

Operating Instructions
for
Ultrasonic Flowmeter/ -Monitor/ -
Counter/ -Dosing Unit

Model: DUK



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Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49 (0)6192-2990
Fax: +49(0)6192-23398
E-Mail: info.de@kobold.com
Internet: www.kobold.com

2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.

The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EWG-machine guidelines.

as per PED 97/23/EG

In acc. with Article 3 Paragraph (3), "Sound Engineering Practice", of the PED 97/23/EC no CE mark.

Diagram 8, Pipelines, Group 1, dangerous fluids

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.

Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:

The standard delivery includes:

- Ultrasonic Flowmeter/ -Monitor/ -Counter/ -Dosing Unit model: DUK
- Operating Instructions

4. Regulation Use

Any use of the Compact Magnetic-Inductive Flow Meter, model: DUK, which exceeds the manufacturer's specifications, may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

5. Operating Principle

5.1 General

The new KOBOLD type DUK flow meters are used for the measurement, monitoring, metering and dosing of low viscosity fluids.

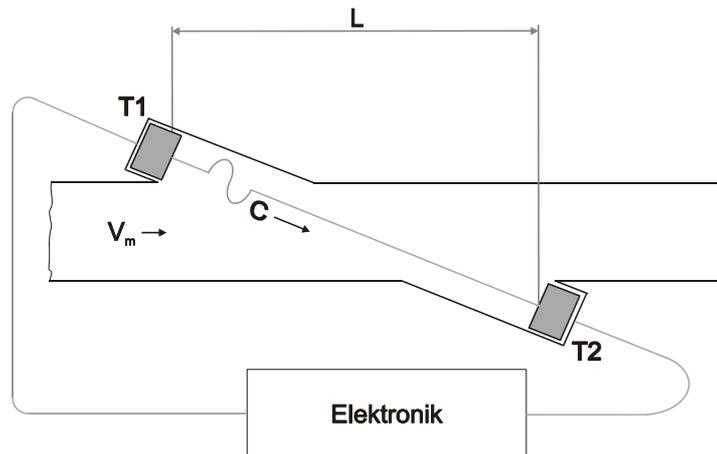
The devices work on the principle of the difference in running times.

This is based on the fact that ultrasonic waves in a medium are influenced by the speed of flow.

Two sensors mounted opposite one another in the pipeline function simultaneously as transmitter and receiver of ultrasound signals.

If there is no flow, then the running times of both signals are identical. If the medium is flowing, then the running time of the signal against the flow is longer than that with the flow.

The running time difference, which is determined by a microprocessor, is proportional to the speed of flow.



The devices can be equipped with a switching output, a frequency output or an analogue output. In addition, a compact circuit can be selected that features a digital display, a switching output and an analogue output.

The device series is rounded off by an optionally available dosing and meter circuit. The meter circuit indicates the momentary flow rate in the first line of the display and the partial or total quantity in the second line. A dosing circuit controls simple filling tasks and similarly measures flow rates, total amounts and filling amounts. The analogue output and two relay outputs can be used for further processing of the signals.

6. Mechanical Connection

6.1 Check operating conditions

- flow rate
- max. operating pressure
- max. operating temperature

In general the DUK is subjected to the same loads as the piping into which it is installed. The DUK should therefore be kept free from extreme loads, such as pressure surges with strong, dynamic pipe movements, vibrations in the proximity of centrifugal pumps, high temperature media, flooding etc.

6.2 Installation

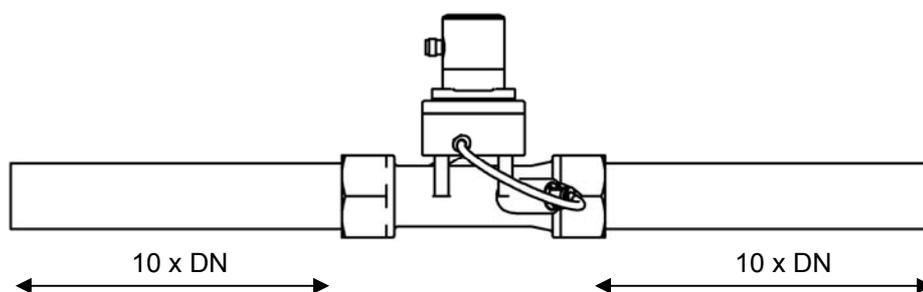
- Remove all packing materials and transport retainers and ensure that no such materials remain in the device.
- It can be installed in vertical, horizontal or rising pipes. Flow in direction of the arrow.
- Avoid pressure and tensile load.
- Mounting the inlet and outlet pipe in a distance of 50 mm from the connections.



Attention! The sensor may be damaged if it is tightened above the tightening torque range. Also, if it is tightened below the tightening torque range, the connecting thread section may loosen.

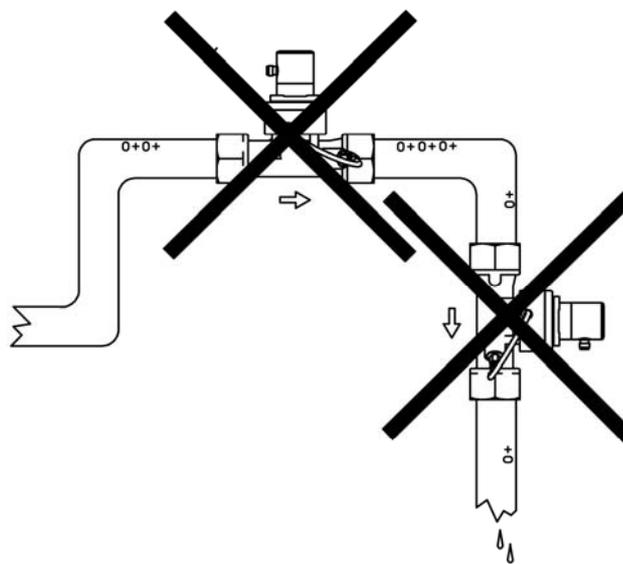
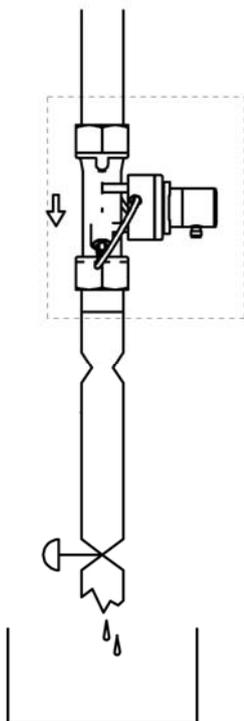
- Avoid valves or large reduction on the inlet section (this increases the inaccuracy of measurements).
- Check the leak tightness of the connections.

In-/Outlet



Mounting from top to bottom

avoid these installation areas



7. Electrical Connection

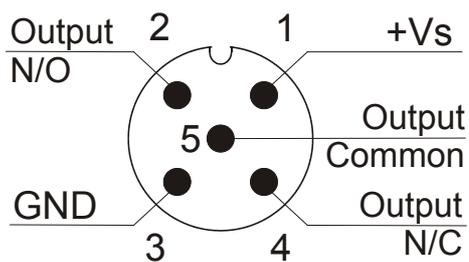
7.1 General



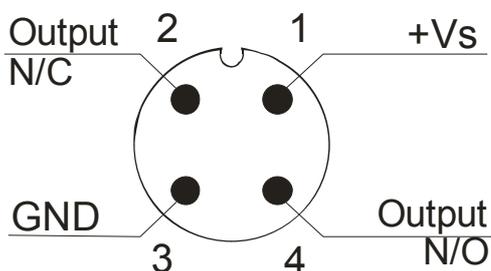
Attention! Make sure that the voltage values of your system correspond with the voltage values of the measuring unit.

- Make sure that the supply wires are de-energised.
- Connect the supply voltage and the output signal to the plug PIN's as stated below.
- We recommend the use of wires with cross sectional area of min. 0,25 mm².

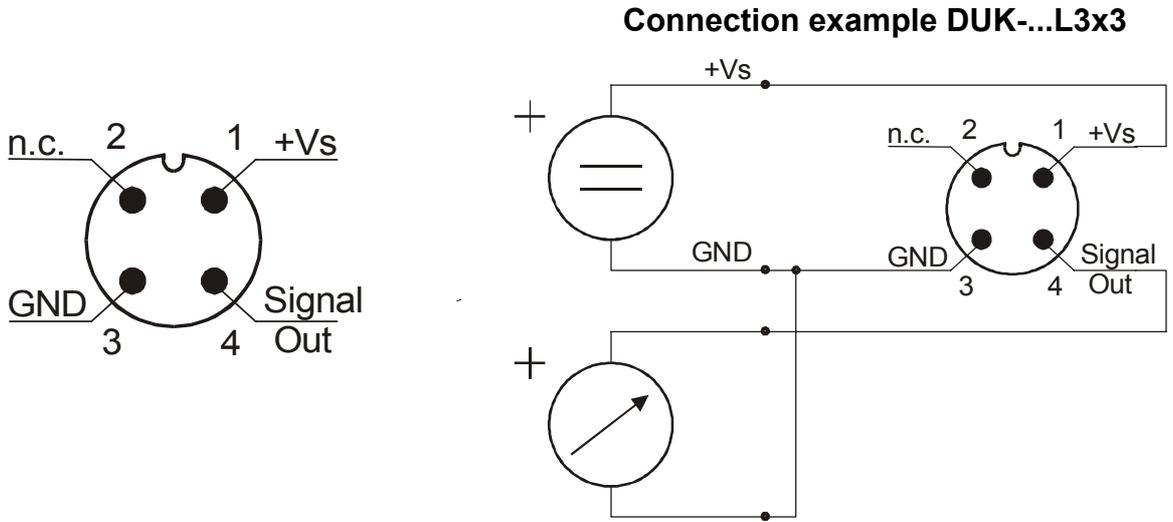
7.2 DUK-...S300



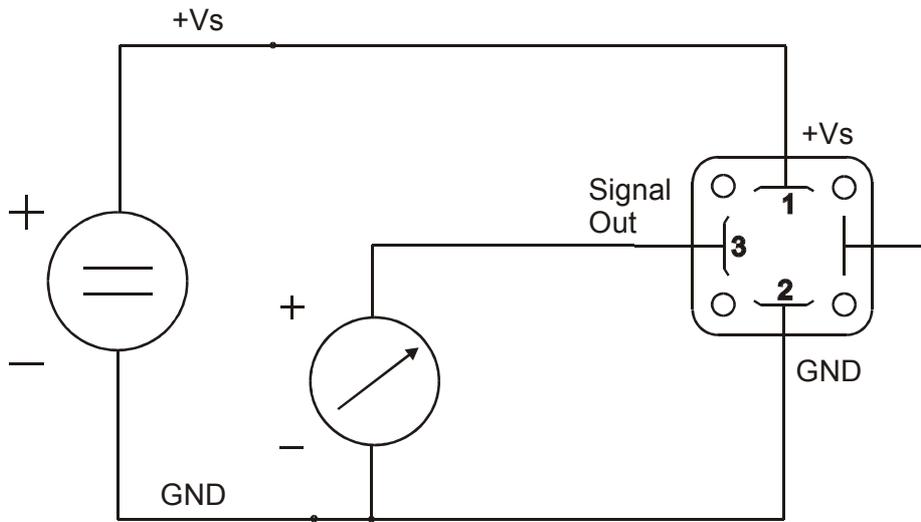
7.3 DUK-...S30D



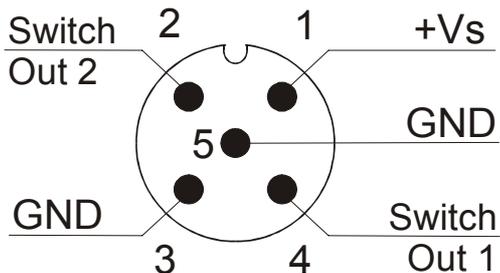
7.4 DUK-...F3x0; DUK-...L3x3



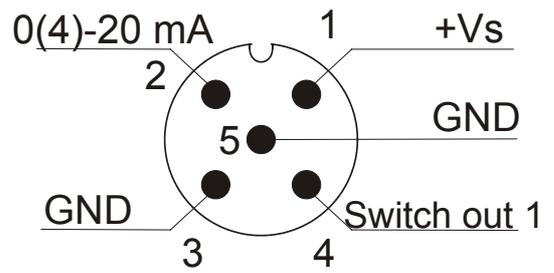
7.5 DUK-...L443



7.6 DUK-...C30..



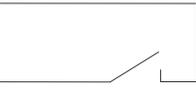
7.7 DUK-...C34..



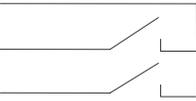
7.8 DUK-...Ex4R, DUK-...Gx4R

Cable connection

Wire number	DUK-...E14R Counter electronics
1	+24 V _{DC}
2	GND
3	(0) 4-20 mA
4	GND
5	n. c.
6	Reset part quantity
7	Relay S1
8	Relay S1
9	Relay S2
10	Relay S2



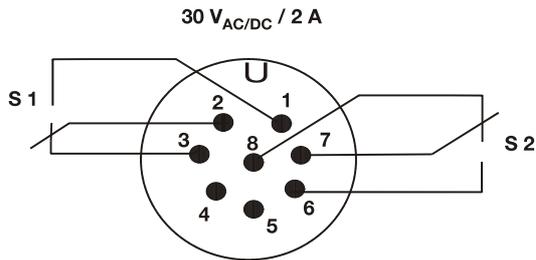
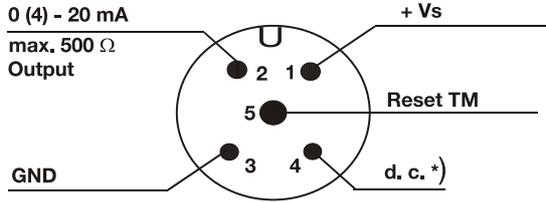
Wire number	DUK-...G14R Dosing electronics
1	+24 V _{DC}
2	GND
3	(0) 4-20 mA
4	GND
5	Control 1*
6	Control 2*
7	Relay S1
8	Relay S1
9	Relay S2
10	Relay S2



*Control 1<->GND: Start-dosing
 Control 2<->GND: Stop-dosing
 Control 1 <-> Control 2 <-> GND: Reset-dosing

Plug connection

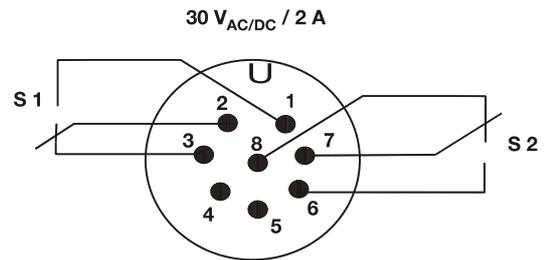
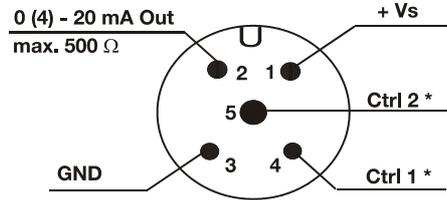
-E34 R



*) Do not connect!

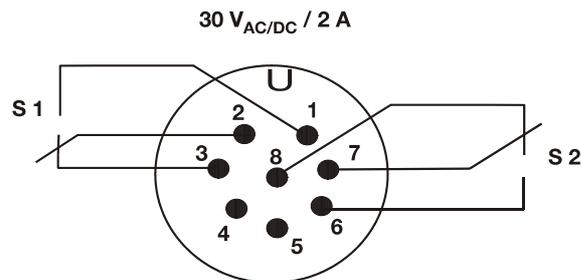
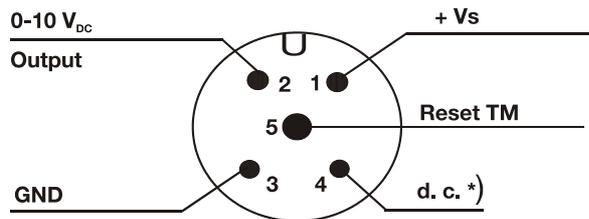
TM : subset

-G34 R

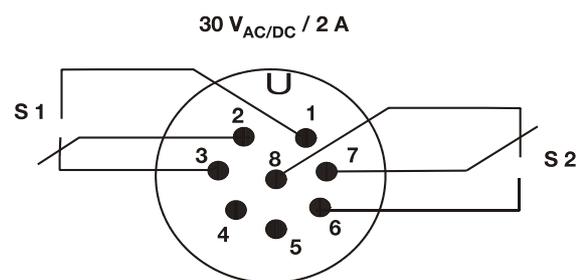
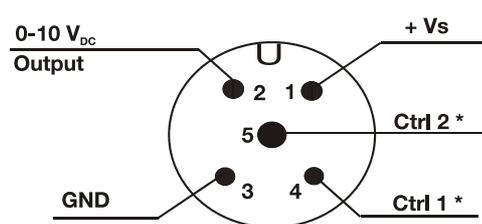


*Control 1<->GND: Start-Dosing
Control 2<->GND: Stop-Dosing
Control 1 <-> Control 2 <-> GND: Reset-Dosing

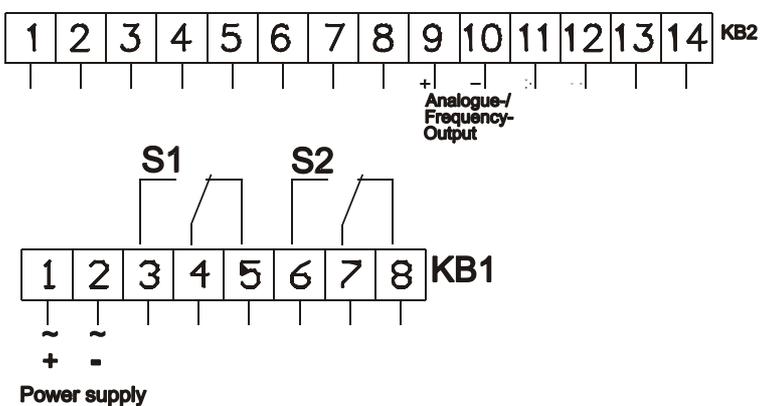
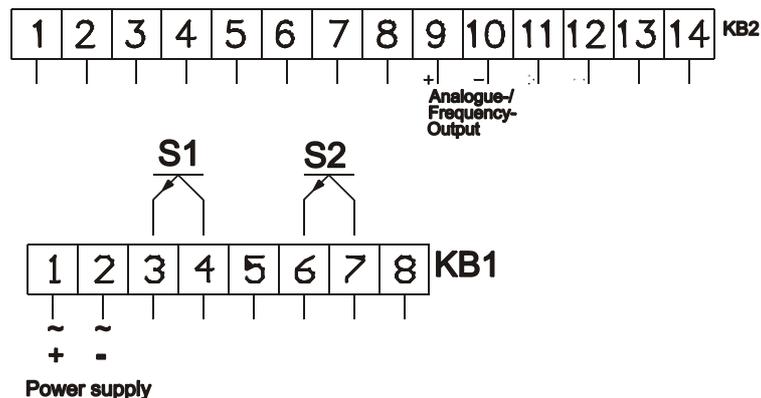
-E31 R



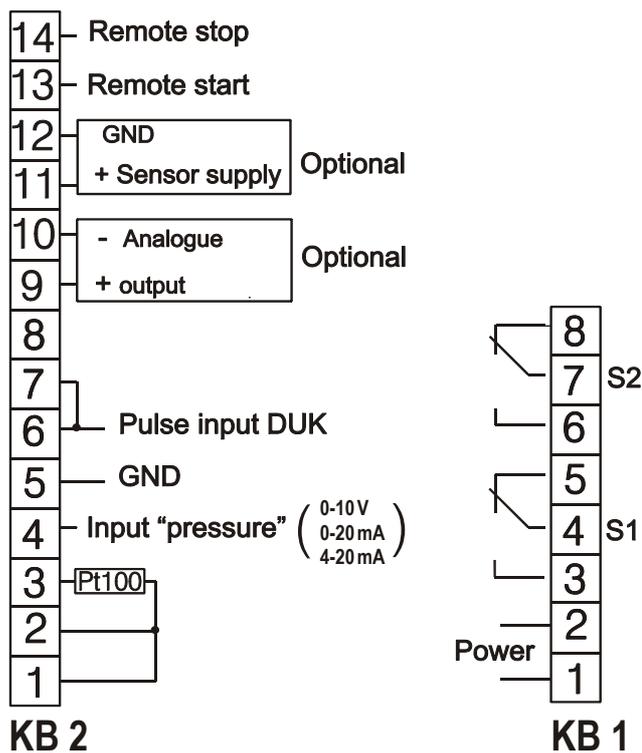
-G31 R



7.9 DUK-...Bxxx, DUK-...Dxxx, DUK-...Kxxx



7.10 DUK-...Axxx



8. Operation

The units are preset and after electrical connection ready for operation.

8.1 Switch point setting DUK-...S300, DUK-...S30D

Switch setting	Switch point
0	Switch function deactivated
1	10 % of f.s.
2	20 % of f.s.
3	30 % of f.s.
4	40 % of f.s.
5	50 % of f.s.
6	60 % of f.s.
7	70 % of f.s.
8	80 % of f.s.
9	90 % of f.s.

Flow above switch point: DUO-LED green

Flow below switch point: DUO-LED red

8.2 Counter electronic DUK-...Ex4R

Operating please see Operating Instructions ZED-Z

8.3 Dosing electronic DUK-...Gx4R

Operating please see Operating Instructions ZED-D

8.4 ADI electronic

DUK-...Bxxx, DUK-...Dxxx, DUK-...Kxxx

Operating please see Operating Instructions ADI-B/-D/-K

8.5 ADI Dosing Electronic DUK-...Axxx

Operating please see Operating Instructions ADI-Z

9. Adjustment – Compact Electronics DUK-...C3..

Connect the compact electronics according to previous connection diagram and supply with the indicated power supply.

After power on, the measuring range (end value) will be shown for 3 seconds.

9.1 Button function

In the standard mode (measuring mode)

 : **Press 3 sec.** → **Setup mode**

 : **Switch point/Window point**

In the set-up mode

 : **Next Step**

 : **Change Value**

Any time

3 sec 

or do not press
a button for 20 sec

↓

Standard mode

9.2 Settings

The following values can be changed in the compact electronic:

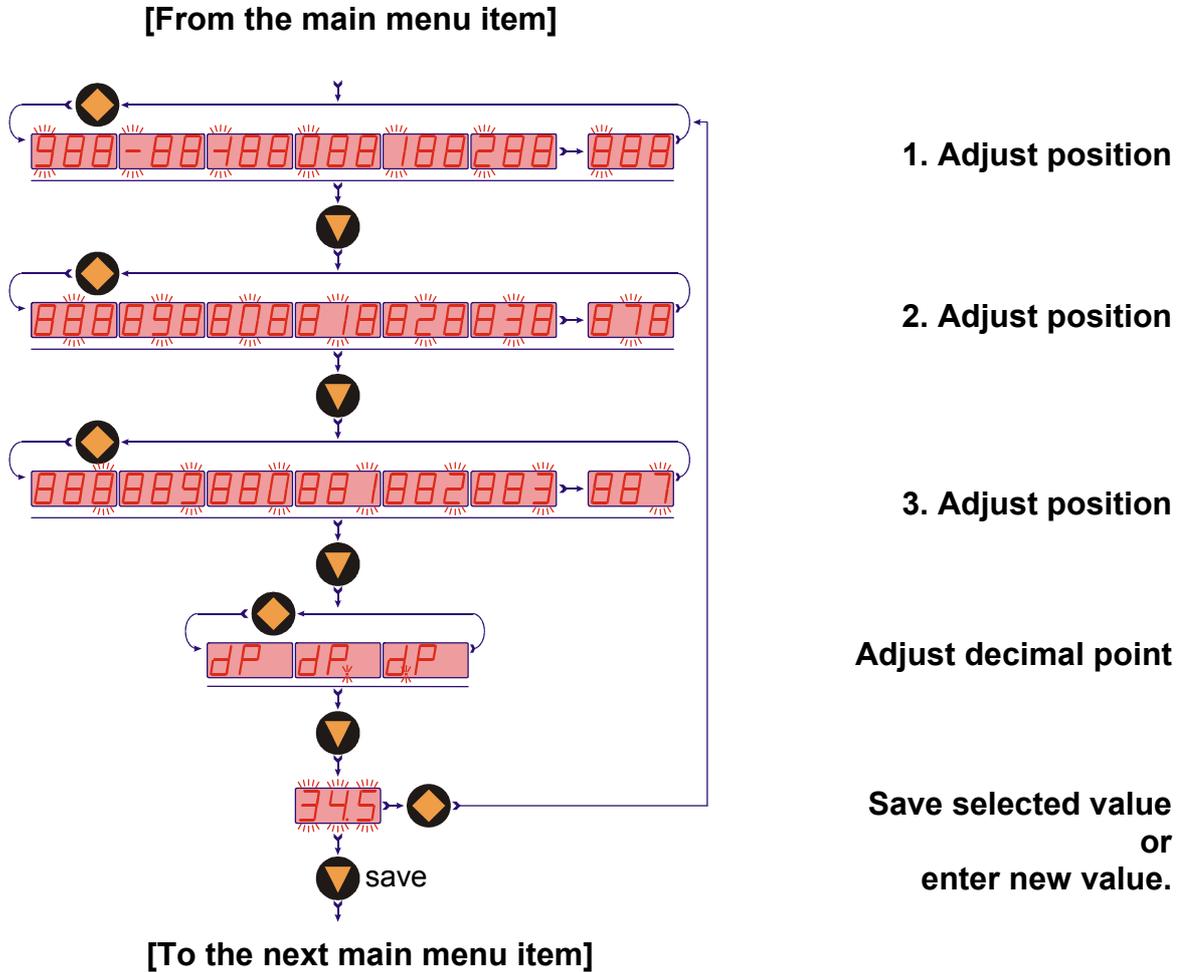
	Scale range	Factory setting
Switch point (SPo, SP1, SP2)	0...999	0,00
Hysteresis (HYS)	-199...0	-0,00
Window point (duo point) (duo)	Switch point ...999	--- (inactive)
Contact-type (Con, Co1, Co2)	(no),(nc) or frequency (Fr)**	no
Start current (S-C)*	000...999	000
End current (E-C)*	000...999	FS
Start current selection (SCS)	0-- (0 mA), 4-- (4 mA)	4 mA
Change Code (CCo)	000...999	000

* Start- and end value of flow relating to 0/4-20 mA

** **not calibrated**, frequency at f.s. approx. 500 -600Hz

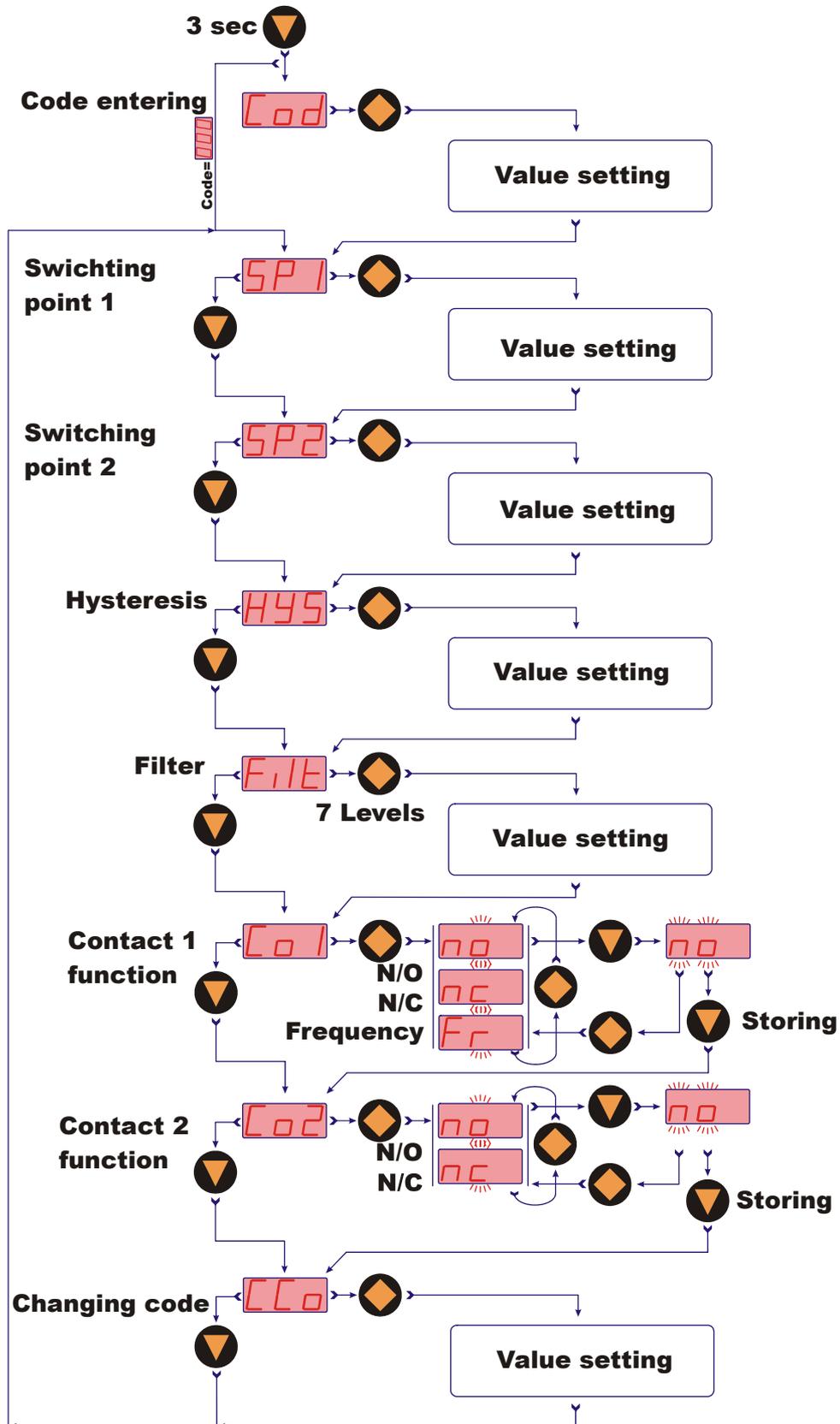
9.3 Value setting

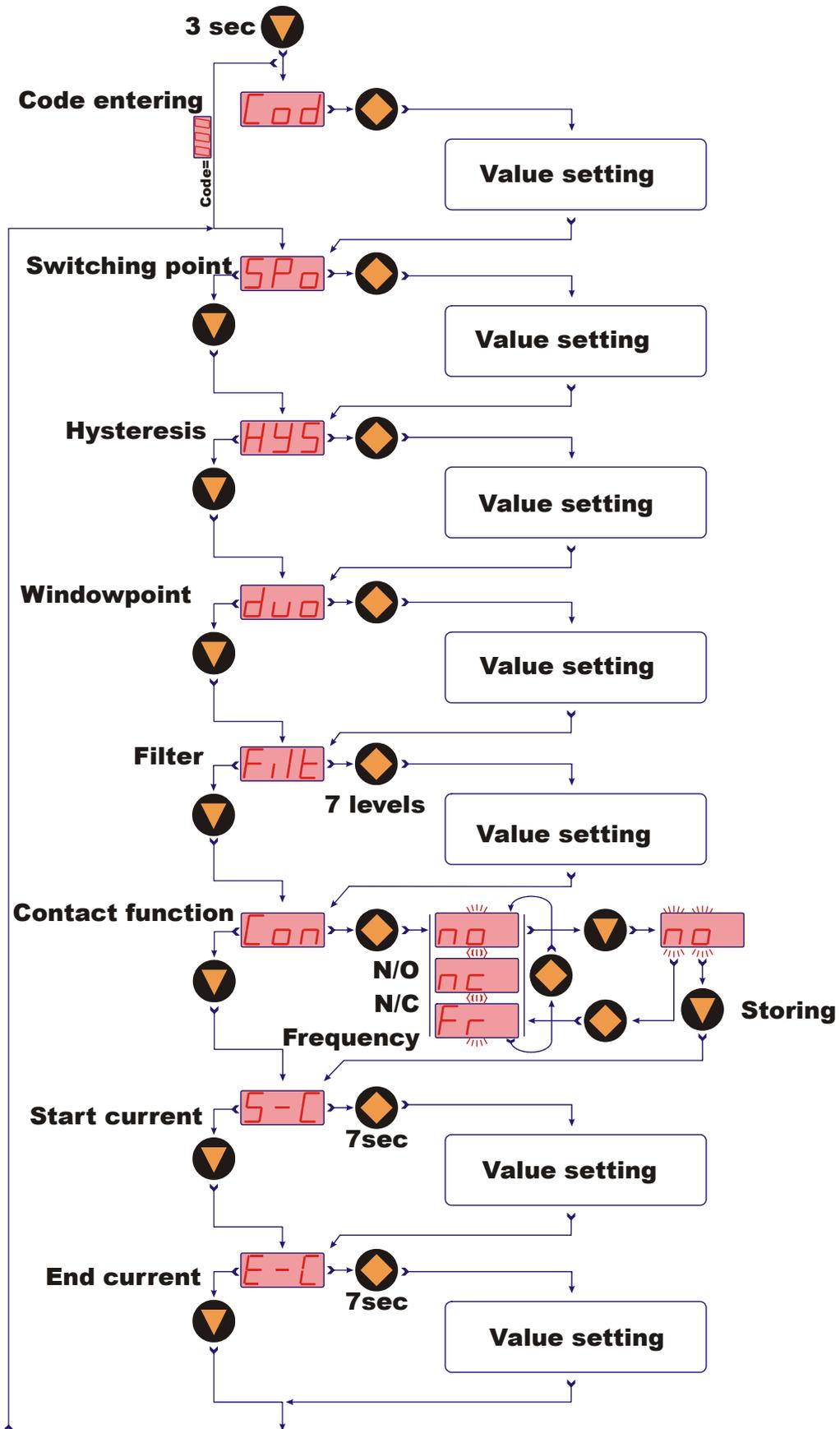
From the main menu item (for example: switch point, "SPo"), press the "◆" button to set the value. The flow chart below illustrates the universal routine for changing individual parameters.

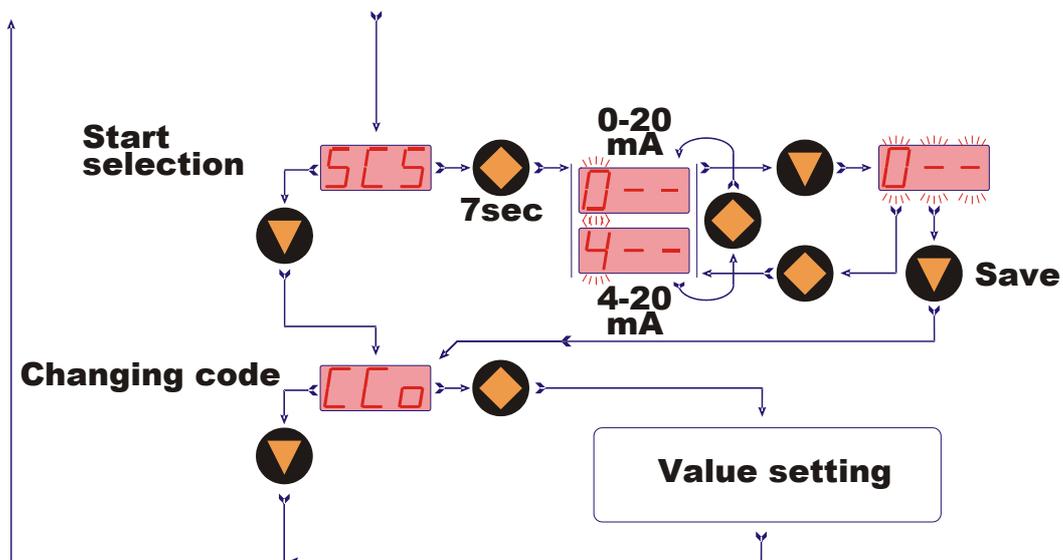


9.4 Set-up mode

Compact electronics DUK-...C30..







9.5 Main menu items

9.5.1 Switching point

The switching point is entered in the menu item "**Spo, SP1, SP2**". A setting value between 000 and 999 can be selected. This value can also include a decimal point. The decimal point can be set at two points (e.g. 10.0 or 1.00). If the display value exceeds the set switch point, the electronic is activated and is signalled by a lightning LED.

If the hysteresis is equal to zero and the window point is de-activated, the electronic switches back whenever the indicated value falls below the switching point.

9.5.2 Hysteresis

After the setting of the switching point, the hysteresis can be entered as a negative value in the "**HYS**" menu. The standard hysteresis value is zero. In operation condition this can lead to ambiguous switching behaviour, if the reading fluctuates around the switching point or window point. In this case, increasing the hysteresis can put things right. The hysteresis relates to the switching point and the window point (switching point minus hysteresis; window point plus hysteresis).

Example: Switch point 100 L/min; Hysteresis: -2.5 L/min

The electronics switches when 100 L/min is exceeded and switches back when the reading under-runs below 97.5 L/min.

9.5.3 Window point (duo-point)

As well as the switching point, it is also to define a "**duo**" (duo-point), the window point. This must be higher than the switching point. By using the window point and the switching point it is possible to monitor the measurement value in a certain range. The switching point limits the measurement range to smaller values and the window point to larger values.



If the window point (duo-point) is less than or equal to the switching point, an error report (Er4) will be indicated on the display and its value is deleted and its function is invalid (in the case that the window point and switching point out of adjustment).

The value is set in the same way as the switch point.

The window point is needed for process, in which monitoring of a certain measurement range is necessary.

Example: Switching point: 100 L/min; window point: 150 L/min;
hysteresis: -1 L/min

The electronic switches when 100 L/min is exceeded. If the measured value remains between 99 L/min (100-1) and 151 L/min (150+1), the contact will also remain in active switching condition (LED on). If it exceeds 151 L/min or is below 99 L/min the electronic switches back.

Switching behaviour

The following diagram clarifies the switching behaviour of the electronics. The contact closes (contact type: no) when exceeding below the switching point or when it under-runs the window point. It only opens again if the window point plus hysteresis is exceeded or if it drops below the switching point minus hysteresis. An **LED** indicates the switching condition of the switching point.

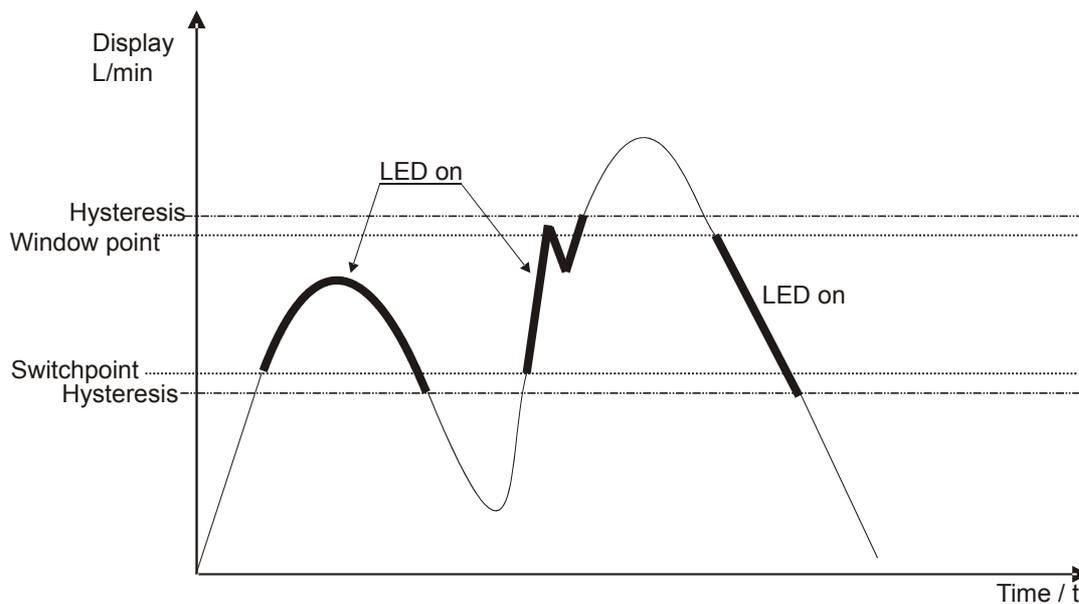
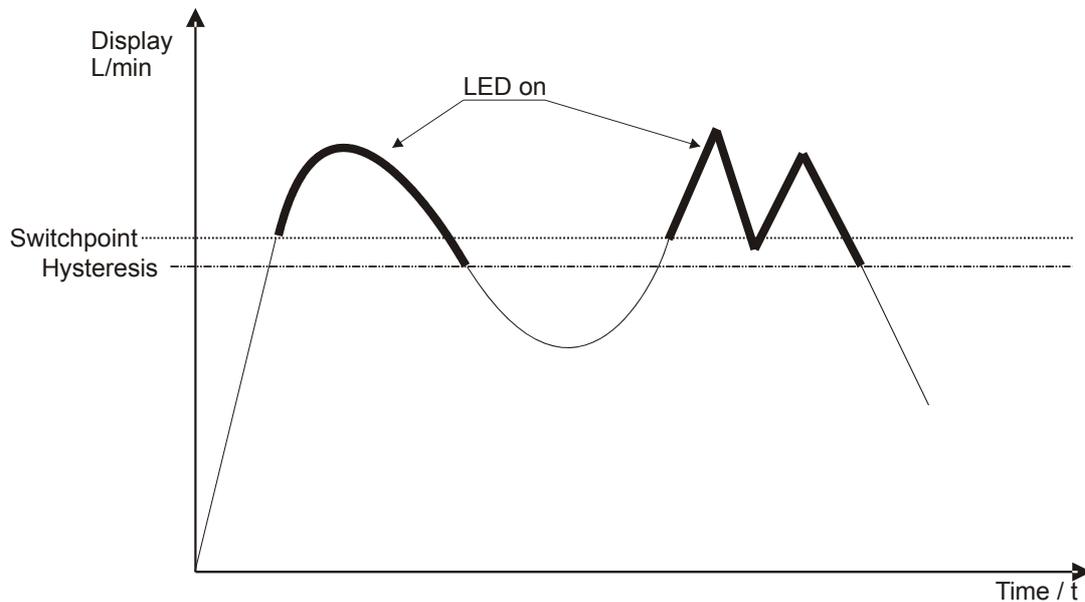
9.5.4 Filter

The filter function "**Filt**" forms a running average from the measured values. The following values can be set (see section 8; set up):

1 / 2 / 4 / 8 / 16 / 32 / 64

They correspond to the number of samples used in the running average. The filter value determines the dynamic behaviour of the display value. The larger the adjusted value, the slower the display response. With a filter value of "1" the filter is switched off, i.e. the display value is equal to the unfiltered measured value.

The integrated step function detector reacts to a change of value corresponding to approx. 6.25% of the full scale value. As soon as a step function signal is detected, the instantaneous measured value is directly indicated in the display.



9.5.5 Contact type

The function of the transistor switching output is set in menu item "**Con, Co1 or Co2**". The switching function switches from

no - N/O contact to

nc - N/C to

Fr – frequency (only Con and Co1)

and back.

N/O contact: contact closes when switch point is exceeded

N/C contact: contact opens when switch point is exceeded

Frequency: frequency output is proportional to flow value

9.5.6 Current output

The current output is selected in menu items

"S-C" Start current indicated value < > 0(4) mA

"E-C" End current indicated value < > 20 mA

"SCS" Start current selection (0-20 mA or 4-20 mA).

The indicated value at which 0(4) mA flow is entered in menu item start current.

The indicated value at which 20 mA flow is entered in menu item end current.

9.5.7 Change code

The change code option "CCo" secures the unit against unauthorised tampering. If the code is different from 000, the user must input the code immediately after entering the adjustment mode.

10. Maintenance

The measurement device requires no maintenance if the measurement medium does not cause deposits. In order to avoid problems, we recommend the installation of a filter, such as the magnetic filter, e.g. model MFR.

If it is necessary to clean the sensor, the sensor can be rinsed with a suitable liquid. Fibre parts or large particles can be carefully removed with a cleaning cloth or similar.

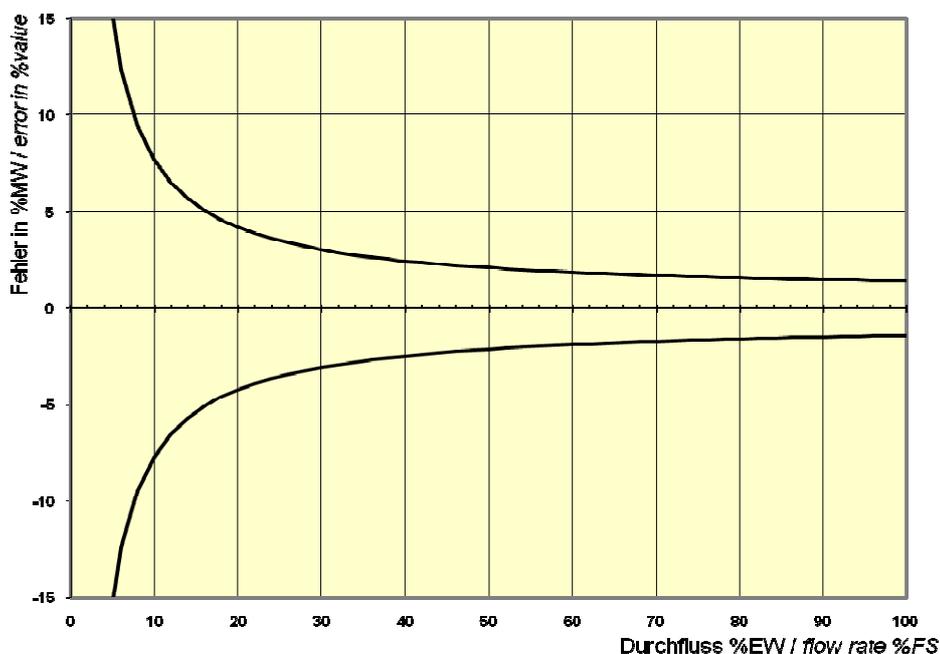
Work on the electronics can only be performed by the factory, or the warranty is otherwise voided.

11. Technical Information

Measuring principle:	ultrasonic
Range:	see table
Medium:	liquids with max. 1% solid
Viscosity:	max. 5 mm ² /s
Accuracy:	0.7 % of reading + 0.7 % full scale
Repeat accuracy:	±0.1 % of F.S.
Mounting position:	in all directions, flow in direction of the arrow (horizontal: electronic on top or below)
In-/Outlet:	10 x DN
Media temperature:	-20...+90 °C -20...+120 °C (high temp. version)
Ambient temperature:	-20...+70 °C
Response time t_{90} :	ca. 0,5...1 s (depends on electronic version) at flow changes > 10 % f.s.
Pressure:	0...16 bar
Pressure loss:	max. 150 mbar at f.s.
Protection:	IP 65

Wetted parts

Sensor housing:	brass or st. st. 1.4408
Sensors:	PEEK
Seal:	NBR, other on request high temp. version FPM



Measuring ranges and weights

Model	Measuring range [L/min]	Size [G/NPT]	DUK-...S30x DUK-...F3x0 DUK-...Lxx3	DUK-...C3xx	DUK-...Exxx DUK-...Gxxx	DUK with ADI 24 V	DUK with ADI 230/115 V
DUK-1xx4	0,08-20	1/2"	ca. 850 g	ca. 1050 g	ca. 1000 g	ca. 2150 g	ca. 2700 g
DUK-1xx5	0,16-40	3/4"	ca. 1050 g	ca. 1250 g	ca. 1200 g	ca. 2350 g	ca. 2900 g
DUK-1xx6	0,25-63	1"	ca. 1450 g	ca. 1650 g	ca. 1600 g	ca. 2750 g	ca. 3300 g
DUK-1xx8	0,6-150	1 1/2"	ca. 2350 g	ca. 2550 g	ca. 2500 g	ca. 3650 g	ca. 4200 g
DUK-1xx9	1-250	2"	ca. 3800 g	ca. 4000 g	ca. 3950 g	ca. 5100 g	ca. 5650 g
DUK-1xxB	2,5-630	3"	ca. 7100 g	ca. 7300 g	ca. 7250 g	ca. 8400 g	ca. 8950 g

DUK-...S300, DUK-...S30D

Display:

Switching output (..S300):

Switching output (..S30D):

Switch point:

Power supply:

Power consumption:

Electrical connection:

Meas. range overflow:

DUO-LED for switch status

relay SPDT, max. 1 A/30 V_{DC}

active 24 V_{DC}, , N/C or N/O

10...90 % f.s. in 10 %-steps

that can be configured by the

customer using a rotary encoder switch

24 V_{DC} ± 20 %

12 mA

plug M12x1, 5-pin

flash of the DUO-LED

(red/green from 105 % of f.s.)

DUK-...F300, DUK-...F390

Impulse output:

Frequency at f.s.:

Power supply:

Power consumption:

Electrical connection:

Meas. range overflow:

PNP, Open Collector, max. 200 mA

500 Hz (...F300)

50...1000 Hz (...F390)

proportional to flowrate

24 V_{DC} ± 20 %

5 mA

plug M12x1, 4-pin

F_{out} approx. 2 kHz flash from 105 % of f.s.

DUK-...L303; DUK-...L343

Output:

Load:

Power supply:

Electrical connection:

Meas. range overflow:

0(4)-20 mA, 3-wire

max. 500 Ω

24 V_{DC} ± 20 %

plug M12x1, 4-pin

I_{out} approx. 20.5 mA from 103 % of f.s.

DUK-...L443 (usage with AUF-3000)

Output:

Load:

Power supply:

Electrical connection:

Meas. range overflow:

4-20 mA, 3-wire

max. 500 Ω

24 V_{DC} ± 20 %

plug DIN 43650

I_{out} approx. 20.5 mA from 103 % of f.s.

DUK-...C3xx (Compact electronic)

Display:	3-digit LED
Analogue output	0(4)...20 mA adjustable (only DUK-...C34x)
Load:	max. 500 Ω
Switching output:	1(2) semiconductor PNP or NPN, set at factory,
Contact function:	N/C-N/O-frequency programmable (frequency output not calibrated, frequency at f.s. approx. 1400 Hz)
Settings:	via 2 buttons
Power supply:	24 V _{DC} \pm 20 %
Power consumption:	ca. 100 mA
Electrical connection:	plug M12x1, 5-pin

DUK-...Exxx (Counter electronics)

Display:	LCD, 2 x 8 digit, illuminated total, part and flow quantities, units selectable
Analogue output:	(0)4...20 mA adjustable
Load:	max. 500 Ω
Switching output:	2 relays, max. 30 V _{AC/DC} / 2 A / 60 VA
Settings:	via 4 buttons
Functions:	reset, MIN/MAX memory, flow monitor, monitoring for part and total quantity, language
Power supply:	24 V _{DC} \pm 20 %, 3-wire
Power consumption:	approx. 150 mA
Electrical connection:	cable connection or 2x plug M12x1 5/8 pin
<i>more technical details see data sheet ZED in the brochure Z2</i>	

DUK-...Gxxx (Dosing electronics)

Display:	LCD, 2 x 8 digit, illuminated, dosing, total and flow quantity, units selectable
Analogue output:	(0)4...20 mA adjustable
Load:	max. 500 Ω
Switching output:	2 relays, max. 30 V _{AC/DC} / 2 A / 60 VA
Settings:	via 4 buttons
Functions:	dosing (relay S2), start, stop, reset, fine dosing, correction amount, flow switch, total quantity, language
Power supply:	24 V _{DC} \pm 20 %, 3-wire
Power consumption:	approx. 150 mA
Electrical connection:	cable connection or 2x plug M12x1 5/8-pin
<i>more technical details see data sheet ZED in the brochure Z2</i>	

DUK with ADI electronic

Display:	bar graph and 5-digit digital display
Analogue output:	(0) 4...20 mA, 0...10 V _{DC}
Load:	max. 500 Ω
2 Switching outputs:	relay/changeover contact max. 250 V _{AC} , 5 A resistive load max. 30 V _{DC} /5 A
Settings:	via 4 buttons
Power supply:	100...240V _{AC} ±10% or 18...30 V _{AC} /10...40V _{DC}
Electrical connection:	pluggable terminal block cable gland

See brochure Z2 for more technical details on ADI evaluating electronics.

12. Order Codes

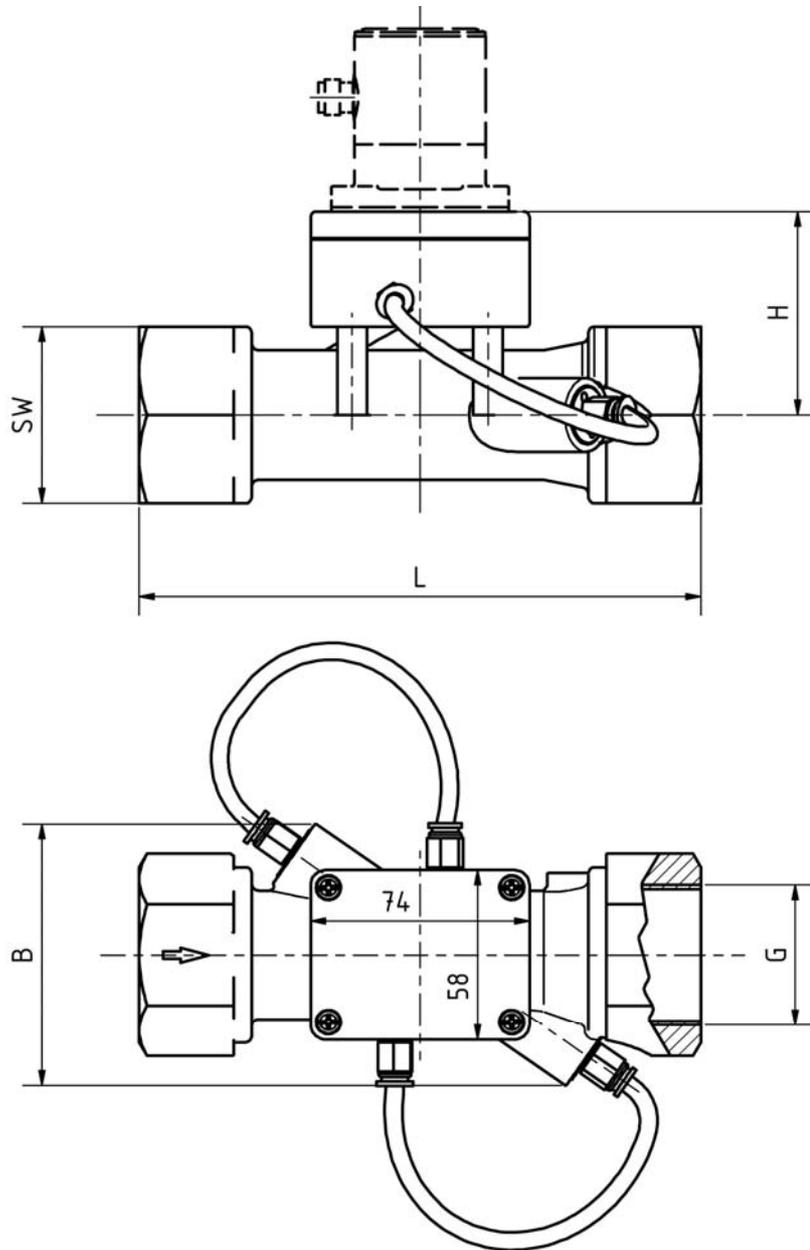
(Example: **DUK-11 G4H S300 L**)

Model / Housing material	Connection*	Electronic	Flow direction										
DUK-11 = brass DUK-12 = st. st. 1.4408 DUK-21 = high temp. version brass DUK-22 = high temp. version st. st. 1.4408	G4H = G ½ fem. G5H = G ¾ fem. G6H = G 1 fem. G8H = G 1½ fem. G9H = G 2 fem. GBH = G 3 fem. N4H = ½ NPT fem. N5H = ¾ NPT fem. N6H = 1 NPT fem. N8H = 1½ NPT fem. N9H = 2 NPT fem. NBH = 3 NPT fem.	Switching output S300 = Relay, M12-Plug S30D = active 24 VDC, M12-Plug Frequency output F300 = M12-Plug, 500 Hz F390 = M12-Plug, 50...1000 Hz Analogue output L303 = M12-Plug, 0-20 mA L343 = M12-Plug, 4-20 mA L443 = DIN-Plug, 4-20 mA Compact electronic C30R = 2xOpen Collector, PNP C30M = 2xOpen Collector, NPN C34P = 0(4)-20 mA, 1xOpen Collector, PNP C34N = 0(4)-20 mA, 1xOpen Collector, NPN ADI-Electronic <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Display</th> <th>Power supply</th> <th>Output</th> <th>Contact</th> </tr> </thead> <tbody> <tr> <td rowspan="2">K =bar graph / digital display</td> <td>0 = 100-230 V_{AC/DC}</td> <td>0 = without</td> <td rowspan="2">2 = 2 change- over contacts</td> </tr> <tr> <td>3 = 18-30 V_{AC}, 10-40 V_{DC}</td> <td>4 = 0(4)-20 mA, 0-10 V</td> </tr> </tbody> </table> Counter electronic E14R = LCD, 0(4)-20 mA, 2xRelay, 1 m cable E34R = LCD, 0(4)-20 mA, 2xRelay, M12-Plug Dosing electronic G14R = LCD, 0(4)-20 mA, 2xRelay, 1 m cable G34R = LCD, 0(4)-20 mA, 2xRelay, M12-Plug	Display	Power supply	Output	Contact	K =bar graph / digital display	0 = 100-230 V _{AC/DC}	0 = without	2 = 2 change- over contacts	3 = 18-30 V _{AC} , 10-40 V _{DC}	4 = 0(4)-20 mA, 0-10 V	L = from left to right R = from right to left T = from top to bottom B = from bottom to top
Display	Power supply	Output	Contact										
K =bar graph / digital display	0 = 100-230 V _{AC/DC}	0 = without	2 = 2 change- over contacts										
	3 = 18-30 V _{AC} , 10-40 V _{DC}	4 = 0(4)-20 mA, 0-10 V											

* Standard display in L/min, Optional: Display GPM (Code G instead of H)

13. Dimensions

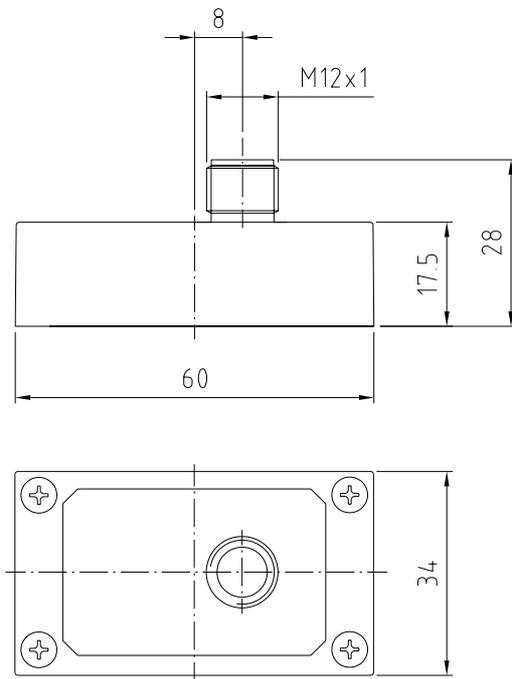
DUK sensor



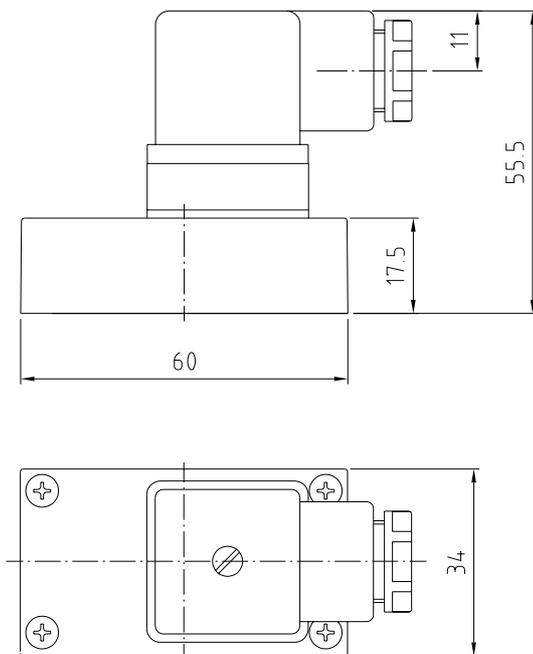
Model	G / NPT	SW [mm]	H* [mm]	L [mm]	B [mm]
DUK-xxx4	1/2	30	57	114	ca.72
DUK-xxx5	3/4	36	59	126,5	ca. 76
DUK-xxx6	1	46	63	146	ca. 80
DUK-xxx8	1½	60	69	190	ca. 90
DUK-xxx9	2	76	74	238	ca. 97
DUK-xxxB	3	105	84	306	ca. 122

*high temp. version

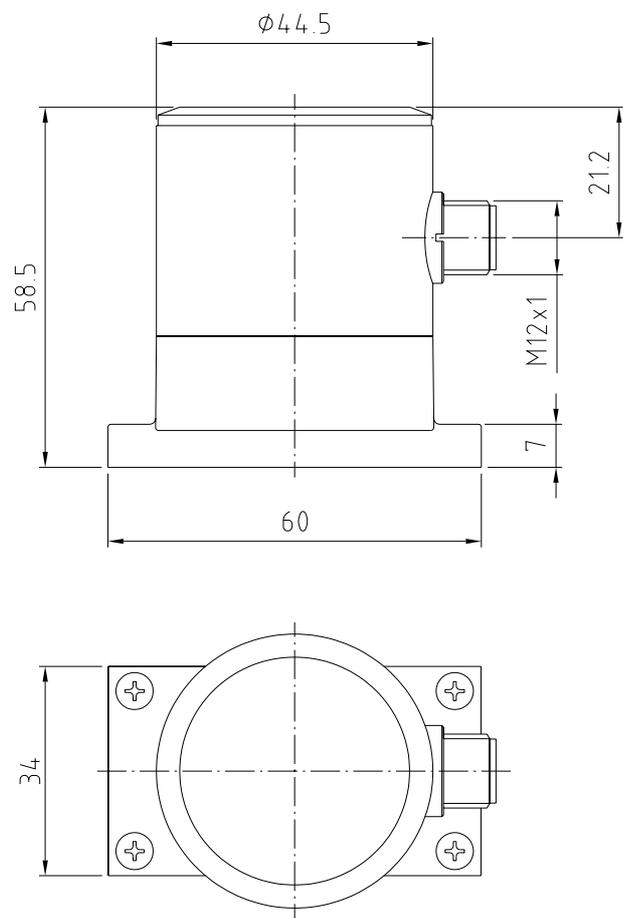
DUK-...S30x; DUK-...F3x0; DUK-...L3x3



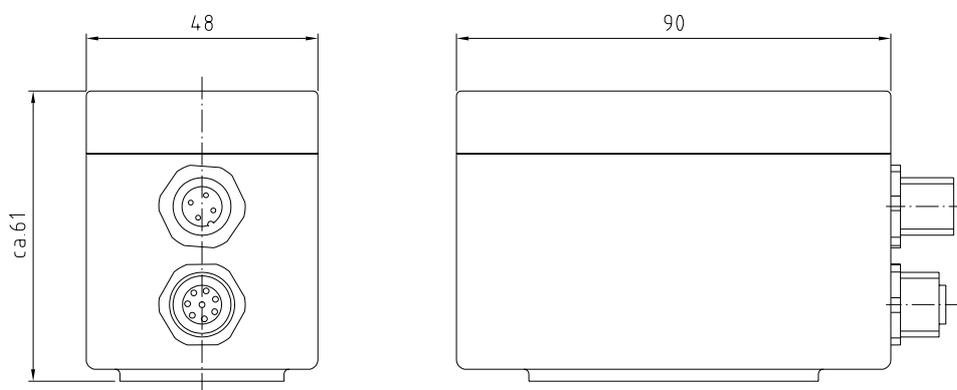
DUK-...L443



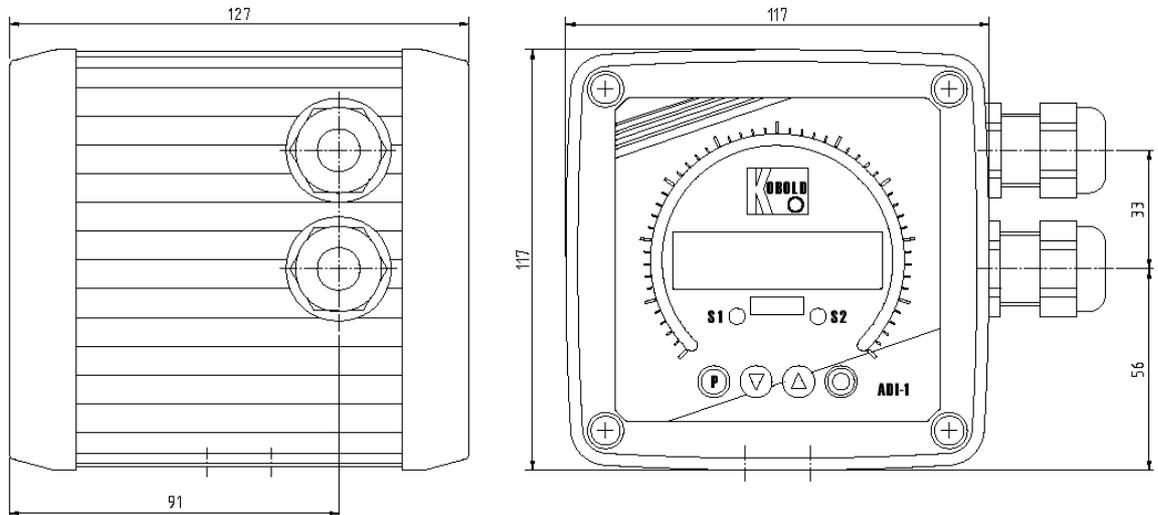
DUK-...C3xx



DUK-...Ex4R, DUK-...Gx4R



DUK-...Bxxx, DUK-...Dxxx, DUK-...Kxxx, DUK-...Axxx,



14. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Ultrasonic Flowmeter/ -Monitor/ -Counter/ -Dosing Unit Model: DUK-...

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1 2006

Electrical equipment for control and instrumentation technology and laboratory use

DIN EN 61010-1 2002

Safety requirements for electrical measuring-, control- and laboratory instruments

Also the following EEC guidelines are fulfilled:

2004/108/EC

EMC Directive

2006/95/EC

Low Voltage Directive

Hofheim, 6. July 2009



H. Peters
General Manager



M. Wenzel
Proxy Holder