation tFUn
(Preset at factory: 1)
The KHU8-DW-1.D speed monitor can be adjusted to any one of 10 different settings, in association with the reversal of direction of operation, in order to modify the switching behaviour of the output relay. In functions 0 to 4, the output relay is active according to the selected time function, when the upper hysteresis value is exceeded. In functions 5 to 9 the sense of operation is inverted, i.e., the relay is active below the lower hysteresis limit.

No.	Function	No.	Function
0	no timer function	5	no timer function, inverted
1	ON delay	6	ON delay, inverted
2	OFF delay	7	OFF delay, inverted
3	Defined ON time	8	Defined ON time, inverted
4	Pulse lengthening	9	Pulse lengthening, inverted

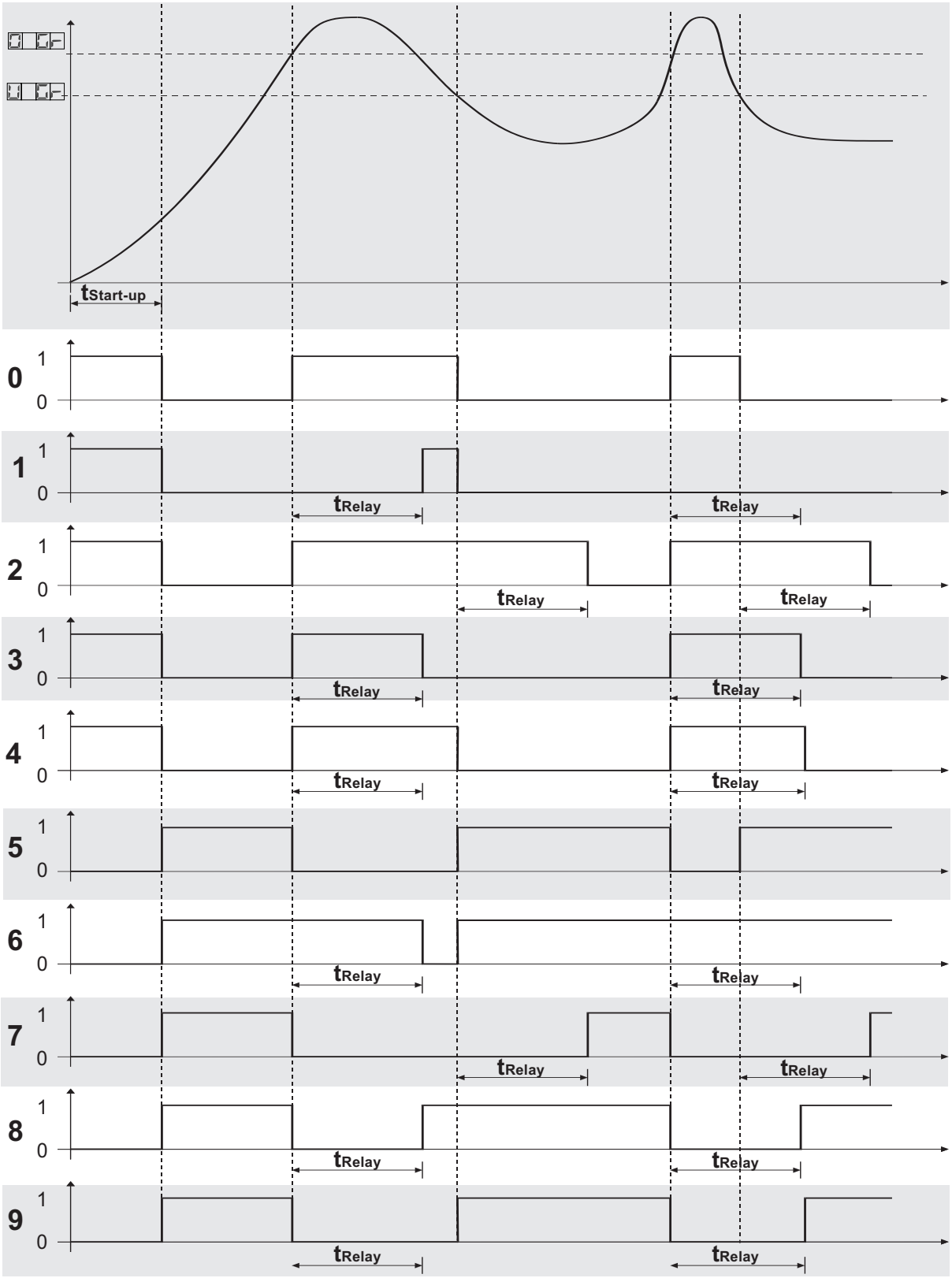
The **ON delay** has the effect of causing the timer to start when the upper hysteresis limit is exceeded and the relay to be triggered (retriggerable) when the timer has run out.
The **OFF delay** causes the relay to operate immediately when the upper limiting value has been exceeded.
Each time the measured parameter falls below the lower limit the timer is started and as soon as the timer has run out the relay drops out (retriggerable).
Defined ON time implies that the relay pulls in when the upper hysteresis limit is exceeded and drops out again after the set time (not retriggerable), independently of further variations in rpm.
Pulse lengthening is the means of providing that the relay pulls in when the upper limit is exceeded and drops out as soon as possible when the set time has elapsed (not retriggerable).
(See also the graphical representation on page 7).

Start-up bypass tAnL

(Preset at factory: 3 s)
A start-up bypass time between 0.1 s and 999.9 s can be programmed in order to avoid false signals on the start-up of a drive which is to be monitored for underspeed. During this time the device and the output relay behave as if the machine had already exceeded the upper hysteresis limit. The start-up bypass time is started by a positive signal on terminal 2; the positive signal must be at least as long as the bypass time. The start signal can originate from a higher order control, or be generated by the connection of the supply voltage to the speed monitor. In the latter case, terminals 2 and 3 have to be bridged.

Example:
In normal operation, a machine requires a maximum of 50 s to run up to a nominal speed of 500 rpm. The start-up bypass time has to be set to a value greater than 50 s. When the period of 50 s has elapsed the rpm underspeed monitoring function is active (relay function 5). If the start-up is as scheduled during this time, the relay will not have actuated. If the start-up takes longer than anticipated, then the relay will switch after commencement of the start-up bypass, until the upper hysteresis limit has been reached.

Figure: Timer functions, reversal of direction of action of the output relay



Display rate tdSP

(Preset at factory: 0.33 s)
In order to ensure good readability of the display, the time taken to indicate the current measured value in the display can be selected between 0.01 s and 2.5 s.

Software version number SOFt

The number of the software version can be read only.

3. Technical data

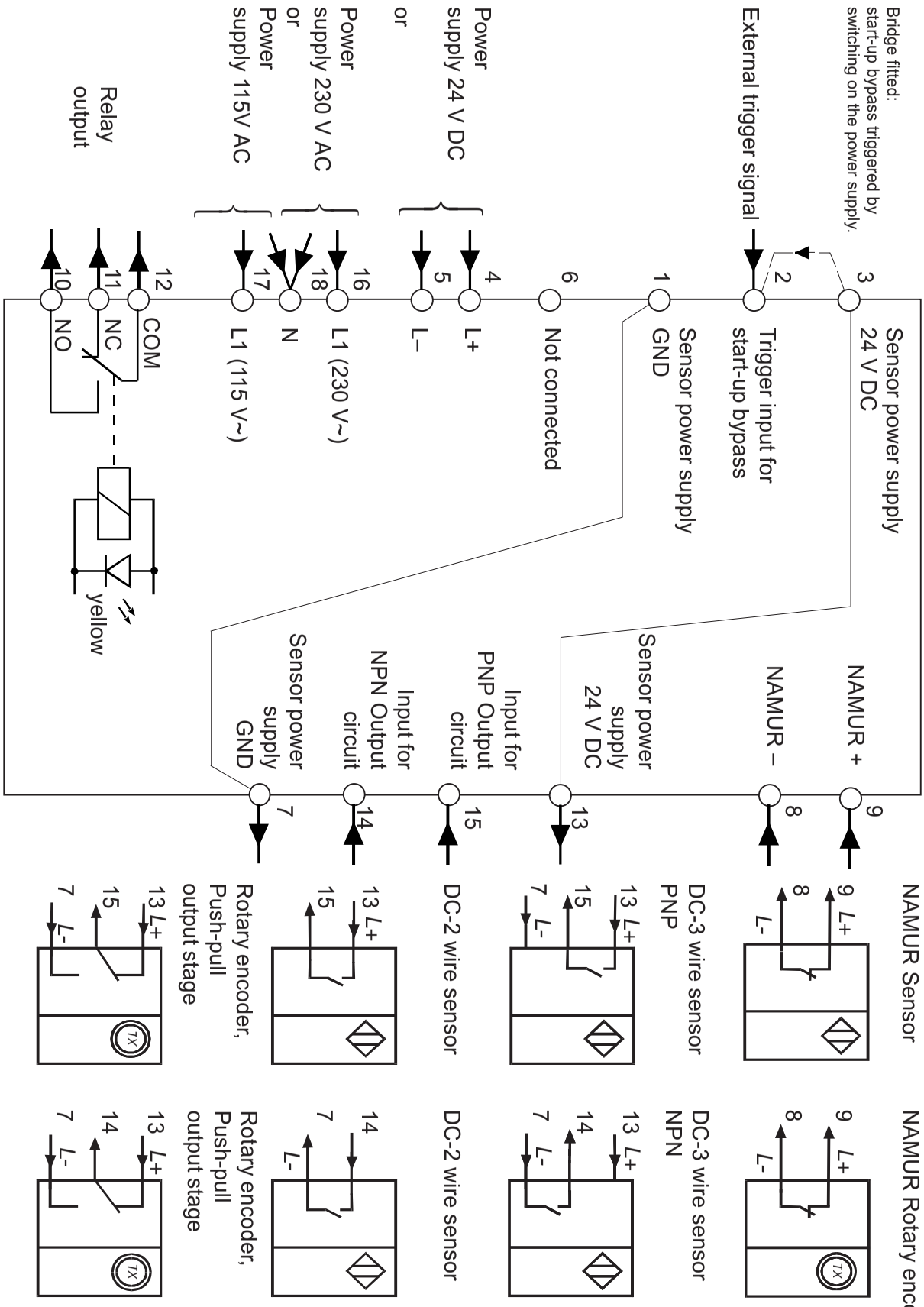
Supply voltages	230 V AC ± 10 %, 47 Hz ... 63 Hz, < 5 VA (Terminal 16, 18) 115 V AC ± 10 %, 47 Hz ... 63 Hz, < 5 VA Terminal 17, 18) 24 V DC +15/-10 %, $u_{ss} \leq$ 10 %, < 5 W (Terminal 4, 5)
Signal inputs	
Frequency	0.001 Hz ... 5000 Hz Minimum pulse length/duration: 20 µs
NAMUR	Switch points: ≥1.2 mA; ≤ 2.1 mA (Terminal 8, 9) No load voltage: 8.2 V; Short circuit current: 6.5 mA Impedance: 1.2 kΩ
PNP-sensor	Switch point: 12 V (Terminal 15) Max. input voltage: 30 V Impedance: 2.8 kΩ
NPN-sensor	Switch point: 12 V (Terminal 14) Impedance: 3.3 kΩ
Triggerinput	Switch point: 12 V (Terminal 2) Max. input voltage: 30 V Impedance: 2.8 kΩ
Output relay	Terminal 10: NO;Terminal 11: NC; Terminal 12: COM 250 VAC, 2 A, cos φ ≥ 0.7 40 VDC, 2 A ON/OFF delay (incl. computation time) ≤ 20 ms Mechanical life ≥ 30 000 000 switch cycles
Switch state indicator	3 mm - yellow LED
Timer functions	ON/OFF delay, defined ON time, pulse lengthening Timer period: 0 s ... 999.9 s
Direction of operation	reversible
Sensor power supply	Terminal 3, 13: L+; Terminal 1, 7: L- 24 VDC ± 10 %, $U_{ss} \leq$ 10 %, 30 mA short circuit protected
Start-up bypass	Triggered by external signal (Terminal 2) or by switching on the supply voltage (Terminal 2 and Terminal 3 bridged) Bypass time: 0.1 s ... 999.9 s

Error of measurement	0.001 Hz ... 100 Hz: ≤ 0.1 % 100 Hz ... 1 kHz: ≤ 0.3 % 1 kHz ... 5 kHz: ≤ 1.5 % Display: ± 1 digit
Ready delay	≤ 400 ms
Display rate of rotation and frequency	4-digit 7-segment-LED-display, red, digit height: 7 mm
Design	Modular terminal housing of Makrolon
Mounting	By clipping onto 35 mm standard rail according to DIN EN 50022 or srew mountable by pull-out clip with 90 mm grid
Terminal connections	Self-opening instrument terminals cross sectional area: ≤ 2 x 2.5 mm^2
Operating temperature	-25 °C ... +70 °C
Storage temperature	-40 °C ... +85 °
Pollution severity class	2
Protection class	IP 20
EMC to	EN 50081-2, EN 50082-2
Overvoltage category II	in accordance with EN 50 178.

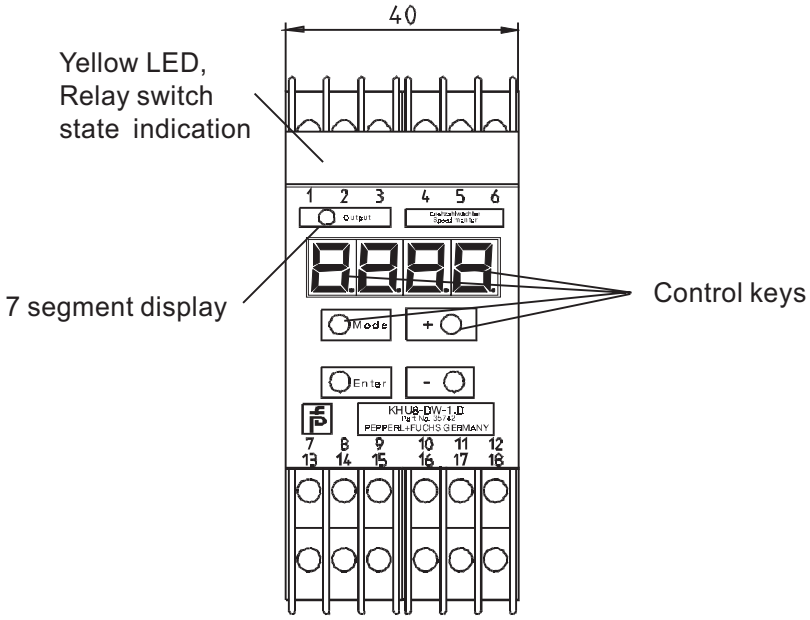
4. Terminal allocation

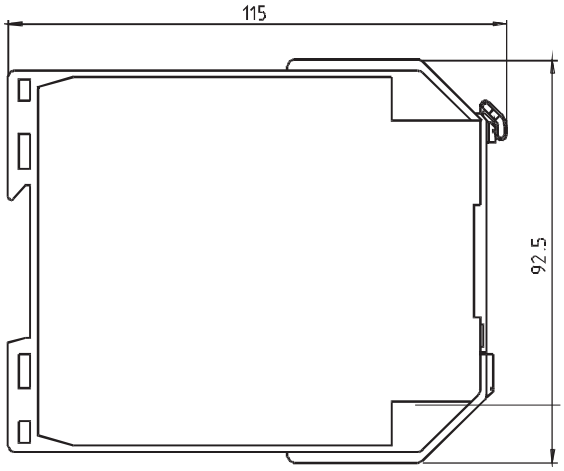
Term. 1: Sensor power supply, GND
Term. 2: Trigger input for start-up bypass
Term. 3: Sensor power supply, 24 V DC
Term. 4: Power supply, 24 V DC
Term. 5: Power supply, GND
Term. 6: Not connected
Term. 7: Sensor power supply, GND
Term. 8: NAMUR input L-
Term. 9: NAMUR input L+
Term.10: Relay normally open contact, NO
Term.11: Relay normally close contact, NC
Term.12: Relay root, COM
Term.13: Sensor power supply, 24 V DC
Term.14: for NPN-sensor Input
Term.15: for PNP-sensor Input
Term.16: Power supply L1, 230 V AC
Term.17: Power supply L1, 115 V AC
Term. 18: Power supply N

5. Connection diagram

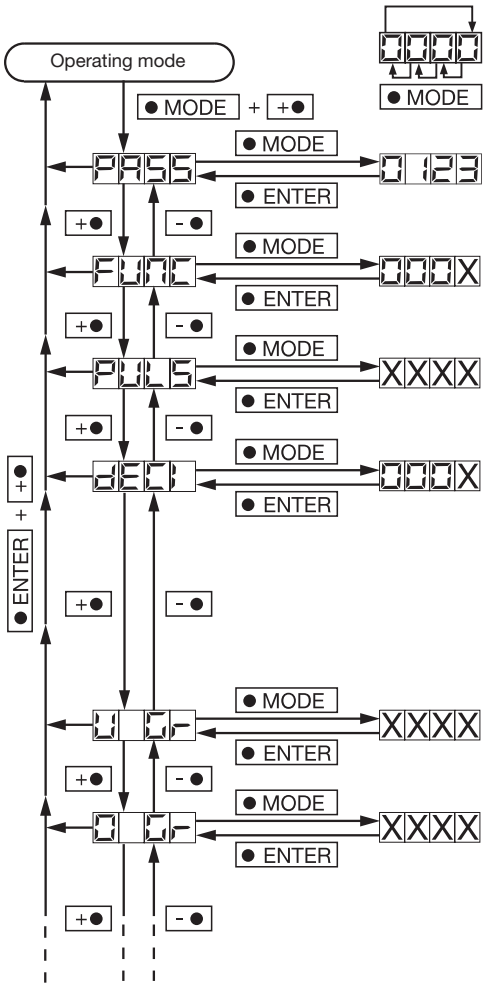


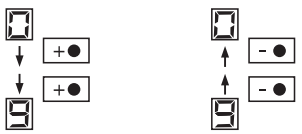
6. Dimensions, description of controls and indicators





‘MODE’ and ‘+’:	Start parameter editor
‘+’:	Select parameters or Increase value of flashing number
‘-’:	Select parameters or Decrease value of flashing number
‘MODE’:	Display parameter value, left number is flashing or Move flashing number to the left side
‘ENTER’:	Quit parameter display, now the unit is operating with the modified parameter.
‘ENTER’ und ‘+’:	Quit parameter editor, the parameters will be permanently memorized in the EEPROM.





Password protection not activated.
Password may not be edited.

X=0: frequency measurement 0.001 Hz...5000 Hz
X=1: rotational speed measurement
0.01 r.p.m....9999 r.p.m.
Preset at the factory: X=1

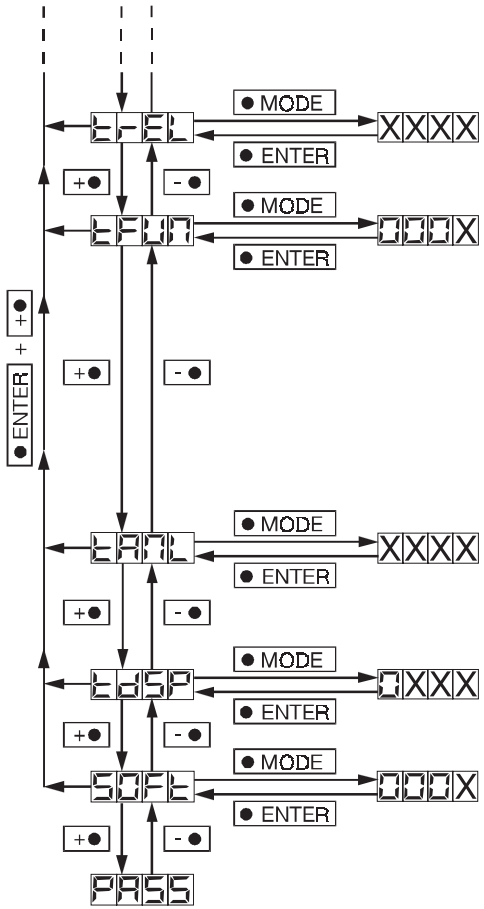
Number of pulses per revolution for rotational speed measurement (will be ignored for frequency measurement)
1 ≤ XXXX ≤ 1200
Preset at the factory: XXXX=1

Measuring and display range
Frequency measurement: 0 ≤ X ≤ 3
Rotational speed measurement: 0 ≤ X ≤ 2
Preset at the factory: X=1

X	Frequency range in Hz	Rotational speed in rpm
0000	0 ... 5000	0 ... 9999
000.1	0.0 ... 999.9	
00.02	0.0 ... 99.99	
0.003	0.0 ... 9.999	—

Lower hysteresis limit of switching point
0 ≤ XXXX ≤ 9998 (depending on the measuring range)
Preset at the factory: XXXX=1

Upper hysteresis limit of switching point
0.001 ≤ XXXX ≤ 9999 (depending on the measuring range)
Preset at the factory: XXXX=2



Period for the timer function of switching relay
0.1 s ≤ XXX.X ≤ 999.9 s
Preset at the factory: XXX.X=1.0 s

Period for the timer function of switching relay
Preset at the factory: X=1

X	Function
0	No timer function
1	ON delay
2	OFF delay
3	Defined ON time
4	Pulse lengthening
5	No timer function, inverted
6	ON delay, inverted
7	OFF delay, inverted
8	Defined ON time, inverted
9	Pulse lengthening, inverted

Start-up bypass
0.1 s ≤ XXX.X ≤ 999.9 s
Preset at the factory: XXX.X=3.0 s

Display rate
0.01 s ≤ XX.X ≤ 2.5 s
Preset at the factory: XX.X=0.33 s

The number of the software version can be read only.

One Company, Two Divisions.

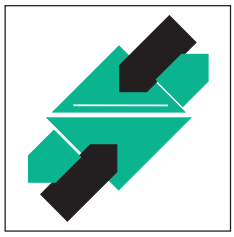
Factory Automation Division

Product Range

- Digital and anaogue 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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