Operating Instructions

for

Ultrasonic Flowmeter/ -Monitor/ - Counter/ -Dosing Unit

Model: DUK

1. Contents

Manufactured and sold by:

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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

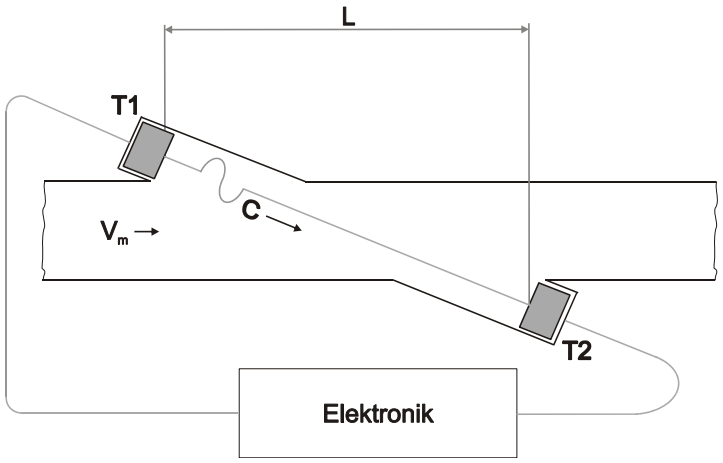
4. Regulation Use

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.

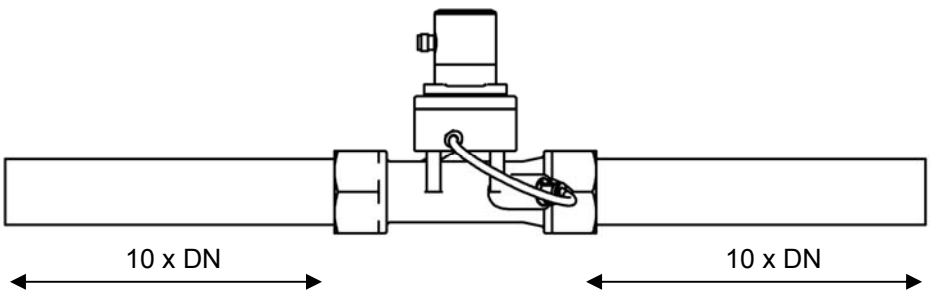
6.2 Installation

- 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.

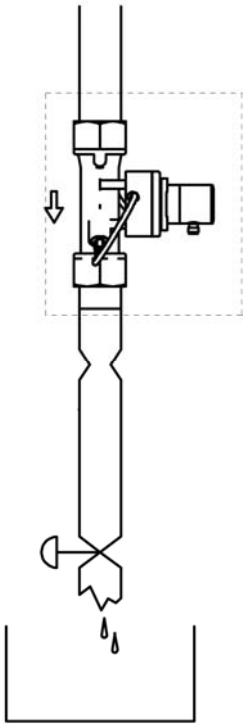
Attention! The sensor may be damaged if it is tightened above the tightening torque range. Also, if it is tightened below the tightening torque range, the connecting thread section may loosen.

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

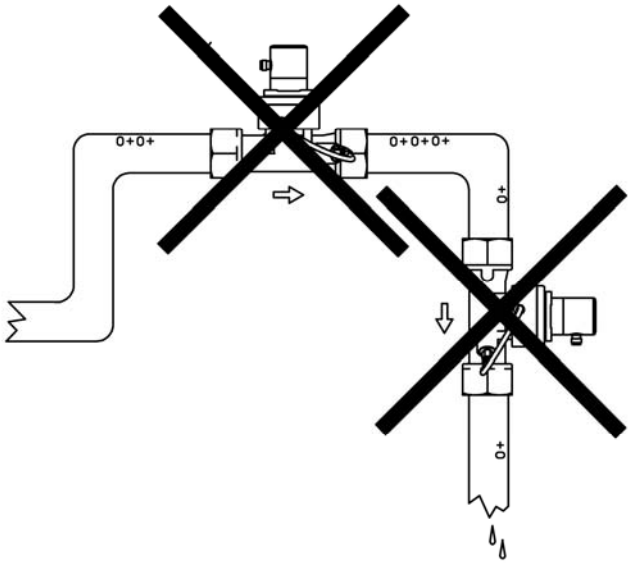
In-/Outlet



Mounting from top to bottom



avoid these installation areas



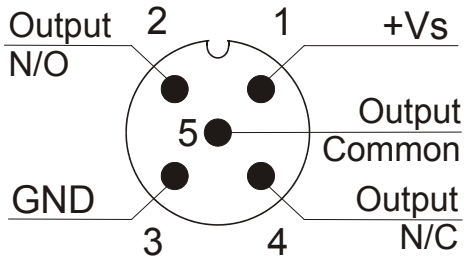
7. Electrical Connection

7.1 General

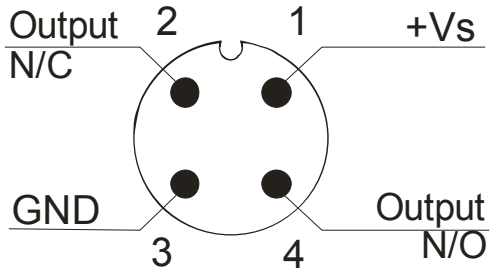
Attention! Make sure that the voltage values of your system correspond with the voltage values of the measuring unit.

- 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.

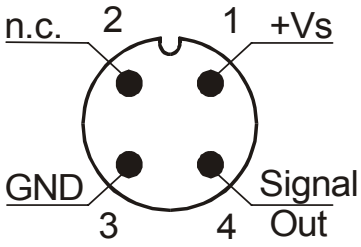
7.2 DUK-...S300



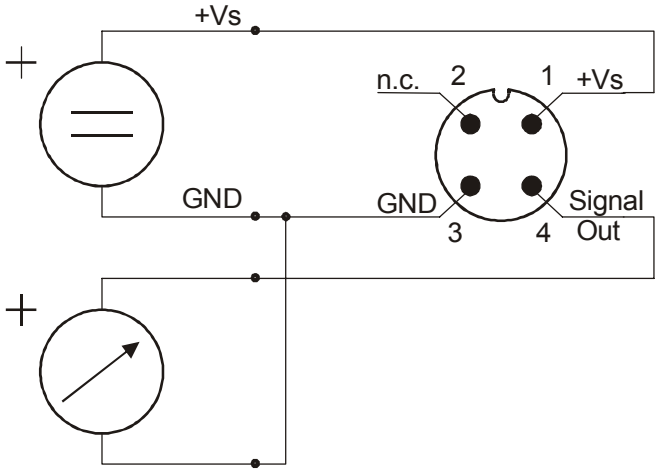
7.3 DUK-...S30D



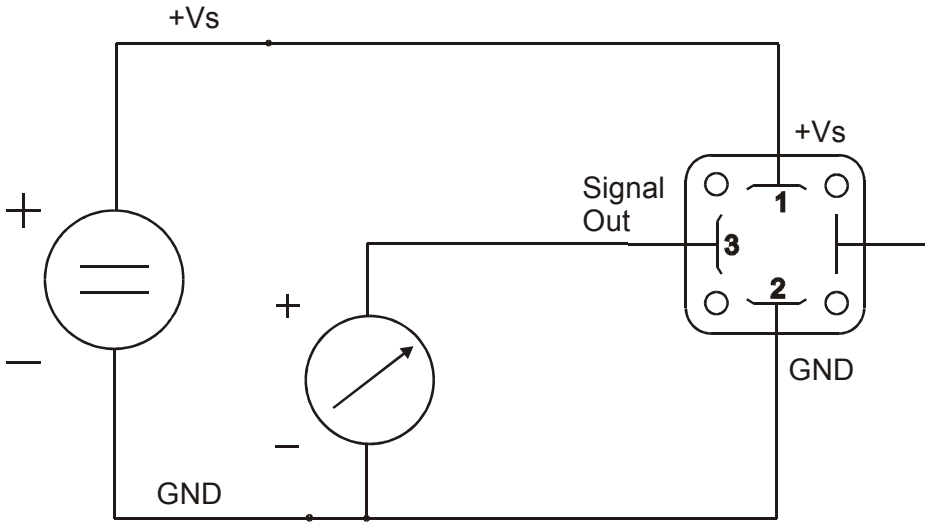
7.4 DUK-...F3x0; DUK-...L3x3



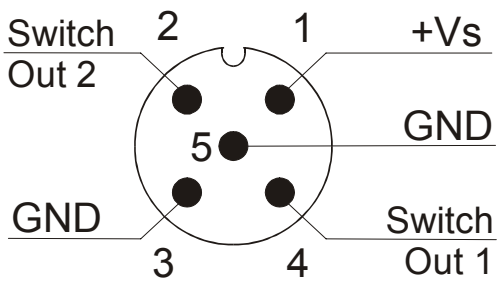
Connection example DUK-...L3x3



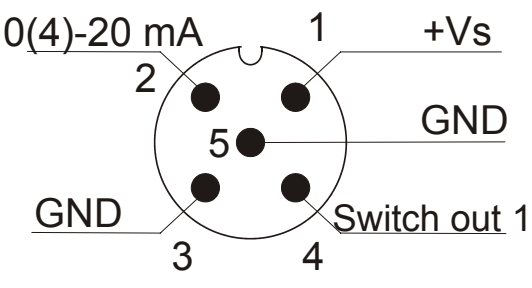
7.5 DUK-...L443



7.6 DUK-...C30..



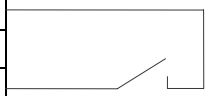
7.7 DUK-...C34..



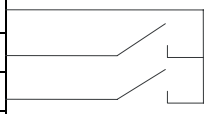
7.8 DUK-...Ex4R, DUK-...Gx4R

Cable connection

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

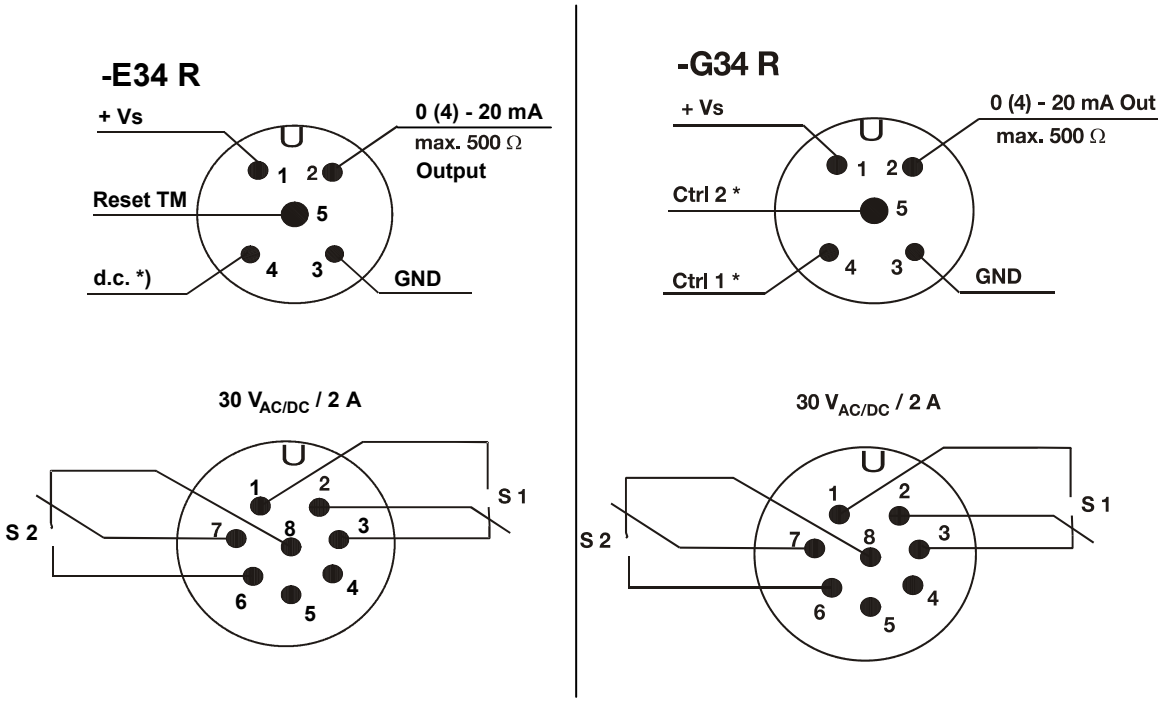


Wire number	DUK-...G14R Dosing electronics
1	+24 V_{DC}
2	GND
3	4-20 mA
4	GND
5	Control 1*
6	Control 2*
7	Relay S1
8	Relay S1
9	Relay S2
10	Relay S2



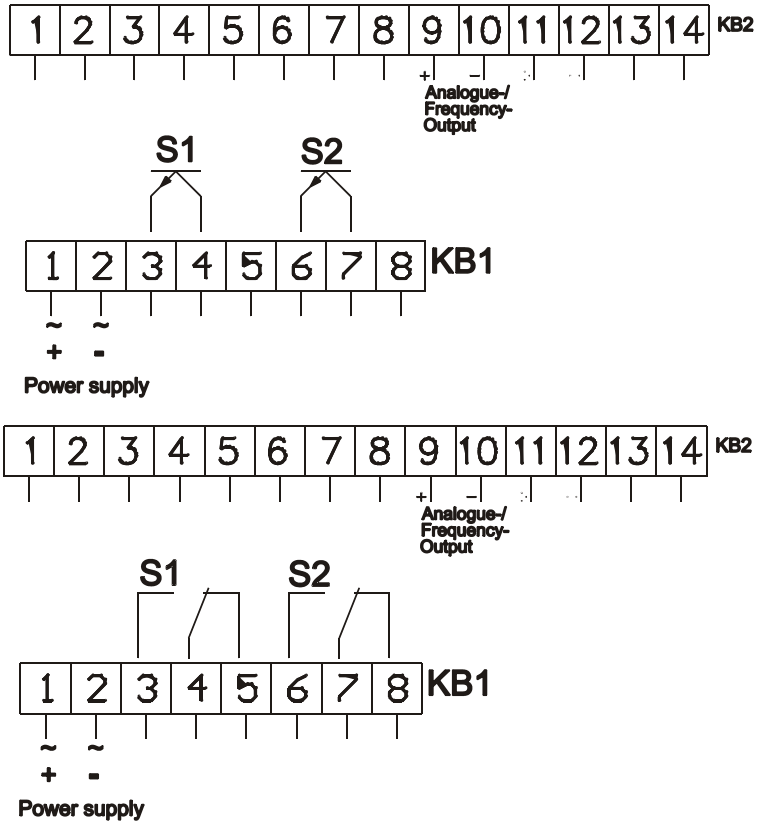
*Control 1<->GND: Start-dosing
Control 2<->GND: Stop-dosing
Control 1 <-> Control 2 <-> GND: Reset-dosing

Plug connection

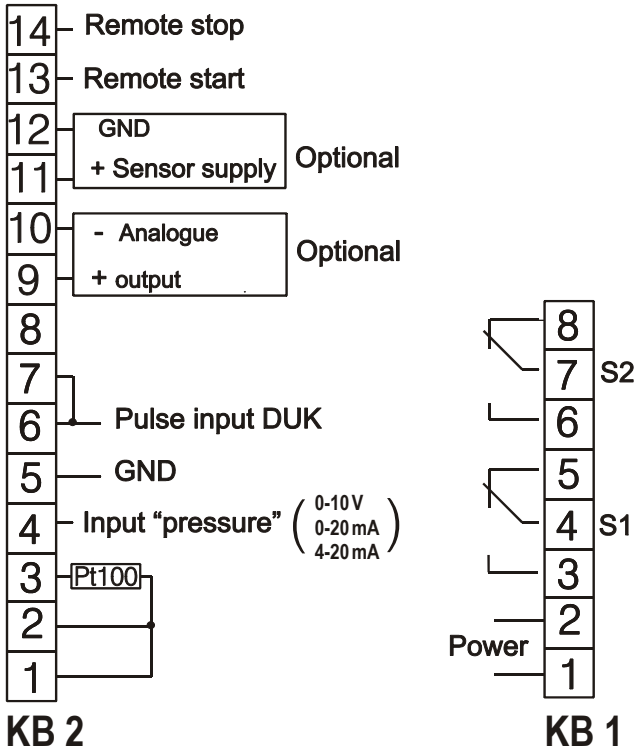


*) Do not connect !

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 electronics DUK-…Ex4R

Operating please see Operating Instructions ZED-Z

8.3 Dosing electronics 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

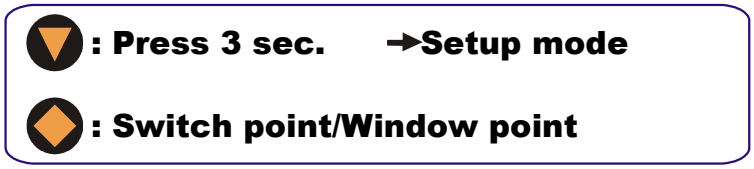
Operating please see Operating Instructions ADI-Z

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

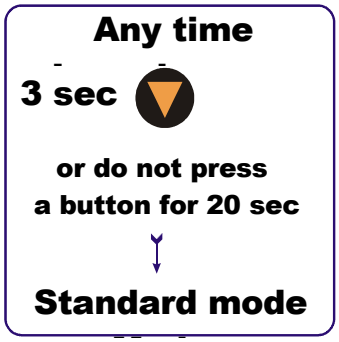
Connect the compact electronics according to previous connection diagram and supply with the indicated power supply.
After power on, the measuring range (end current) will be shown for 3 seconds.

9.1 Button function

In the standard mode (measuring mode)



In the set-up mode



9.2 Settings

The following values can be changed in the compact electronic:

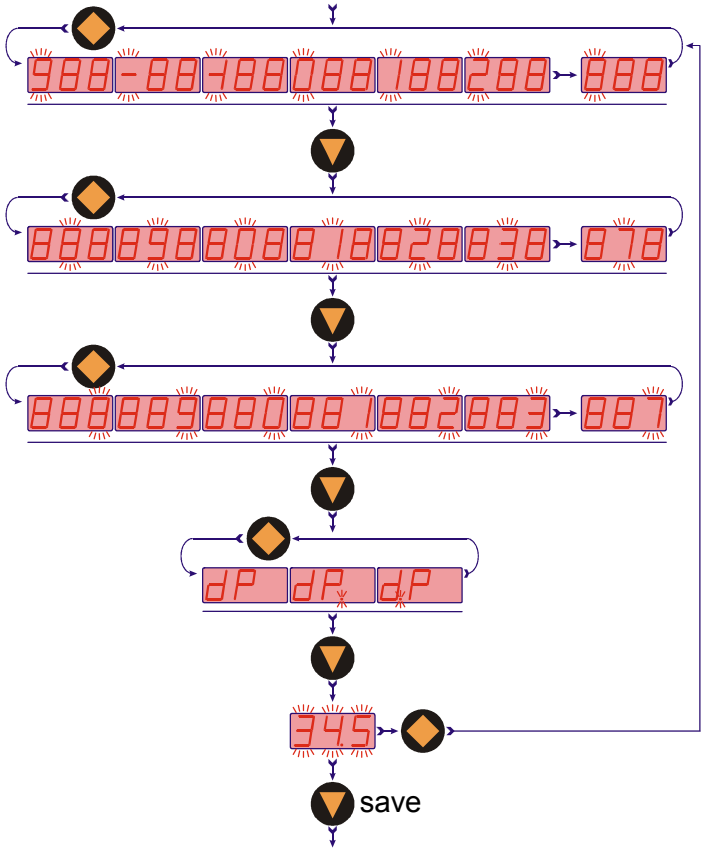
	Scale range	Factory setting
Switch point (**SPo, SP1**, **SP2**)	0...999	0,00
Hysteresis (**HYS**)	-199...0	-0,00
Window point (duo point) (**duo**)	Switch point ...999	--- (inactive)
Contact-type (**Con**, **Co1, Co2**)	(**no**),(**nc**) or frequency (**Fr**)**	**no**
Start current (**S-C**)*	000...999	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.

[From the main menu item]



1. Adjust position

2. Adjust position

3. Adjust position

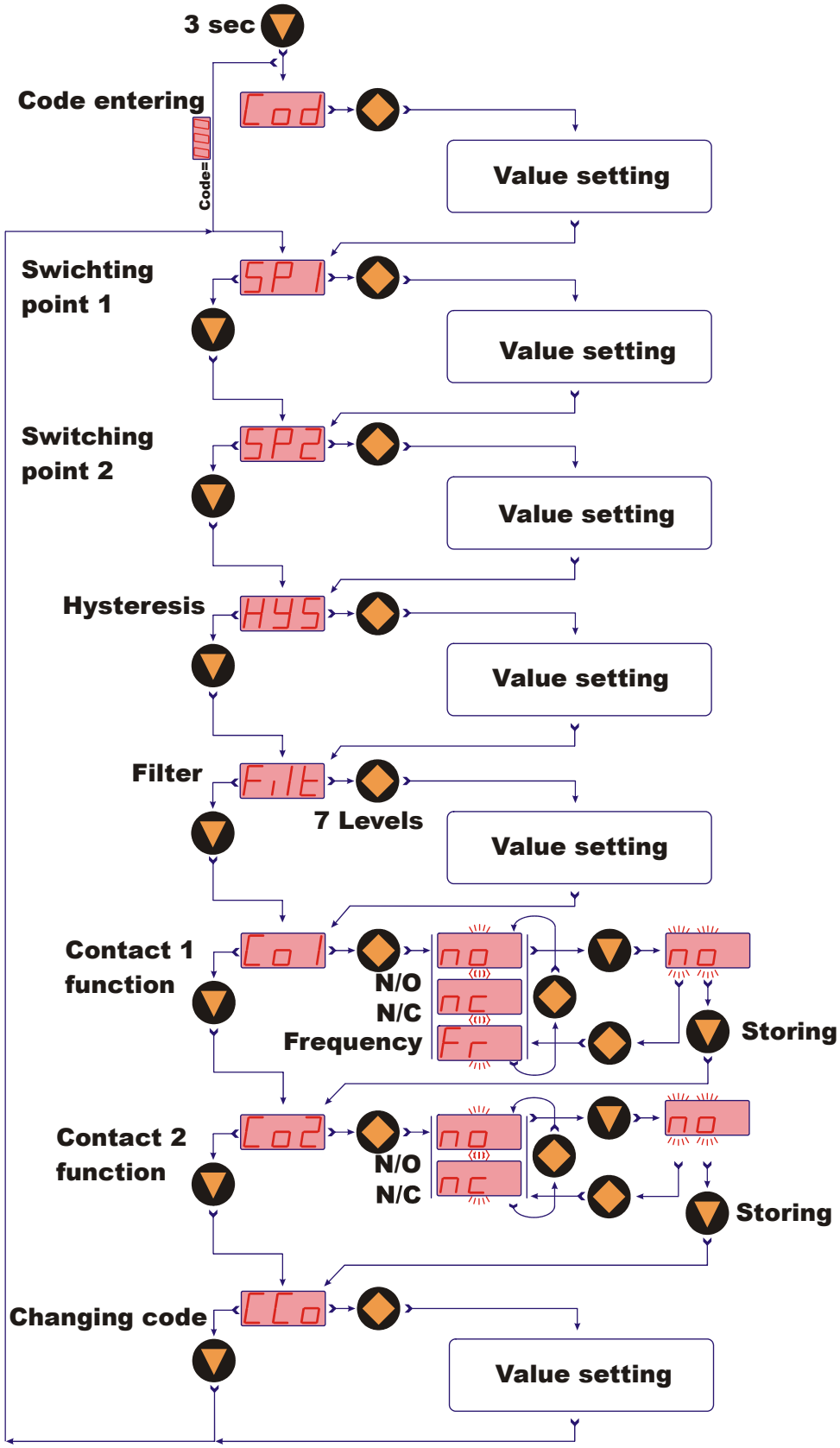
Adjust decimal point

Save selected value or enter new value.

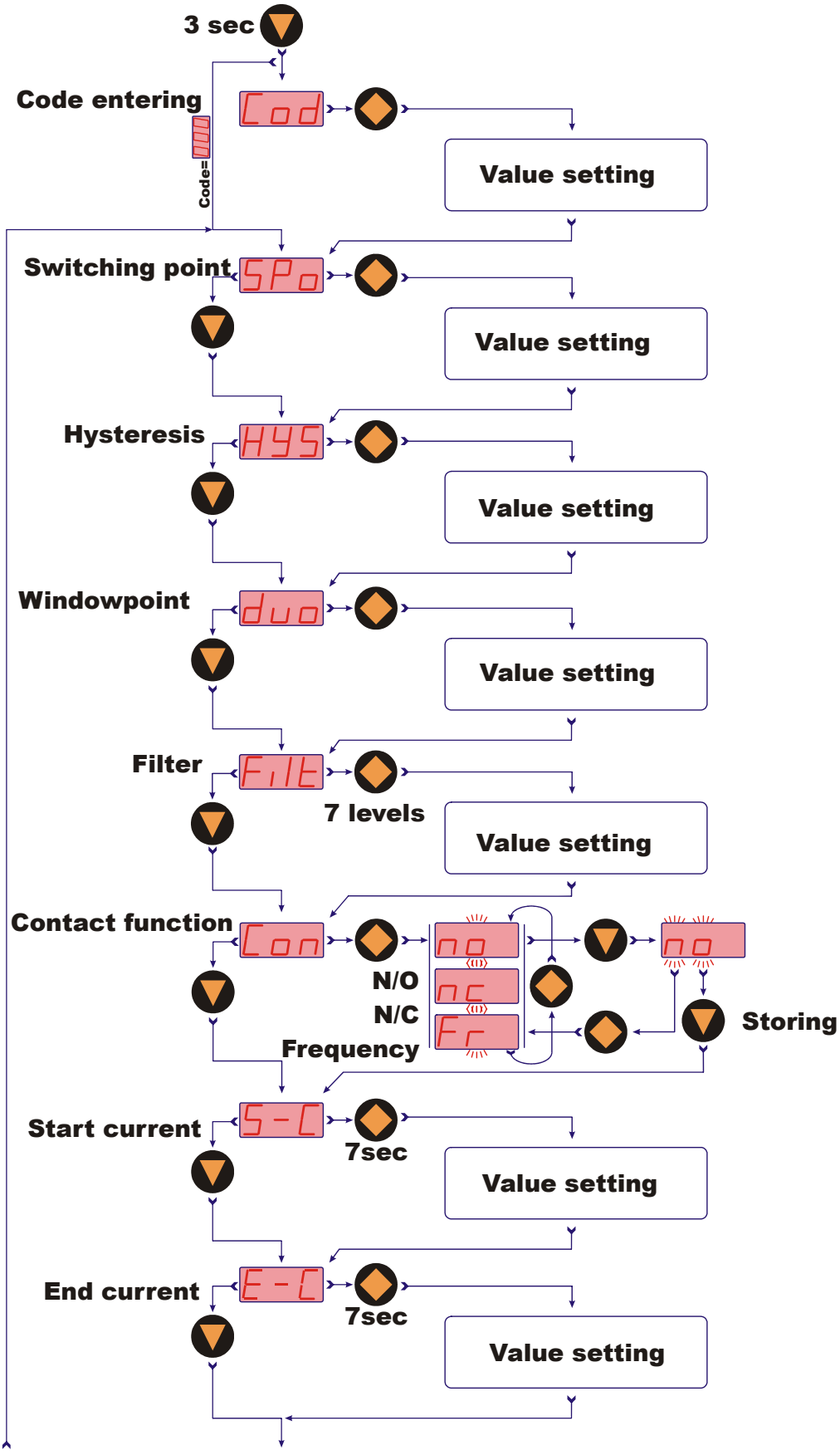
[To the next main menu item]

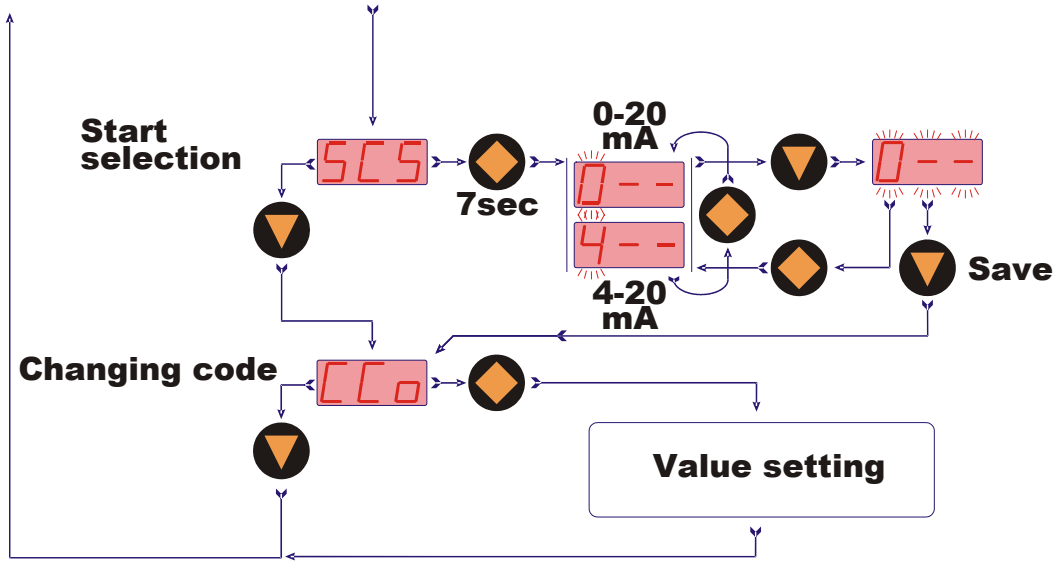
9.4 Set-up mode

Compact electronics DUK-...C30..



Compact electronics DUK-...C34





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 signalised 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.

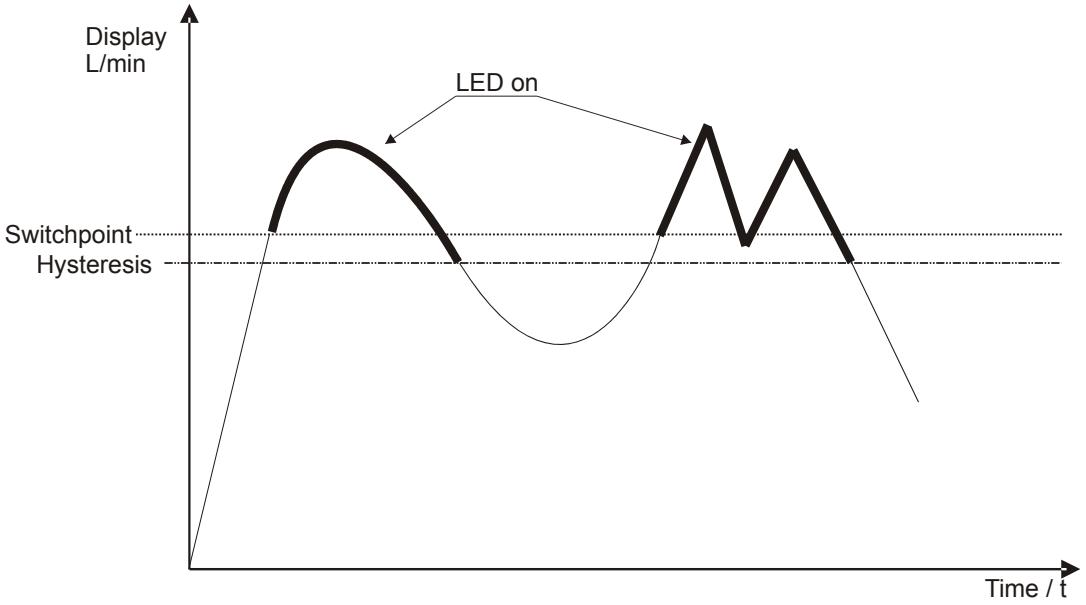
9.5.4 Filter

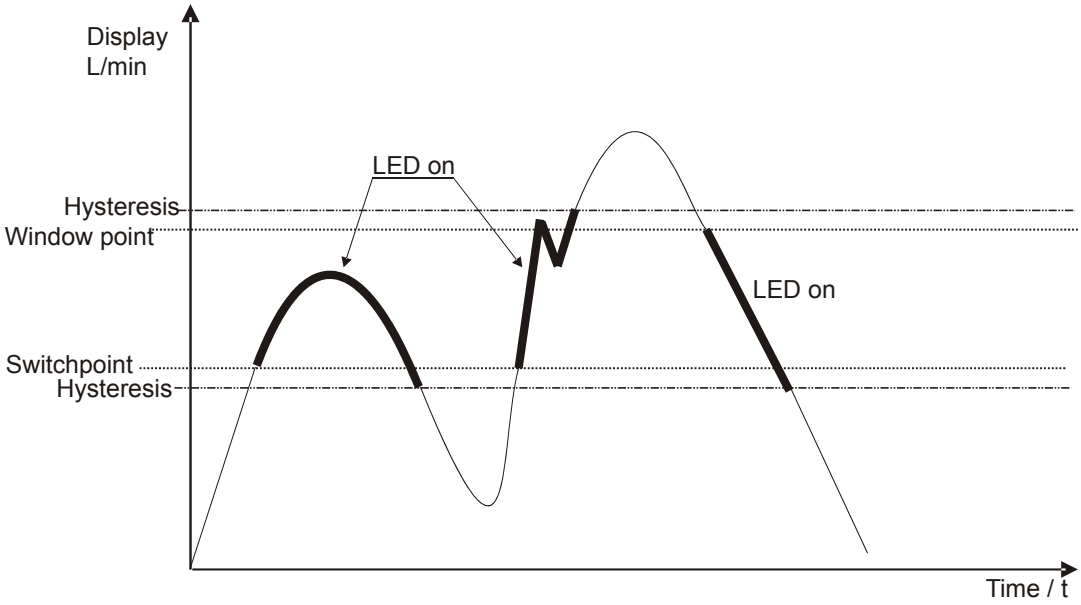
The filter function "**Filt**" forms a running average from the measured values. The following values can be set (see section 8; set up):

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, 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. 3 mm²/s
Accuracy:	±1,5 % of F.S.
Repeat accuracy:	±0,5 % 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
Ambient temperature:	-20...+70 °C
Response time:	ca. 0,5...1 s (depend of electronic version)
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

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	½“	ca. 850 g	ca. 1050 g	ca. 1000 g	ca. 2150 g	ca. 2700 g
DUK-1xx5	0,16-40	¾“	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	1½“	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:	duo-LED for switch status
Switching output (..S300):	relay SPDT, max. 1 A/30 V_{DC}
Switching output (..S30D):	active 24 V_{DC}, , N/C and N/O
Switch point:	10...90 % f.s. in 10 %-steps that can be configured by the customer using a rotary encoder switch
Power supply:	24 V_{DC} ± 20 %
Power consumption:	12 mA
Electrical connection:	plug M12, 5-pin

DUK-...F300, DUK-…F390

Impulse output:	PNP, Open Collector, max. 200 mA
Frequency at F.S.:	500 Hz (…F300) 50…1000 Hz (…F390) proportional to flowrate
Power supply:	24 V_{DC} ±20 %
Power consumption:	5 mA
Electrical connection:	plug M12, 5-pin

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

Output:	0(4)-20 mA, 3-Leiter
Load:	max. 500 Ω
Power supply:	24 V_{DC} ± 20 %
Electrical connection:	plug M12x1

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

Output:	4-20 mA, 3-Leiter
Load:	500 Ω
Power supply:	24 V_{DC} ± 20 %
Electrical connection:	plug DIN 43650

DUK-...C3xx (Compact electronics)

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, max. 300 mA
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} ± 20 %, 3-wire
Power consumption:	ca. 100 mA
Electrical connection:	plug M12x1

DUK-...Exxx (Counter electronics)

Display:	LCD, 2x8 digit, illuminated total, part and flow quantities, units selectable
Quantity meter:	8-digit
Analogue output:	(0)4...20 mA adjustable
Load:	max. 500 Ω
Switching output:	2 relays, max. 250 V/5 A/1000 VA
Settings:	via 4 buttons
Functions:	reset, MIN/MAX memory, flow monitor, monitoring for part and total quantity, language
Power supply:	24 V_{DC} ±20 %, 3-wire
Power consumption:	approx. 150 mA
Electrical connection:	cable connection or M 12 plug

more technical details see data sheet ZED in the brochure Z2

DUK-...Gxxx (Dosing electronics)

Display:	LCD, 2x8 digit, illuminated, dosing, total and flow quantity, units selectable
Quantity meter:	8-digit
Dosage:	5-digit
Analogue output:	(0)4...20 mA adjustable
Load:	max. 500 Ω
Switching output:	2 relays, max. 250 V / 5 A / 1000 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} ±20 %, 3-wire
Power consumption:	approx. 150 mA
Electrical connection:	cable connection or M 12 plug

more technical details see data sheet ZED in the brochure Z2

DUK with ADI electronic

Display:	bar graph, 3.5-digit digital or combination display; batch system
Analogue output:	4...20 mA, 0…10 V
Switching output:	2 relays/SPDT, max. 115/230 V_{AC}, 5 A resistive load max. 30 V_{DC}/5 A or 2 Open-Collector 5-50 V_{DC}, Itotal= 50 mA
Settings:	via 3 buttons
Power supply:	230/115/48/24 V_{AC}, 24 V_{DC}
Electrical connection:	pluggable terminal block cable gland

more technical details see data sheet ADI electronic in the brochure Z2

12. Order Codes

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

<table>
<tr><th>Model / Housing material</th><th>Connection*</th><th>Electronic</th><th>Flow direction</th></tr>
<tr>
<td>DUK-11 =
Messing

DUK-12 =
st. st. 1.4408</td>
<td>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.</td>
<td>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

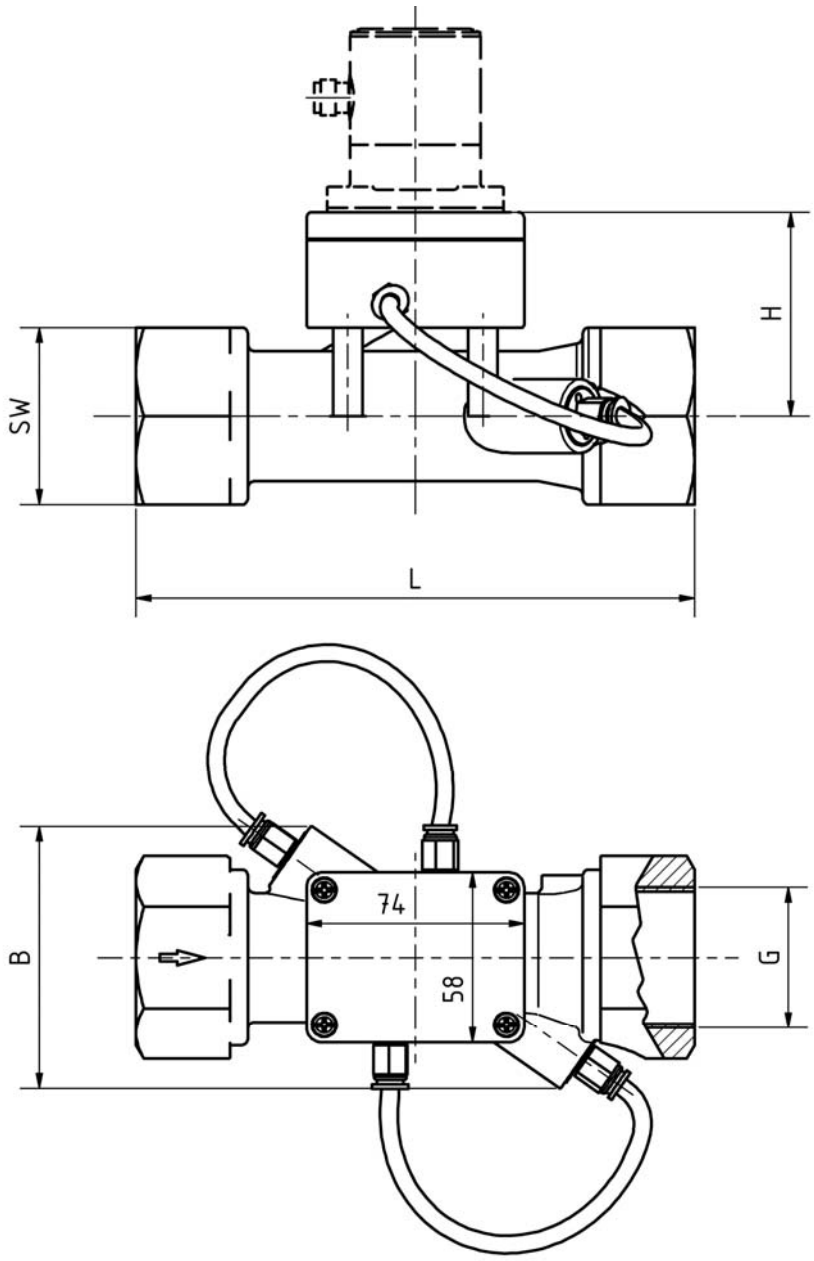
ADI-Electronic
<table>
<tr><th>Display</th><th>Power supply</th><th>Output</th><th>Contact</th></tr>
<tr><td>B = Bar graph
D = Digital
K = Bar graph / Digital display
A = Dosing unit</td><td>0 = 230 V_{AC}
4 = 115 V_{AC}
1 = 48 V_{AC}
2 = 24 V_{AC}
3 = 24 V_{DC}</td><td>0 = without
1 = 0-10 V
2 = 0-20 mA
4 = 4-20 mA</td><td>0 = without
2 = 2 Wechsler
6 = 2 Open Collector</td></tr>
</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</td>
<td>L = from left to right
R = from right to left
T = from top to bottom
B = from bottom to top</td>
</tr>
</table>

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

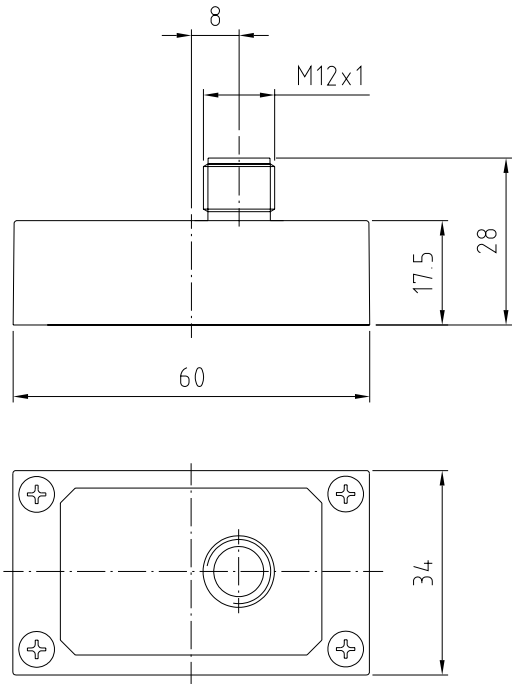
13. Dimensions

DUK sensor

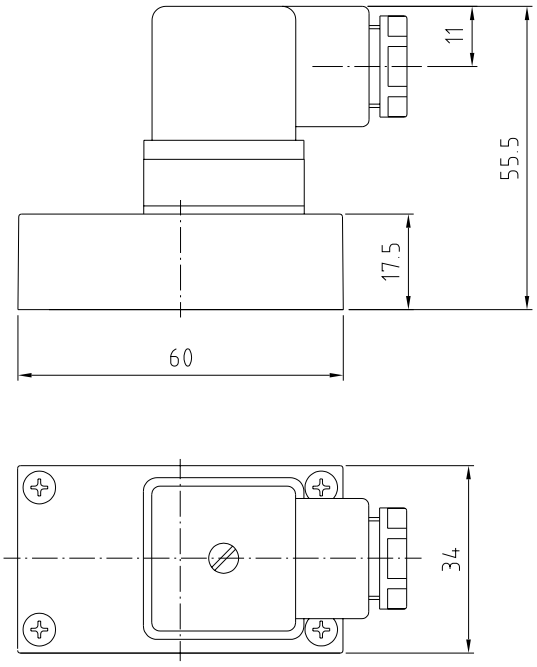


Model	G / NPT	SW [mm]	H [mm]	L [mm]	B [mm]
DUK-xxx4	1/2	30	57	114	ca.72
DUK-xxx5	3/4	36	59	126,5	ca. 76
DUK-xxx6	1	46	63	146	ca. 80
DUK-xxx8	1½	60	69	190	ca. 90
DUK-xxx9	2	76	74	238	ca. 97
DUK-xxxB	3	105	84	306	ca. 122

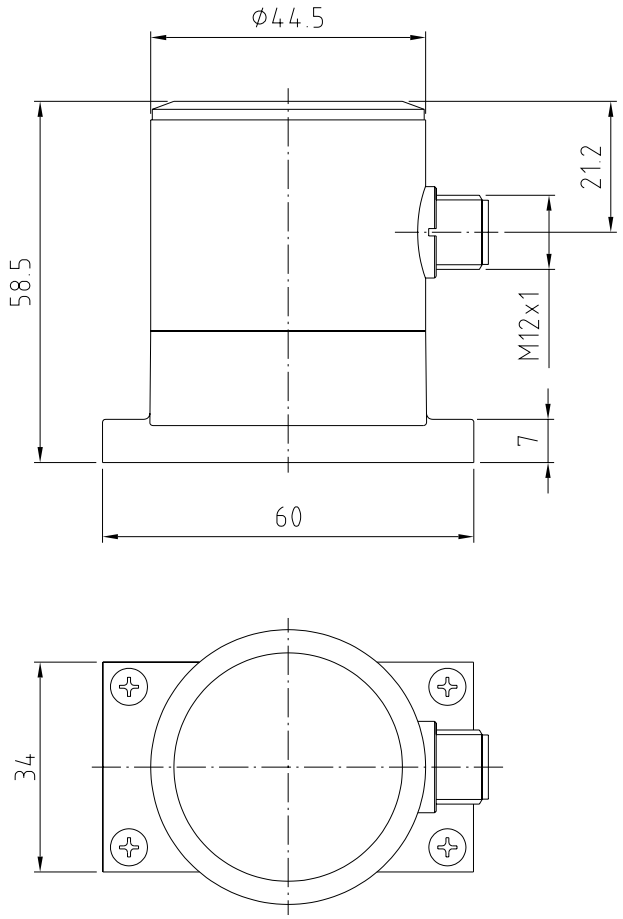
DUK-...S30x; DUK-...F3x0; DUK-...L3x3



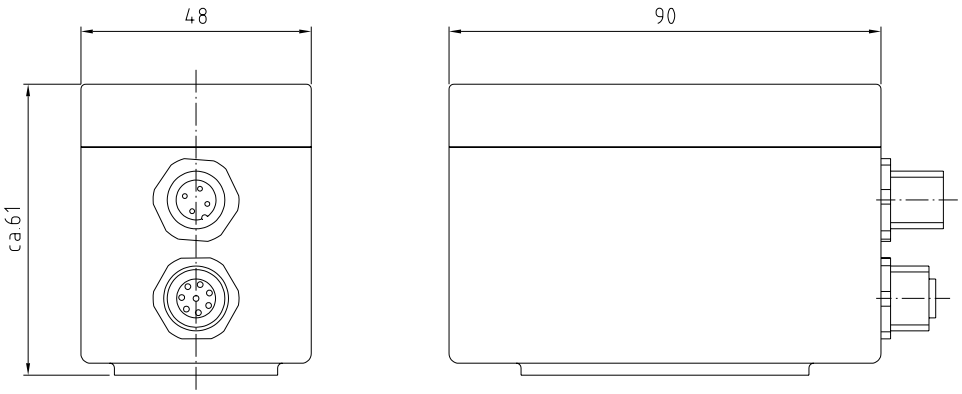
DUK-...L443



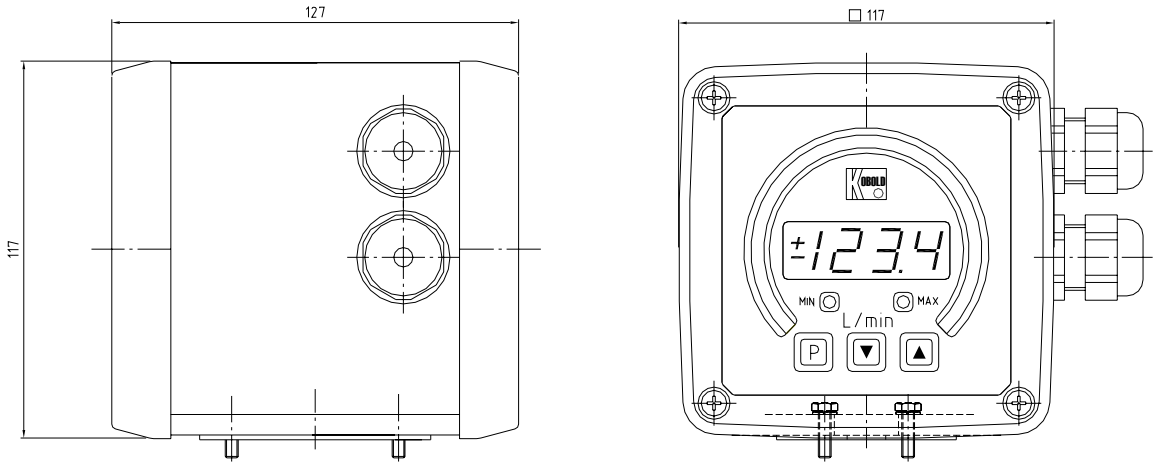
DUK-...C3xx



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/EEC EMC Directive

Hofheim, 6. July 2009

H. Peters
General Manager

M. Wenzel
Proxy Holder